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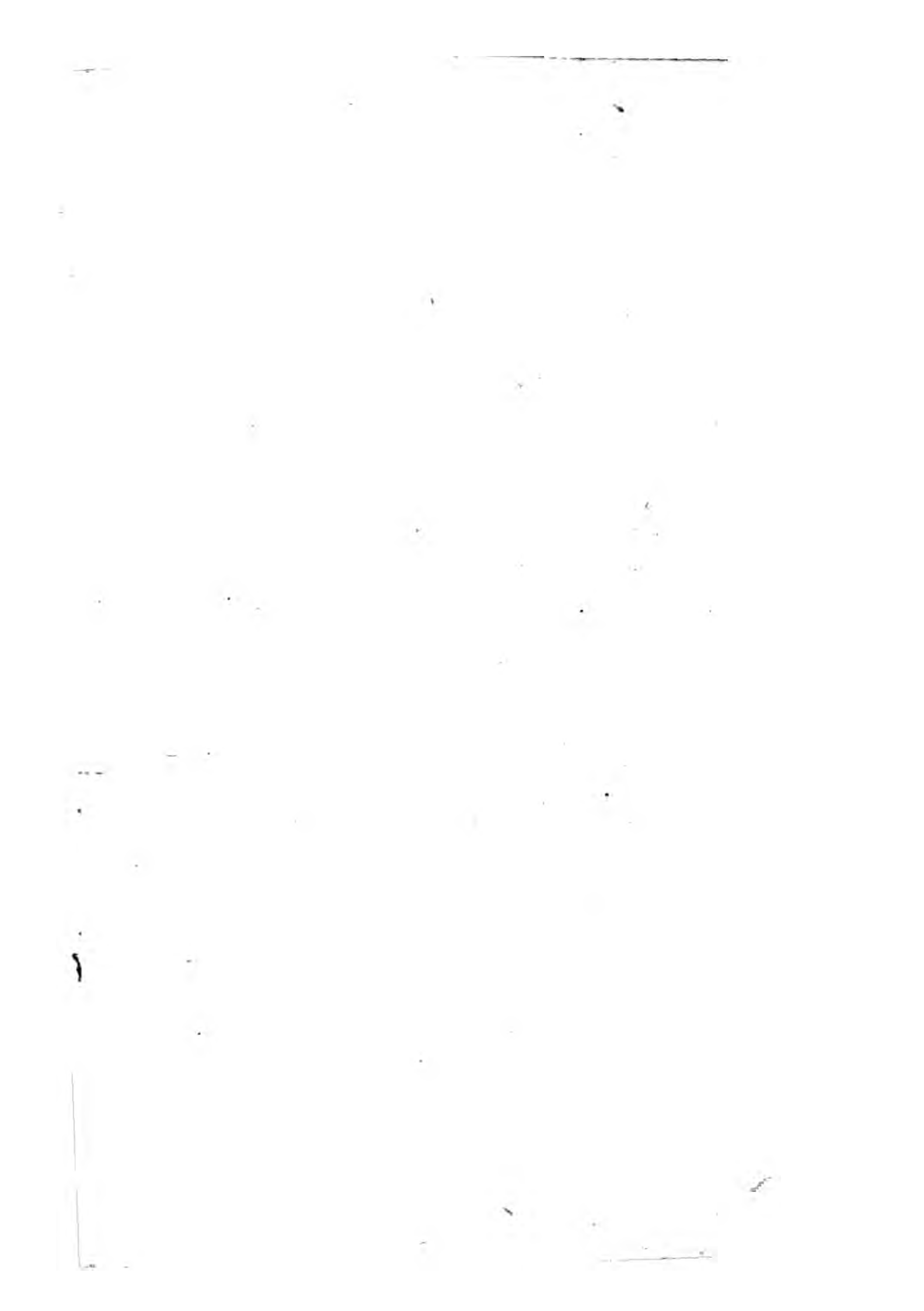
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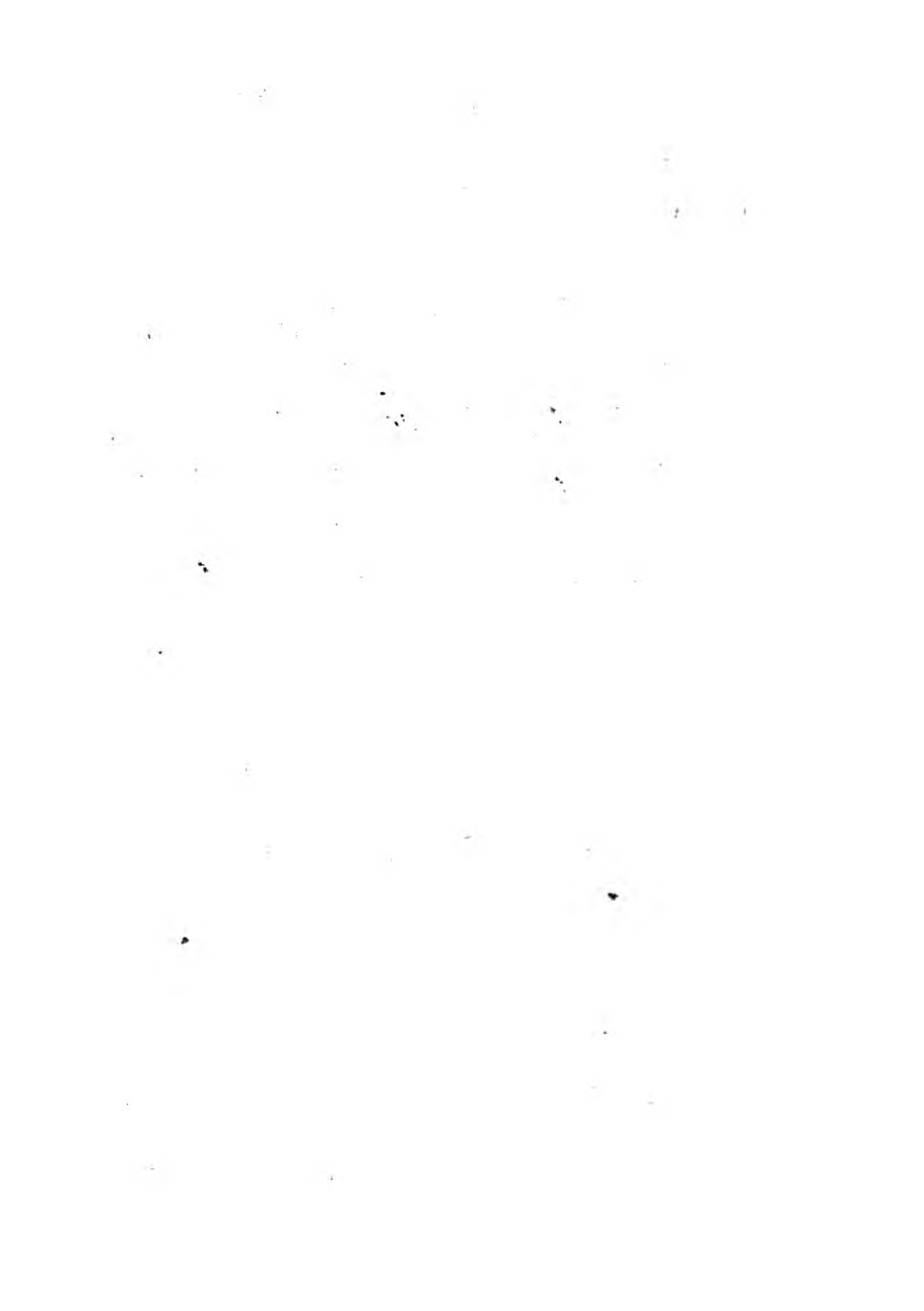
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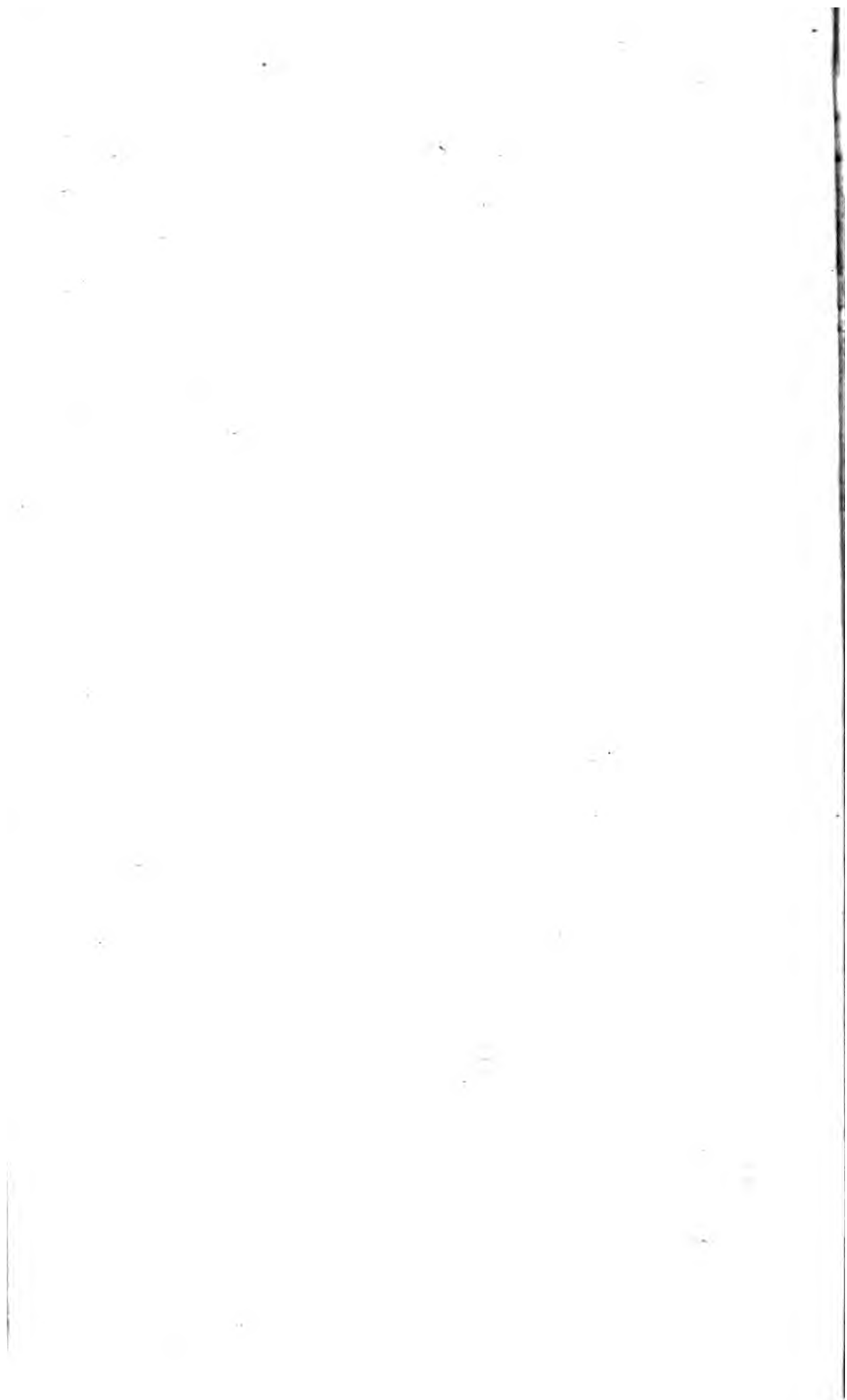
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The Reverend
Richard John Geldart. B.A.
Aul Cath. Soc Camb—
Elected Nov^r 7th 1809—
Now residing at Kirkcaldy
July 25th 1811—







FONTENELLE.

H. J. Geldart...

CONVERSATIONS
ON THE
PLURALITY OF WORLDS.

BY
BERNARD DE FONTENELLE,
One of the Forty belonging to the French Academy ; and Secretary to the
Academy of Sciences.

WITH NOTES,
AND A CRITICAL ACCOUNT OF THE AUTHOR'S WRITINGS,

BY
JEROME DE LA LANDE,
SENIOR DIRECTOR OF THE OBSERVATORY AT PARIS.

Translated from a late Paris Edition, by
MISS ELIZABETH GUNNING.

London:
PRINTED BY J. CUNDEE, IVY-LANE ;
SOLD BY T. HURST, PATERNOSTER-ROW.

1803.

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CRITICAL ACCOUNT
OF THE
Life and Writings of the Author,
BY
JEROME DE LA LANDE.

WHENEVER I have entered into conversation with any sensible woman on astronomy, I have always found that she had read Fontenelle's *Plurality of Worlds*; and that his book had excited her curiosity on the subject. As it has been so much read already, it must continue to engage attention: I therefore thought it would be useful to point out its faults; to add some observations, without which the reader would be led into error with respect to the vortices; to make known the late discoveries; and to shew what numbers, before our author, had written on the plurality of worlds. But I have made no alterations in the text; the reputation of Fontenelle renders him respectable, even in his mistakes.

The *Astronomy for Ladies*, which I have published as a substitute for this book, would be more instructive, but less amusing; therefore, as it will be but little read, I shall endeavour to supply the defects of Fontenelle's work, by adding to the original some ideas more exact than his own.

M. Codrika has translated it into Greek, with explanations taken from my *Astronomy*.

M. Bode has translated it into German; and his translation has already gone through three editions: the last is that of 1798, Berlin, in octavo, *Bernard de Fontenelle, Dialogen ueber die Mehrheit der Welten.*

When Voltaire published, in 1738, his *Essays on the Elements of Newton*, he began with these words: "Here is no Marchioness; no imaginary philosophy." It was supposed that he here alluded to Fontenelle; this he contradicts by saying: "so far from having his book in view, I publicly declare that I consider it one of the best works that ever were written." (*Mem. de Trublet*, p. 135).

This book has been printed a hundred times; the handsome edition of Fontenelle's *Works*, in folio, published at the Hague in 1728,* with figures by Bernard Pickart; the still more beautiful edition of the *Worlds alone*, edited by Didot the younger, in 1797, in folio, are master-pieces of typography; but in them nothing is found but the original work; therefore I consider our edition far preferable.

I shall here give a short account of the author of this work.

Bernard le Bovier † de Fontenelle was born at Bouen, February 11, 1657. He died January 9, 1757.

The first efforts of his genius were directed to poetry: at the age of thirteen he had composed a Latin poem: about the year 1683 he devoted himself to literature and philosophy. In 1699 he began *L'Histoire de l'Académie des Sciences*, which he continued with great success during forty-two years. Few persons have contributed more to the progress of the sciences than he has done, by accommodating them to every capacity, and inspiring by his panegyrics, a love of study. For my part, I feel a pleasure in acknowledging that I am indebted to him for the germ of that insatiable activity of mind I have experienced ever since the

* That edition does not contain the account of the bees, which is in the present edition.

† Lebeau writes the name le Bouyer, from the family name, in the *Memoires de l'Académie des Inscriptions*; but it is pronounced le Bovier. (*Mem.* p. 19.)

V

age of sixteen. I could find nothing in the world like the Academy of Sciences, and ardently wished for the happiness of seeing it, long before I had any idea of the possibility of one day belonging to it.

In 1727 he published his *Elemens de la Géométrie de l'infini*; this was merely the amusement of a man of genius who had heard a little of geometry, and chose to hazard his opinions on the subject.

We may find an eulogium on our author in l'*Historie de l'Académie des Sciences* for 1757, in the *Mémoires de l'Académie des Belles-Lettres*, and in a work written entirely on the subject, published by Trublet in the year 1761, entitled *Mémoires pour servir à l'Histoire de la vie et des Ouvrages de Fontenelle*. In these memoirs a particular critique shews us the various merits of Fontenelle's works: there is also an article by Trublet in the edition of Moréri, published in 1759.

I have remarked in the twentieth book of my *Astronomy*, that in every period of time it has been believed that the planets were inhabited, on account of their resemblance to the earth. The idea of the plurality of worlds is expressed in the *Orphics*, those ancient Grecian poems attributed to Orpheus (*Plut. de Placitis Philosoph. l. 2, cap. 13.*) Proclus has preserved some verses in which we find that the writer of the *Orphics* places mountains, men, and cities in the moon. The Pythagoreans, such as Philolaüs, Hicetas, Heraclides, taught that the stars were all worlds. Several ancient philosophers even admitted an infinity of worlds beyond the reach of our sight. Epicurus, Lucretius, and all the Epicureans were of the same opinion; and Metrodorus thought it as absurd to imagine but one world in the immensity of space, as to say that only one ear of corn could grow in a great extent of country. Zeno of Eleusis, Anaximenes, Anaximander, Leucippus, Democritus, asserted the same thing: in short, there were some philosophers

who, although they did not consider the rest of the planets inhabited, placed inhabitants in the moon; such were Anaxagorus, Xenophanes, Lucian, Plutarch, (*De Oraculor. defectu. De Facie in orbe Lunæ.*) Eusebius, Stobius. We may see a long list of the ancients who have treated on the subject, in Fabricius, (*Biblio. Græcæ, t. 1. cap. 20.*) and in the *Mémoire de Bonamy* (*Acad. des Inscriptions, tom. ix.*) Hevelius appeared as firmly persuaded of this opinion in 1647, when he talked of the difference between the inhabitants of the two hemispheres of the moon: he calls them *selenitæ*, and examines at length all the phenomena observed in their planet, after the example of Kepler (*Astron. Lunar.*) It was maintained at Oxford, in certain themes which are mentioned in the *News of the Republic of Letters*, June 1784, that the system of Pythagoras on the inhabitants of the moon was well founded: two years afterwards Fontenelle discussed this subject in his agreeable work. There are farther details of the different astronomical opinions at the end of Gregory's book. For the objections, we may refer to Riccioli. (*Almagestum, tom. 1, p. 188, 204.*) In 1686 the *Plurality of Worlds* was adorned by Fontenelle with all the beauties of which a philosophical work was susceptible. Huygens (who died in 1695) in his book entitled *Cosmothéoros*, published in 1698, likewise enters largely into the subject.

The resemblance between the earth and the other planets is so striking, that if we allow the earth to have been formed for habitation, we cannot deny that the planets were made for the same purpose; for if there is, in the nature of things, a connection between the earth and the men who inhabit it, a similar connexion must exist between the planets and beings who inhabit them.

We see six planets around the sun, the earth is the third; they all move in elliptical orbits; they have all a rotatory motion like the earth, as well as spots, irregularities, moun-

tains: some of them have satellites, the earth has one satellite: Jupiter is flattened like our world; in short there is every possible resemblance between the planets and the earth: is it, then, rational to suppose the existence of living and thinking beings is confined to the earth? From what is such a privilege derived but the groveling minds of persons who can never rise above the objects of their immediate sensations?

Lambert believed that even the comets were inhabited. (*Système du Monde*, Bouillon; 1770.) Buffon determines the period when each planet became habitable, and when it will cease to be so, from its refrigeration. (*Supplémens*, in 4to. tom. 11.) What I have said of planets that turn round the sun, will naturally extend to all the planetary systems which environ the fixed stars; every star being an immoveable and luminous body, having light in itself, may properly be compared with our sun. We must conclude that if our sun serves to attract and enlighten the planets which surround it, the fixed stars have the same use. It is thought that the sun and fixed stars are uninhabitable because they are composed of fire; yet M. Knight, in a work written to explain all the phœnomena of nature, by attraction and repulsion, endeavours to prove that the sun and stars may be habitable worlds, and that the people in them may possibly suffer from extreme cold. M. Herschel likewise thinks the sun is inhabited (*Philos. Trans.* 179. p. 155. et suiv.)

Some timid, superstitious writers have reprobated this system, as contrary to religion: they little knew how to promote the glory of their Creator. If the immensity of his works announce his power, can any idea be more calculated than this to exhibit their magnificence and sublimity? We see with the naked eye, several thousands of stars; in every part of the firmament we discover with telescopes, innumerable others; with more perfect telescopes, we still

find a multitude more. We compute, from the number seen through Herschel's telescopes in one region of the sky, that there are a hundred millions. Imagination pierces beyond the extent of vision, beholding multitudes of unknown worlds, infinitely more in number than those which are visible to our sight; and ranges unrestrained in the boundless space of creation.

Our only difficulty with respect to the inhabitants of so many millions of planets, is the obscurity of the final causes, which it is difficult to admit when we see into what errors the greatest philosophers have fallen; for instance Fermat, Leibnitz, Maupertius, &c. in attempting to employ these final causes or metaphysical suppositions of imagined relations between effects that we see and the causes we assign them, or the ends for which we believe them to exist.

If the plurality of worlds be admitted without difficulty; if the planets are believed to be inhabited, it is because the earth is considered merely as a habitation for man, from which it is inferred that were the planets uninhabited they would be useless: but I will venture to assert that such a mode of reasoning is confined, unphilosophic, and at the same time, presumptuous. What are we in comparison of the universe? Do we know the extent, the properties, the destination, and the connexions of nature? Is our existence, formed as we are, of a few frail atoms, to be considered any thing when we think of the greatness of the whole? Can we add to the perfection and grandeur of the universe? These ideas are expressed by Saussure, who in speaking of a traveller to Montblanc says: "if, during his meditations, the thought of the insignificant beings that move on the face of the earth offers itself to his mind, if he compares their duration with the grand epochs of nature, how great will be his astonishment that man, occupying so small a space, existing so short a time, can ever imagine that his being is the only end for which the universe was created."

From these considerations d'Alembert, in the Encyclopedia, (art. World) after examining the arguments for supposing the planets inhabited, concludes by saying: *the subject is enveloped in total obscurity.*

But Buffon affirms that wherever there is a certain degree of heat, the motion produces organized beings ; we need not enquire in what way, but imagine these to be the inhabitants of the planets : if that should be the case, we may conclude it highly probable that they are inhabited, notwithstanding the preceding objections.

LA LANDE.

1802.

LINES ON FONTENELLE.

Muse ! if thou canst, this picture's truth excel ;
Strive to pourtray the *soul* of Fontenelle :
Him, to whose works, with wit and judgment warm,
Indulgent Nature, gave a magic charm.---
'Twas his to strew with flowers the toilsome road,
Which leads to Science in her dark abode ;
And while he touch'd the pastoral reed, to prove,
That courtly pomp, must yield to rural love.
A Lucian rising from the silent tomb,
'Twas his, to pierce through Error's doubtful gloom ;
And, with resistless eye, at once to dart
Full on the hidden secrets of the heart.---
Union divinae !---in Fontenelle we find
A glowing genius, and a gentle mind !

PREFACE

BY

BERNARD DE FONTENELLE.

I FIND myself nearly in the situation of Cicero, when he undertook to write in his own language on philosophical subjects, that, till then, had never been treated of but in Greek. He tells us that his works were said to be useless, because those who delighted in philosophy, having taken the pains to study the books written in Greek, would not afterwards think of examining his Latin ones, which were not originals; and that persons who had no taste for philosophy, would neither care for the Greek nor the Latin.

To which he answers, that exactly the contrary would happen; that the unlearned would be allured to philosophy by the facility of reading Latin works; and that the well-informed, after studying the Greek authors, would be pleased to see how the subjects were handled in Latin.

Cicero might with propriety speak in this manner; his superior genius and great celebrity assured him success in this untried project, but I have not the same advantages to inspire me with confidence, in a similar undertaking. I was

desirous of representing philosophy in a way that was not philosophical ; I have attempted to compose a book that shall neither be too abstruse for the gay, nor too amusive for the learned. But if what was said to Cicero should be repeated to me, I could not venture to answer as he did : possibly in attempting to find a middle way which would accommodate philosophy to every class, I have chosen one that will not be agreeable to any. It is very difficult to maintain a medium, and I think I shall never be inclined to make a second attempt of this nature.

I should warn those that have some knowledge of natural philosophy, that I do not suppose this book capable of giving them any information ; it will merely afford them some amusement, by presenting in a lively manner what they have already become acquainted with by dint of study. I would also inform those who are ignorant of these subjects that it has been my design to amuse and instruct them at the same time : the former will counteract my intention if they here expect improvement, and the latter, if they here only seek for entertainment.

I need not say that of all philosophical subjects I have chosen that which is most calculated to excite curiosity : surely nothing ought to interest us more than to know how our own world is formed ; and whether there be other worlds similar to it, and inhabited in the same way : but let no one be disquieted if unable to answer these enquiries ; they who have time to spare may examine such subjects ; many have it not in their power.

In these Conversations I have represented a woman receiving information on things with which she was entirely unacquainted. I thought this fiction would enable me to give the subject more ornament, and would encourage the female sex in the pursuit of knowledge, by the example of a woman who though ignorant of the sciences, is capable of understanding all she is told, and arranging in her ideas the worlds and vortices. Why should any woman allow the superiority of this imaginary Marchioness, who only believes what she could not avoid understanding?

'Tis true, she gives some attention to the subject, but what sort of attention is requisite? Not such as will laboriously penetrate into an obscure thing, or a thing that is spoken of in an obscure manner; it is needful only to read with sufficient application to render the ideas familiar. Women may understand this system of philosophy by giving it as much attention as they would bestow on the Princess of Cleves, in order to understand the story and see all the beauties of the work. I do not deny that the ideas contained in this book are less familiar to the generality of females than those in the Princess of Cleves, but they are not more abstruse, and I am convinced that on a second perusal they would be perfectly understood.

As I did not wish to establish an imaginary system that had no foundation, I have employed true philosophical arguments, and as many of them as were necessary to establish my opinions; but fortunately the ideas connected with natural philosophy are in themselves beautiful, and whilst they satis-

fy the understanding, give as much pleasure as if formed only to charm the imagination.

To such parts of my subjects as did not possess these beauties I have given extraneous ornaments ; Virgil has done this in his Georgics, where he renders a dry subject interesting by frequent and agreeable digressions : Ovid likewise in his Art of Love has pursued the same plan, although the matter of his poem was far more pleasing than any thing he could add to it: he seems to think it tiresome to speak constantly of one subject—even of love. I have more need of embellishments than he, yet I have used them sparingly. I have only given such as the freedom of conversation authorised ; I have only placed them in parts that I thought required them ; I have inserted most of them in the commencement of the work to accustom the mind by degrees to the objects I wish to present to its attention, in short, I have derived them from my subject, or formed them as much as possible to resemble my subject.

I did not venture to give any opinions on the inhabitants of the different worlds, since they must have been entirely chimerical ; I have endeavoured to express all that might reasonably be imagined, and even the conjectures that are added are not without foundation. Truth and fiction are in some measure blended, but always so as to be distinguishable from each other : I do not undertake to justify such a composition ; the union of philosophy and amusement is the chief aim of this work, but I know not whether I have adopted the right method.

It only remains for me now to address one class of persons ; they are perhaps the most difficult to satisfy, not because my reasoning is inconclusive, but because they feel themselves privileged to disregard the best arguments : I am speaking of scrupulous people who may imagine religion is endangered by placing inhabitants any where but on the earth. I respect even an excessive scrupulosity when it arises from piety, nor would I willingly hurt the feelings of any one from whom I differed : but by rectifying a little error of the imagination we shall find that this objection cannot affect my system of giving inhabitants to an infinite number of worlds. When you are told that the moon is peopled, you immediately figure to yourself men like ourselves, and then a variety of theological difficulties occur. The posterity of Adam cannot have colonized the moon ; therefore the inhabitants of that planet are not descendants of our first parents ; now it would be a difficult point in theology to account for the existence of men who had any other ancestor. No more need be said ; every imaginable difficulty is included in this, and the expressions that would be necessary for a more full explanation are too worthy of reverence to be employed in a work containing so little of the serious as this. The objection then turns on the existence of men in the moon, but it is the objectors themselves who talk of men as its inhabitants ; I have asserted no such thing : I say there are inhabitants, and I likewise say they may not at all resemble us. What are they then ?—I have never seen them ; I do not speak from acquaintance with them.

Do not consider it a subterfuge, to rid myself of the objection, when I affirm that the moon is not peopled by men; you will see that according to the idea I entertain of the endless diversity of the works of nature, it is impossible such beings as we, should be placed there. This opinion is supported throughout the book, and it is an opinion which no philosopher can deny: I think, therefore, on this ground, the following conversations will be objected to only by those who have never read them. But will this consideration suffice to deliver me from the fear of censure? No; it rather gives me cause to apprehend objections from every side.

FONTENELLE.

CONVERSATIONS
ON THE
PLURALITY OF WORLDS.

TO MR. L——.

YOU desire me, dear Sir, to give you a particular account of the manner in which my time has been spent whilst at the Marchioness of G—'s* in the country. To obey your injunctions strictly, I shall be obliged to fill a volume, and what is still more formidable, a volume of philosophy.

You expect to be entertained with a history of splendid feasts, hunting, and card-parties; and you will hear of nothing, but planets, worlds, and

* The lady here mentioned was Madame de la Mesangire of Rouen. She was a beautiful brunette; but in compliance with her desire to be concealed, the author has spoken of her in the following pages, as having a fair complexion. The park belonging to her residence, is described in the "First Evening."

vortexes: * for the discussion of these latter subjects, formed our principal amusement. Fortunately *you* are a philosopher, therefore I have the less reason to dread raillery from such a quarter; on the reverse, I may even hope for your congratulations, on having rendered the Marchioness sensible to the charms of philosophy: we could not have made a more valuable acquisition; for youth and beauty, in every cause holds such power, that if wisdom herself were desirous of being welcomed by mortals, and would assume the form of this lovely woman, surely with such an exterior, and such fascinating eloquence, she could not fail to attract every heart.

Notwithstanding all this, you must not expect to be transported with admiration, whilst I repeat the conversations I have held with her ladyship: my genius should be equal with her's,

* The Vortexes of Descartes, occupied the attention of the learned, for nearly a century; but this hypothesis was superceded by a discovery of the laws of attraction. Although Newton's famous book on principles was published in 1687, Fontenelle always retained his educational prejudice in favour of the Vortexes. A few years before his death, he consulted me on a little work he had some time since composed on the subject. I endeavoured to dissuade him from making it public; but Falconet was afterwards weak enough to do so. The book is entitled "Theory of the Cartesian Vortexes, with Reflections on Attraction." The author's name was never affixed to the work.

to relate what she said, in her own delightful manner. Conscious of inability, I must relinquish the attempt, and leave you to discern through the recital, that rapidity of apprehension, which characterizes the mind of the Marchioness. From the wonderful quickness with which she comprehends the most abstruse subjects, I consider her already learned: at least, I may be allowed to say, that after a little study, she might attain the heights of science; when many, who spend their lives amid the dull disputes of vast libraries, remain for ever in the deepest ignorance.

Before I recount our various conversations, perhaps you may expect some description of their scene; some picture of the romantic country, under whose shades the Marchioness is enjoying the autumn. If so, you will be disappointed: so many people have exercised their talents on this gay species of writing, that I shall dispense with the ceremony, and merely say, that on my arrival I had the pleasure of finding myself the only visitor.

The two first days were passed in relating the news of Paris, which I had just quitted. When that subject was exhausted, an evening walk in the park, suggested the discussion of those learned topics, the commencement of which you will find in the next page.

*FIRST EVENING.**

THE EARTH IS A PLANET WHICH TURNS ON ITS AXIS,
AND GOES ROUND THE SUN.

AFTER supper we went to take a walk in the park. We felt the fragrant breeze of evening peculiarly delightful, as the heat had been intense during the day: the silvery rays of the moon, gleaming through the foliage, formed an agreeable contrast with the darkened shadows of the landscape. Not a cloud intercepted or veiled the smallest star. Every orb appeared a mass of pure gold, rendered more brilliant by the rich blue of the sky. The beauty of the scenery produced a gentle reverie, from which, had not the Marchioness been with me, I should not have been easily roused; but in the company of so interesting a woman I could not long abandon

* This first book has been translated into a variety of languages; it is the best eclogue that has been composed in the last fifty years: the descriptions and imagery it contains are perfectly suited to the style of pastoral poetry; indeed many of the images would not have disgraced the pen of a Virgil.

Dubos. Reflections on Poetry and Painting.

myself to the influence of the moon and stars. Do you not think, said I, addressing myself to her, that the charms of a fine night greatly exceed those of the day? Yes, she replied, the splendour of day resembles a fair and dazzling beauty, but the milder radiance of night may be compared to a woman of less brilliancy of complexion, and more sweetness of expression. You are very generous, resumed I, in giving the preference to the brunette, whilst you are so fair. It is however true, that an unclouded sun is the most glorious object in nature; and it is equally true, that the heroines of romance, the most beautiful objects imagination can depict, have almost invariably been represented with fair complexions. Beauty, answered my companion, is nothing, unless it interests our feelings. You will not deny that the finest day never had the power of inspiring so delightful a reverie as you were falling into just now in contemplating the loveliness of the evening. You are right, said I, but the loveliest night I ever beheld, with all its shadowy beauty, would fail to give me such enchanting sensations as the contemplation of the fair face of the Marchioness de G——. I should not be satisfied with your compliment, she replied, did I even believe you sincere, since the brightness of day, with which we have been comparing fair women, has so little influence on your heart. Why do lovers, who undoubtedly

can judge of what is most touching, address all their poetic effusions to the night? To the ear of day they neither confide their transports nor their sorrows—why is it so entirely excluded from their confidence? Probably, I answered, because it is not calculated to inspire that delicious sentiment, at once impassioned and melancholy, which we feel in the stillness of night, whilst all nature seems to repose. The stars appear to move with more silent progress than the sun: every object that decorates the heavens is soft, and attractive to the eye: in short, we resign ourselves more easily to reverie because we feel as if no other being was at that time enjoying the pensive pleasure that expands our soul. Perhaps, too, the uniformity of day, in which the sky presents no other object than the sun, is less favourable to the wild and pleasing illusions of fancy than the view of innumerable stars, scattered with sportive irregularity, over the boundless space. I have always felt what you describe, said she, I love to see the stars, and am almost inclined to reproach the sun for hiding them. Ah! cried I, I cannot forgive him for concealing so many worlds from my sight! Worlds! she exclaimed, turning to me with surprize, what do you mean? Forgive me, said I, you touched the wildest chord of my imagination—I forget myself in a romantic idea. And what is this romantic idea? enquired the Marchioness. Ah!

replied I, I am half ashamed of owning it:—I have taken it in my head that every star may be a world. I would not positively assert the truth of my opinion, but I believe it because it affords me pleasure; it has possessed my mind with irresistible force; and I consider pleasure a needful accessory to truth. Well, said she, since your whim is such a pleasant one, make me a partaker of it; I'll believe any thing you chuse about the stars, provided it contributes to my happiness. Ah! madam, I replied, 'tis not such an enjoyment as you would find in seeing one of Molière's comedies: it is an idea which can only give delight to the understanding. What! exclaimed she, do you think I am not susceptible of pleasures which depend only on reason? I will convince you of your mistake. Teach me your system. No, answered I, I will not subject myself to the reproach of having talked of philosophy, in such an enchanting walk as this, to the most interesting woman of my acquaintance. No, seek for pedants elsewhere.

For a long while I attempted, in vain, to excuse myself; I was at last obliged to yield: I insisted, however, for my reputation's sake, on a promise of secrecy. Every objection being removed, I wished to begin the subject, but found the commencement extremely difficult; for, with a person who was ignorant of natural philosophy, it was necessary to converse in a very circuitous

manner, to prove that the earth was a planet, the other planets similar to the earth, and all the stars so many suns which enlightened a number of worlds. I once more assured her it would be much better to talk on such trifles as other people, in our situation, would amuse themselves with. In the end, however, to give her a general idea of philosophy, I pursued the following plan.

All philosophy, said I, is founded on two things; an inquisitive mind, and defective sight; for if your eyes could discern every thing to perfection you would easily perceive whether each star is a sun, giving light to a number of worlds; on the other hand, had you less curiosity, you would hardly take the trouble to inform yourself about the matter, and consequently remain in equal ignorance; but the difficulty consists in our wanting to become acquainted with more than we see: besides, it is out of our power to understand much of what is even within the reach of our sight, because objects appear to us very different from what they are. Thus philosophers pass their lives in disbelieving what they see, and endeavouring to conjecture what is concealed from them; such a state of mind is not very enviable

In thinking on this subject, nature always appears to me in the same point of view as theatrical representations. In the situation you occupy

at the opera you do not see the whole of its arrangements: the machinery and decorations are so disposed as to produce an agreeable effect at a distance, and at the same time the weights and wheels are hidden by which every motion is effected. You behold all that is passing, without concerning yourself about the causes; and so perhaps do all the other spectators, unless among the number some obscure student of mechanics is puzzling himself to account for an extraordinary motion which he cannot understand. You see the case of this mechanical genius resembles that of the philosopher studying the structure of the universe. What, however, augments the difficulty with respect to philosophers is, that nature so entirely conceals from us the means by which her scenery is produced, that for a long time we were unable to discover the causes of her most simple movements. Figure to yourself, as spectators of an opera, the Pythagorases, the Platos, the Aristotles; all these men whose names are now so celebrated. Let us suppose them viewing the flight of Phæton, rising on the wind; ignorant at the same time of the construction of the theatre, and the cords by which the figure is put in motion. One to explain the phenomenon, says, *it is some hidden virtue in Phæton which causes him to rise*; another replies, *Phæton is composed of certain numbers which produce his elevation*. A third says, *Phæton*

has a love for the top of the stage ; he is uneasy at any other part. The fourth thinks, *it is not essential to the nature of Phæton to rise in the air, but he prefers flying up to leaving a vacuum at the top of the stage.* Such were the ridiculous notions of the ancient philosophers, which to my astonishment have not ruined the reputation of antiquity. After all Descartes and some other moderns appear : they tell you that *Phæton rises in consequence of being drawn by cords, fastened to a descending weight, which is heavier than himself.* It is no longer believed that a body can have motion, unless acted upon by another body ; that it can rise and descend without a counterbalancing weight ; thus, whoever examines the mechanism of nature is only going behind the scenes of a theatre. If that be the case, answered the Marchioness, philosophy is a very mechanical affair ! So much so, I replied, that I am afraid it will fall into disrepute. In short, the universe is but a watch on a larger scale ; all its motions depending on determined laws and the mutual relation of its parts. Confess the truth, have you not hitherto entertained a more exalted idea of the works of nature ? Have you not considered them with more veneration than they deserve ? I have known some people esteem them less as their knowledge increased. For my part, said she, I contemplate the universe with more awful

delight now I find that such wonderful order is produced by principles so simple.

I know not, rejoined I, how you have acquired such rational ideas, for, to say the truth, they are not very common. The generality are affected only by the obscure and marvellous. They admire nature merely because they consider it a sort of magic ; something too occult for the understanding to reach : to them a thing appears contemptible as soon as they find the possibility of explaining its nature : but you, madam, can reason so clearly, that I have only to draw aside the veil, and present the world to your inspection.

What we behold at the greatest distance from our earth is the azure heaven, that immense arch to which the stars seem firmly to adhere. They are called fixed, because they appear to have no other motion than that of their sky, carrying them from east to west. Between the earth and the remote firmament are suspended, at various distances, the sun, moon, and the other five stars, denominated planets ; Mercury, Venus, Mars, Jupiter and Saturn.* These planets not being stationary at one point in the heavens, but having unequal motions, vary with

* In 1781, M. Herschel discovered a sixth. Astronomy by Lalande, third edition, 1792, Vol. 1, Art. 116.

respect to their relative situations; the fixed stars, on the contrary, always bear the same local relation to each other. The chariot, for instance, that you may distinguish, formed of those seven stars, has always had that configuration, and is likely to retain it; but the moon sometimes approaches nearer to the sun; sometimes retreats farther from it; the same is observed of the other planets. Such were the observations made by the Chaldean shepherds whose continual leisure enabled them to give so much attention to the heavenly bodies as to form the rudiments of astronomy, for we learn that that science took its rise in Chaldea,* as Geometry was first studied in Egypt, where the inundations of the Nile destroyed the boundaries of different possessions, made the inhabitants desirous of exact measures by which they could again separate their own lands from those of their neighbours. Thus astronomy is the offspring of idleness, geometry of interest; and if we enquire into the origin of poetry, we shall probably find that she is the daughter of love.

I am glad, said the Marchioness, you have given me this genealogy of the sciences; astronomy is the only one that will suit me: geometry, according to your account of it, requires a

* Perhaps in Ethiopia. Astronomy, Art. 260.

more selfish heart than mine; and I have not susceptibility enough to attempt poetry with success; I have, however, as much leisure as can be needful for the study of astronomy; it is another favourable circumstance that we are in the country, leading a pastoral life. Do not mistake madam, answered I, talking of planets and fixed stars is not all that constitutes a pastoral life. Was the conversation of the shepherds, in the golden age, confined to astronomy? Ah, said she, but it would be dangerous to conform one's mode of life to their's. No, that of the other shepherds you mention appears preferable to me; therefore let us converse, if you please, in the Chaldean style. After this disposition of the stars was remarked, what followed? The next thing, I replied, was to imagine the arrangement of the different parts of the universe; that is what the learned call making a system. But before I explain to you the first of these systems, give me leave to premise that we are all naturally disposed to the same sort of madness as a certain Athenian of whom you have heard, who had taken it in his head that every vessel which went into the port of Pyreum belonged to him. We chuse to believe that every thing in creation is destined to our service; and when we enquire of some philosophers the use of such a prodigious number of fixed stars, of which a smaller proportion would have been sufficient for all the

offices they appear to perform ; they coolly answer, they were made to gratify our sight. On this selfish principle it was for a long time supposed that the earth was motionless in the midst of the universe, whilst all the heavenly bodies were created for the sole purpose of journeying round, and distributing their light to her. Next to the earth they placed the moon, after the moon, Mercury, then Venus, the Sun, Mars, Jupiter, Saturn; beyond all these the firmament of fixed stars. It was imagined that the earth was stationed exactly in the middle of the circles described by these planets which extended in proportion to their distance from the earth, and that consequently the most remote planets required a longer time to perform their revolutions, which certainly is true. But, interrupted the Marchioness, I can't see why you should disapprove such an arrangement of the universe, it appears to me sufficiently commodious and intelligible, I really feel quite satisfied with it. I have taken pains, answered I, to represent this system in the most favourable point of view; if I were to explain it exactly as it was conceived by Ptolomy the author of it, and his disciples, you would be quite shocked. As the motions of the planets are irregular, being sometimes quicker, sometimes slower; going sometimes in one direction, sometimes in another; now nearer to the

earth, then at a greater distance from it; the ancients figured to themselves an endless number of circles intersecting each other, by which they endeavoured to understand the great variety of movements. The confusion, however, caused by such an infinity of circles was so perplexing that, at the time no better system was known, one of the kings of Castile,* a profound mathematician, was daring enough to say, that if the supreme Being had consulted him when he created the world, he would have given him some good advice. We are filled with horror at the impiety of this expression, but it serves to shew us how absurd must have been the hypothesis which could prompt it. The advice this man wished to have given, undoubtedly regarded the suppression of so many circles, which did but prevent the planetary motions from being understood. Probably he would likewise have expunged from the system two or three superfluous firmaments, supposed to be above the fixed stars. The philosophers, to explain some particular motion of the heavenly bodies, placed, beyond the heaven that bounds our view, a sky of crystal, which communicated this motion to the lower sky. Was a new movement discovered? they had nothing to do but to form a second crys-

* Alphonsus, king of Castile died in 1284.

tal firmament. In short skies of crystal were made without any trouble. Why did they always chuse crystal? enquired the Marchioness; would nothing else have answered the purpose as well? No, answered I, it was necessary to have a substance, at once transparent and solid, for it was Aristotle's opinion that solidity was essential to the dignity of their nature, and as this was believed by a great man, nobody thought of doubting it. But since that time comets have been seen which, being higher than was formerly imagined, must have broken all the crystal of these skies, in passing through them, and by that mean, thrown the universe into confusion; it was therefore found necessary to change the matter of which these firmaments were composed, into a fluid, such as air.

It is now discovered with certainty, by the researches of later ages, that Venus and Mercury turn round the Sun, and not round the earth, on this subject the ancient system is absolutely exploded. I will now acquaint you with another which provides for every difficulty, one that does not require any amendments of the king of Castile, for its simplicity is so charming that one cannot refuse to believe it. Your's, interrupted the Marchioness, seems a sort of bargaining philosophy; whoever offers a system that is effected at the least expense, has the preference. 'Tis true, said I; we have no other chance of under-

standing the plan by which the operations of nature are carried on. Nature is a wonderful economist; if a work is to be effected, and two ways are practicable, we may be sure she will adopt that which costs her the least, however trifling the difference. This economy is notwithstanding in every respect consistent with the surprising magnificence which appears in all her productions. Magnificence is employed in the design, and frugality in the execution of it. Nothing should excite our admiration so much as a stupendous project effected by simple means: but we are apt to cherish ideas of a very different kind. We place the frugality in the designs of nature, and her grandeur in the execution. We imagine her forming a contracted plan, and executing it with ten times the labour that is requisite: what can be so ridiculous? I hope, she replied, that the system you are going to explain will strictly imitate nature; the simplicity you so admire will spare me a great deal of trouble in comprehending your instructions. Your hope will be realized, said I, we have now no useless incumbrances. At the appearance of a certain German named Copernicus,* astronomy became simplified; he destroyed all the unnecessary cir-

* He was born in 1472, at Thorn, in Prussia Royal: he died in 1543.

cles, and crushed to pieces the crystalline firmaments.* Animated with philosophic enthusiasm, he dislodged the earth from the central situation which had been assigned it, and in its room placed the sun, who was more worthy of such a mark of distinction. The planets were no longer supposed to perform their revolutions round the earth, and enclose it in the centre of their orbits. If they afford us light it is as it were by chance, and in consequence of passing us in their course. They all turn around the sun; the earth itself not excepted; and as a punishment for the indolent repose it had been thought to enjoy, Copernicus made it take an ample share of the general activity: in short of all these celestial attendants, appointed for the service of our little globe, the moon alone is left to move round it. Stop a moment, said the Marchioness, your imagination is so elevated with your subject, you have explained it in such pompous language, that I believe I have scarcely understood you. The sun, you say, is immoveable in the centre of the universe; which of the planets is next in succession? 'Tis Mercury, I replied. Mercury goes regularly round the Sun in nearly a circular orbit, of which that luminary is the central point. Next

* Several of the ancients were of opinion that we should admit the motion of the earth. Astron. Art. 1075.

to Mercury is Venus, which turns in the same manner round the Sun. Afterwards comes the Earth, and being higher than Mercury and Venus, describes a larger circle round the Sun than either of those planets. Then follow Mars, Jupiter and Saturn, in the order I have named them; thus you see the circle of Saturn must be the most extensive of all; it likewise requires a longer time than the other planets to perform its revolution. But, exclaimed she, you have forgotten the moon. I shall recollect it presently, said I; the moon never abandons the earth, but is constantly going round it; but as the earth is continually moving onwards in a circle round the sun, the moon at once follows its motion, and revolves round it; this attendant planet, therefore only goes round the sun in consequence of invariably continuing near to the earth.

I understand you, said she, and I love the moon for remaining attached to us when we were forsaken by all the other planets. Confess that if your German could have alienated that too, he would have done it without regret; for one may see, in every part of his hypothesis, that he was but little inclined to favour the earth. He did well, I replied, to humble the vanity of men who chuse to claim the best situation in the universe; 'tis with pleasure I consider the world mixing in the croud of planets. Pshaw! cried the Marchioness; do you think vanity can have

any thing to do with a system of astronomy? Do you suppose I feel humbler for knowing that the earth goes round the sun? I assure you I esteem myself just as highly as I did before. Certainly, madam, I answered, men would be less concerned about the rank they held in the universe than that they enjoyed amongst their associates; neither would the disputes of two planets, for precedence, be so important in their judgement as those of two ambassadors. Nevertheless, the same disposition which induces a man of the world to aspire after the most honourable place in a room, will make a philosopher desirous of placing the globe on which he lives in the most distinguished situation in the universe. He likes to consider every thing made for his use; he encourages, without being aware of his vanity, so flattering an opinion, and his heart becomes deeply engaged about an affair of mere speculation. Upon my word, she exclaimed, you are calumniating human nature—how happened it that the opinions of Copernicus were received, since they are so very humiliating? Copernicus, answered I, was himself very doubtful of the reception they would meet with: it was a long while before he could resolve to publish his system; at last, however, he yielded to the entreaty of several distinguished characters; but what do you think was the consequence?—on the day they took him the first printed copy of his book, he

died: so he made use of the shortest way to escape from all the contradictions he had been anticipating.

Listen to me, said the Marchioness: let us be just to every body: it certainly is difficult to imagine we turn round the sun, for we never change places; we rise in the morning where we went to rest at night—I see from your look that you are going to tell me, that as the earth moves altogether——. Assuredly, said I, it is the same thing as going to sleep in a boat which was sailing down a river; on waking, you would find yourself in the same boat, and in the same part of the boat. Yes, replied she, but here is a difference; when I awoke I should find an alteration in the shore, and that would prove that the boat had changed its place: it is not so with respect to the earth, I there find every thing as I left it. No, no, madam, you may observe an alteration in the shore, as you do in the boat: you will recollect that beyond all the planets are the fixed stars, these are what we must consider the objects on the shore. I am on the earth; the earth describes a large circle round the sun; when I look to the middle of this circle I find the sun, and were not its brightness so dazzling as to render the stars invisible, I should constantly see, by looking beyond the centre, some of the fixed stars opposite to the sun; by viewing them however at night, I can easily determine how

they were situated in the day, which renders my observations equally accurate. If the earth remained in the same place I should always find the same fixed stars answering to the situation of the sun, but as the earth moves on in her orbit, I necessarily see other fixed stars at the point which I had before examined. Such is our shore, which is every day varying; and as the earth goes round the sun in a year, I observe the sun, during that space of time, successively answering to different fixed stars which compose a circle; this circle is called the Zodiac; shall I shew it you by tracing a figure on the earth? No, said she, I can dispense with that; it would give my park too learned an appearance. I think I have heard that a philosopher, shipwrecked on an island with which he was unacquainted, cried out to his companions on perceiving some lines and circles drawn on the sand; *courage, my friends! the island is inhabited; here are the footsteps of men.* You must consider that such *footsteps* ought not to be seen here.

It would certainly, I replied be more in character, to trace only the footsteps of lovers; that is to say, your name, engraved by your adorers on the bark of every tree. No more of adorers, cried she; let us talk of the sun. I understand perfectly why we imagined it performing the revolution which is merely effected by our own motion, but this circle requires a year; how, then,

does the sun appear to go round us every day? You undoubtedly know, I replied, that if a ball were rolled along this walk it would have two sorts of motion; it would go towards the end of the walk, and at the same time turn several times on its own axis, so that the side of the ball which is at first uppermost will presently descend, and the other, of course, rise to the top. This is the case with the earth: whilst she is proceeding, through the year, in her orbit round the sun, she turns on her own axis every twenty-four hours: each part, therefore, of the earth loses, and recovers sight of the sun during that time. When in the morning we turn towards the sun, it seems to rise; and when, by continued rotation, we again are more distant from it, it appears to descend. That's curious enough, said she; the earth undertakes every thing, and the sun does nothing at all: and when the moon, the other planets, and the fixed stars appear to pass over us in four-and-twenty hours, it is merely imagination. Exactly so, I replied, and produced by the same cause. The planets perform their revolutions round the sun in unequal periods of time, in consequence of their different distances from it; and one which we see to day answer to a certain point in the zodiac, or circle of fixed stars, will to-morrow at the same hour answer to some other point: this is the effect both of the progress which the planet has made in its orbit and of that which we have made

in ours. We move onward; the other planets do the same, but we do not continue all in a line: this occasions us to see them in such different situations, and renders their course apparently irregular. You now understand that such irregularity depends only on the different points from which we view them, and that, in reality all their movements are directed by the most exact order. It may be so, answered the Marchioness; but I should be glad if their order did not cost the earth so much: you seem to have very little consideration for it, and to require an astonishing agility in so large a body. But, said I, do you think it more reasonable for the sun, and all the other heavenly bodies, which are extremely large, to perform in four-and-twenty hours an immense journey round the earth? That the fixed stars, being in the largest circle, should travel, in the course of a day, more than twenty-seven thousand six hundred and sixty times two hundred millions of leagues?*

* According to later calculations, it would be a thousand millions of times a million of leagues; but a person who did not believe the motion of the earth would have no occasion to admit this prodigious distance.

leagues. Consider what a trifle are nine thousand in comparison of the terrific number I have just mentioned.

Oh! replied the Marchioness; the sun and stars are made of fire, a swift motion is nothing to them, but the earth does not seem formed for motion. And should you think, I answered, if experience had not proved the fact, that a large ship, carrying a hundred and fifty pieces of cannon, three thousand men, and a heavy freight of merchandize, could be *formed for motion*?—Yet a gentle breeze is sufficient to move it forwards, because the water, being liquid, and easily divided, makes a very slight resistance to the progress of the ship, or if it be in the middle of a river, it follows without difficulty the current of the water, since there is then no impediment. In like manner the earth, notwithstanding its weight, is with facility carried through the sky which is infinitely more fluid than water, and which fills the immense space occupied by all the planets. To what could the earth be fastened so strongly as to resist the current of this celestial fluid and remain motionless? we might as well imagine a little wooden ball could resist the tide of a river.

But, said she, how can a body so ponderous as the earth be suspended in your celestial fluid, which from its great fluidity must be extremely

light? It does not follow, I replied, that a substance must be extremely light because it is fluid. What do you think of the great ship we have been talking of, which, with all its lading, is lighter than the water that supports it? I won't have any more to say to you, answered she, half angrily, if you mention your ship again.* But tell me, is it not dangerous to inhabit such a whirling as you represent the earth? If you are afraid, said I, let us have the world supported by four elephants, as the Indians do. Well! cried she, here is a new system. I like those people for providing such good foundations for the earth to rest on, whilst we Copernicans are imprudent enough to swim at random in this celestial fluid. I dare say if the Indians knew there was the least danger of the earth's being moved, they would double the number of elephants.

It would be worth while, I replied, laughing at the thought, we must not be sparing of elephants if they can enable us to sleep in peace; if you would find them serviceable to night we'll put as many as you please, and then remove them one or two at a time as you find

* The Marchioness was in the right not to listen to such an answer. It is absurd to pretend that the ætherial fluid, so light and rare, can be capable of bearing along those enormous masses, the planets.

your courage return. No, said she, I don't think there is any need for them, and to speak seriously, I feel courageous enough to let the world turn round. And I can venture to predict, answered I, that in a little while its turning will give you pleasure; will even inspire the most delightful ideas, I sometimes imagine myself raised above the surface of the earth, and remaining motionless whilst its daily rotation continues. All the different inhabitants pass in review; some fair, some copper-coloured, some black. Now I see heads covered with hats; then with turbans; some shaven, others with flowing hair. As the towns pass before me, I observe some have steeples, some long spires with crosses on them, others are ornamented with towers of porcelaine. Then I behold large countries with no other buildings than little huts: afterwards, immense seas; then frightful desarts; and in short, all the boundless variety which is to be found on the face of the earth.

Really, she replied, it would be worth while to devote four-and-twenty hours to such a sight. If I understand you, when we move, other countries with their inhabitants pass into the situation we are leaving, and so on, till in four-and-twenty hours we again arrive at the same place.

Copernicus himself, said I, could not have comprehended it more clearly. The first that

would succeed us* would be the English: we should probably find them arguing on some political topic with less gaiety than we are discussing our philosophy. When we had dismissed them we should discover a vast sea,† on which perhaps would be some vessel, less at her ease than we. Then come the Iroquois, eating one of their prisoners of war, who does not even utter a groan though still alive when they begin to devour him.‡ After them the women of Jesso, who employ all their time in preparing victuals for their husbands, and painting their lips and eye-brows blue to appear handsome in the eyes of the most disgusting men in the world. Then the Tartars, very devoutly going on a pilgrimage to their high priest, who dwells in an obscure recess, enlightened only by lamps, the rays of which direct these votaries to the object of their adoration. Afterwards the beautiful Circassians who make no ceremony of granting all their favours to the first that solicits them, except what they believe the essential prerogative of their husbands. Then the inhabitants of Little Tartary, who go to steal women for the Turks and Persians. Last of all

* To speak more properly they would be one hundred leagues northward.

† The Atlantic.

‡ We should next see the Pacific Ocean.

our countrymen, whom we should find entertaining each other with the vagaries of their imagination.

It is amusing enough, said the Marchioness, to fancy oneself in a situation to see all these things: but if I were taking the view I should wish for the power of hastening or retarding the earth's motion, according to the feelings with which each object inspired me: I assure you I should soon push on those that argued on politics, and the others that devoured their enemies; but there are some of the people you have been speaking of that would excite my curiosity; the handsome Circassians, for instance, whose customs are so peculiar. But a serious difficulty occurs to me respecting your system. If the earth turns, we every moment change our atmosphere, and respire that of a new climate. By no means, madam, I replied; the air which surrounds the earth rises only to a certain height, twenty leagues perhaps at farthest;* this atmosphere always turns with us. You have doubtless observed the sort of shell in which a silk-worm imprisons itself, and which it forms with such astonishing art. It is composed of silk closely woven, but covered with a light down. Thus it is with regard to the earth, it is a solid body cover-

* Even at two leagues it is no longer discernable.

ed with an atmosphere extending to a certain height, which adheres to, and moves with it, as the down does with the firmer substance beneath it. Above our atmosphere is the celestial matter, incomparably more pure, subtile and active than air.

You represent the earth in a very contemptible light, said the Marchioness. Nevertheless on this silk-worm's shell we find stupendous works, furious wars, and universal agitation. Yes, answered I, and while all this is going on, nature, who does not concern herself about such frivolous things, carries us all along, with an uninterrupted motion, and amuses herself with the little ball.

It appears very ridiculous, replied she, to give way to so much anxiety, whilst one is living on a thing that is perpetually turning; but unfortunately we are not assured that it does turn, for, to tell you the truth, all the precautions you take to convince me that we should not feel its motion are unsatisfactory. How could it avoid giving some indication by which we should be sensible of it?*

The most common and natural motions, said I, are the least felt: this observation is true even in a moral sense: the motions of self-love are so frequent in our minds, that for

* There are several; one of them is the aberration of the stars. Astron. Book xvii.

the most part we are not sensible of them, but believe ourselves actuated by other principles. Ah! you are beginning to moralize, said she; moralizing and explaining natural philosophy are a little different; I fancy you grow tired of your subject: let us return home, we have had enough for the first lecture. To-morrow we will come here again—you with your systems, and I with my ignorance.

In our way to the house, to give her a complete history of systems, I told her that a third had been invented by Ticho Brahe, who, from a determination to keep the earth in a state of rest, placed her in the centre of the universe, making the sun revolve round her, and the planets round the sun; for in consequence of some discoveries which had been lately made, he found it impossible to make the planets go round the earth. The Marchioness, with her usual discernment, concluded that it was mere whim to exempt the earth from moving round the sun, when so many other larger bodies were allowed to perform the revolution; that the sun was rendered more unfit for turning round the earth when incumbered with the other planets, and in short that this system was only calculated to support a prejudice in favour of the earth's immobility,* without

* The ridiculous system of Ticho was invented out of re-

offering any thing to convince the judgment; we therefore resolved to retain that of Copernicus, which is more uniform and pleasing, and at the same time unmixed with prejudice. In fact its simplicity convinces, whilst its boldness excites admiration.

spect to the holy scriptures, not considering that their object was more important than the refutation of popular errors on natural philosophy.

SECOND EVENING.

THE MOON IS A HABITABLE GLOBE.

THE next morning as soon as the Marchioness was awake, I sent to enquire how she did, and whether she had been able to sleep whilst the globe was turning? I received for answer, that she already felt quite accustomed to the motion; and had slept as undisturbedly as Copernicus himself. Soon afterwards, some company came to spend the whole day with her; a tiresome custom which is always observed in the country; yet long as the visit was, we considered it a great kindness in the guests, not to prolong it to the next day; which I find is a common practice in this part of the world: however, as they had the civility to leave us, the Marchioness and I had the evening to ourselves. We immediately went to the park and resumed our astronomical conversation. She understood so perfectly all I had said on the former evening, that she disdained to hear any repetition of the subject, and desired me

to enter on a new one.—Well then, said I, since the sun, which we concluded is immovable, can no longer be considered a planet; and the earth is proved to be one, and to move round the sun; you will be the less surprised to hear, that the moon is a world like ours; and to all appearance, inhabited.—I never heard speak of peopling the moon; she replied, but as a ridiculous, visionary hypothesis.—It may be so, answered I; I only adopt the interest of any party, in these cases, as people do in civil wars; in which the uncertainty of the event, induces them to hold a correspondence with opposite sides, and even, when possible, with their enemies. For my part, though I believe the moon is inhabited, I can be very civil to any one that disbelieves it; and I always retain the power of going over to their side without disgracing myself, if I found they had the advantage: but in the present state of the question I have the following reasons for thinking the moon is inhabited.

Let us suppose that no communication had ever been carried on between Paris and St. Dennis; and that a Parisian who had never gone out of his own city should stand on one of the towers of Notre-Dame, and at that distance view St. Dennis: were he asked if he believed that St. Dennis was inhabited like Paris, he would without hesitation answer, No; I see inhabitants in Paris, but I can discover none at St. Dennis, nor

did I ever hear of any being there. Somebody standing by, might answer, that we certainly cannot see them from the towers of Notre-Dame, but that is, because we are at too great a distance ; that from all we can discern of St. Dennis it is very much like Paris ; that it has steeples, houses, walls ; and therefore is very probably inhabited. All this makes no impression on our citizen ; he insists upon it that St. Dennis is uninhabited because he does not see any body in it. The moon is our St. Dennis, and each of us is this Parisian who has never left the city in which he resides.

Oh ! you wrong us, interrupted the Marchioness ; we are not so stupid as your citizen ; when he sees that St. Dennis is constructed exactly on the same plan as Paris, he must be out of his senses not to believe it inhabited : but the moon is very different from the earth. Be cautious, madam, said I ; if the moon's resemblance to the earth prove it habitable, I shall force you to believe that it is inhabited. I confess, answered she, that if you can shew me the similarity, I cannot pretend to deny its being inhabited, and I see so much confidence in your looks that I am afraid you will be triumphant. The two different motions of the earth, which I never before knew any thing about, make me fearful of hastily rejecting any other opinion ; but still, can it be possible that the earth is luminous like the

moon?—that you know is essential to their similarity. Indeed, madam, I replied, the luminous quality of planets depends on less than you imagine. The sun alone is, in his *nature*, luminous; but the planets only reflect the light they receive from him. He enlightens the moon; the moon reflects his rays on the earth, and the earth is undoubtedly in the same manner a source of light to the moon; it is not farther from us to the moon, than from the moon to us.

But, enquired the Marchioness, is the earth equally capable of reflecting the sun's light? I see, answered I, you have an invincible partiality for the moon. Light is composed of globules which rebound from a solid substance, but pass through any thing in which they find interstices, such as air or glass: the moon, therefore, gives us light in consequence of being a hard, solid body, which sends back these globules. I suppose you will not dispute the hardness and solidity of the earth. See then the effect of an advantageous situation—because the moon is at a distance we only view her as a luminous body instead of a large mass of matter similar to the earth. Our globe, on the contrary, from having the ill luck to be more closely inspected, appears only a mass of dark soil, fit for nothing but to produce food for animals; we do not perceive the splendour of her light, because we cannot remove to a distance from her. So it is, answered the Mar-

chioness, with the different ranks of society: we are dazzled with the grandeur of situations superior to our own, without considering how much every condition of human life resembles all the rest.

'Tis precisely the same thing, I replied; we take upon us to decide on every thing, but we are never in a proper place for making our observations. We would form an opinion of ourselves, and we are too near; we would judge of others; they are too distant from our view. We should be placed between the earth and the moon to form a just comparison; a spectator, not an inhabitant of the world. I shall be inconsolable for the injustice we do our world, said she, and the partial regard we have for the moon, unless you can assure me that the inhabitants of that planet are as ignorant of *their* advantages, and consider our globe a luminous body, without knowing that from their own we derive so much light. I can make you easy on that head, answered I; we are certainly a luminary to them: they do not, it is true, see us describe a circle round them,* but

* This is an error, for if they consider the earth's situation relatively to the firmament, they must see that she performs a revolution in twenty-seven days: they certainly always find her answer to their zenith, or at the same distance from the zenith, but at the same time this zenith is continually answering to some new point in the heavens.

that does not signify. The reason of our appearing to remain in the same place is this;—the side of the moon which was turned towards us at the creation, has always continued so; we always observe the same eyes, mouth, and other features of the face which, by the help of imagination, we have contrived out of the spots on her surface.* If the other half were presented to us, we should see spots arranged in a different form: this does not arise from the moon's not turning on her axis; she turns in the same time that is employed in going round the earth, that is, a month; but whilst she is performing part of her revolution on her axis, she at the same time performs an equal part of her circle round the earth, and thus, by putting herself in a new situation, continues to shew the same side: therefore although with regard to the sun and the rest of the heavenly bodies the moon evidently turns on her axis, yet when viewed from the earth she does not appear to do so. All the other luminaries seem to the moon to rise and set in the space of a fortnight, but she constantly sees our globe in the

* When the moon is viewed through a telescope its spots bear no resemblance to the human face; but on contemplating it with the naked eye, it is easy to imagine that form; and it is become so common to talk of the face on the moon, that even an astronomer can hardly divest himself of the idea.

same part of the heavens.* This apparent immobility, were it invariable, would be thought inconsistent with the nature of a planet; but the moon has a sort of vibratory motion which sometimes conceals a small part of the face, and exhibits a part of the other side. Now, I can venture to say that the inhabitants attribute this motion to us, and imagine that we vibrate in the heavens, like a pendulum.

All the planets, said the Marchioness, are like us human beings, who always attribute to others what belongs to ourselves. The earth says; *it is not I who turn, it is the sun.* The moon says; *it is not I who vibrate, but the earth:* there is error throughout. I would not advise you to attempt making any reform, answered I; you had better consider the remaining proofs of the resemblance which the earth and moon bear to each other. Figure to yourself those two globes suspended in the heavens. You know the sun always enlightens one half of a circular body, whilst the other half remains in the shade. There is then one half of both the earth and the moon, which is enlightened by the sun, or in other words, in which it is day, and the other half in which it is night.

* The earth always answers to one side of the moon, but not the same point in the sky.

Observe likewise that as a ball moves with less force and celerity after it has struck against a wall from which it flies off to an opposite place, so the light is weaker when reflected to us from a body that only receives it. The pale light of the moon is in reality the brilliancy of the sun, but as we receive it merely by reflection, in coming to us, it is deprived of its strength. Of course, it shines with much greater splendour on the moon, and for the same reason the dazzling light received by our globe, from the sun, must appear faint, when reflected back to the moon. That part of the moon which to us appears luminous during the night, is the side which has day-light; and the part of the earth which is illuminated by the day, when turned toward the dark side of the moon, affords equal light to her. All this depends on the mutual position of the earth and moon. During the first days of the month, when the moon is not discernible, she is placed between the sun and us, and proceeding in the day time with the sun: the luminous side is therefore necessarily turned to the sun, whilst the dark part is towards the earth. We are unable to see the unenlightened side of the moon, but this dark half viewing the part of our globe in which it is day, is assisted by our light, and though invisible to us, has the advantage of seeing the earth as a full moon: it is then to the lunar inhabit-

ants *full-earth*, if I may so express myself.* After this, the moon advancing in her monthly round, and no longer between the sun and earth, turns towards us a small part of her enlightened half, and that we call the crescent. At the same time that part of the moon which is involved in the obscurity of night, ceases so see all the luminous side of the earth, and finds it continue to decrease.

Enough—said the Marchioness, in her lively manner; I shall easily learn the rest when I like: let me stop a moment, and trace the moon through her monthly circle. I see that in general that planet and the earth have very different degrees of light, and I imagine that when we have the full-moon all the luminous side of the moon is turned toward all the part of our globe which is obscure; and that, at that time, the inhabitants cannot discern us at all, but say they have *new-earth*. I should not chuse to be obnoxious to reproach for obliging you to enter into a long explanation of any thing so easily understood, but the eclipses—how are they effected? You could guess it without difficulty, I replied. When

* We have a convincing proof of the light reflected from the earth at this time, in the dusky light perceived on a part of the moon that is not enlightened by the sun. Astron. Art. 1412.

we have a new moon, and she, being between us and the sun, presents her dark side to our luminous half, the shadow of this obscure part falls on the earth; so that wherever the moon is in a direct line under the sun, she hides that luminary from our sight, and darkens a part of the enlightened side of our globe; this, then, forms an eclipse of the sun to us during the day-time, and an eclipse of the earth to the moon during her night. When the moon is at the full, the earth is between her and the sun, the shaded side of the earth towards the light side of the moon. If the earth's shadow fall directly on the moon, it darkens the luminous half that we see; 'tis then we have an eclipse of the moon in our night, and the moon, an eclipse of the sun in her day. What prevents an eclipse every time the moon is between the sun and us, or the earth between the sun and moon, is this; it often happens that these three bodies are not placed exactly in a line, in which case the one that would occasion the eclipse throws its shadow on one side of the other and consequently does not obstruct its light.

I am very much astonished, said the Marchioness, that there is so little mystery in eclipses, and that being produced by such simple means, every body does not discover the cause of them. In truth, answered I, there are many people, who from the emotions they feel at one of these phe-

nomena, appear to have little chance of finding out the occasion of them at present. Throughout the East-Indies, when the sun and moon are eclipsed, the inhabitants believe that a great dragon with his black claws is going to seize these luminaries; and all the time the eclipse lasts, you may see whole rivers covered with the heads of these Indians, who have put themselves up to the throat in water, because, according to their notions, this is a very religious act, and will induce the sun or moon to defend itself bravely against the dragon. In America, it was thought that the sun and moon were angry when they were eclipsed, and every kind of absurdity was practised to regain their favour. The Grecians too, who had arrived at such a height of refinement—did they not, for a long time, believe that the moon was eclipsed by the power of sorcery, and that the magicians caused her to descend from the skies and cast a baneful influence on the herbs? And were not we likewise in great alarm, but two-and-thirty years ago,* at a total eclipse of the sun? Did not an immense number of people shut themselves up in caves and cellars; and were they easily persuaded to leave them by

* 1654. There have been others in Europe in 1724, 1715, and 1716.

the philosophers who wrote so much to re-assure them?

Really, replied she, all that is too ridiculous. There ought to be a decree passed to prevent any body from ever talking of eclipses, lest the memory of these follies should be perpetuated. The decree, said I, should extend so far as to obliterate the memory of every subject, for I can think of nothing in the world which is not the monument of some human folly.

Answer me this question, said the Marchioness:—Are the inhabitants of the moon as much afraid of eclipses as those of the earth? How ridiculous it is if the Indians of that world put themselves up to the chin in water; if the Americans believe the earth is angry with them; if the Greeks imagine we are enchanted, and suppose we shall injure their herbs; and in short, if we are inflicting on them all the terror they have caused us? I have no doubt but that is the case, answered I; for why should the good folks in the moon have more sense than we? What right have they to frighten us, unless we can frighten them? I dare say, added I, laughing; that, as a prodigious number of men have been, and still are, silly enough to worship the moon; so there are some in the moon that pay their adorations to the earth, and that they are kneeling to one another. If it be so, she replied, we may pretend to have an influence on the moon, and to

produce the crisis in the diseases of her sick people, but as a little common sense in the dwellers on that globe would be sufficient to destroy all these honours, I must confess I am afraid they will have the advantage over us.

Don't alarm yourself, said I; 'tis not probable that we are the only fools in the universe. There is something in ignorance that is calculated for general reception, and though I can only guess the character of the people in question, yet I have no more doubt, that could we form the comparison, we should find ourselves equal to them, than I have that the accounts are true that we receive of their globe.

What accounts do you receive? enquired she. Those, I replied, that are given us by the learned who travel there every day by the assistance of telescopes. They tell us that they have discovered in the moon earth, seas, lakes, elevated mountains, and profound abysses.

You astonish me, cried the Marchioness: I cannot imagine the possibility of discovering mountains and abysses, from the great irregularity they cause on the surface of the globe; but how do they distinguish earth from sea? Because, answered I, the water,* by suffering part of the

* It is proved that there is no water in the moon, but there are volcanos; they may even be seen without a teles-

light to pass through it, and consequently reflecting less than the earth, has, at a distance, the appearance of dark spots; whilst the solid parts, by reflecting all the light, look much more brilliant. The illustrious M. Cassini, who has acquired a greater knowledge of the celestial bodies than any man in the world, discovered in the moon something which separates, then re-unites, and afterwards loses itself in a cavity. We have reason to believe, from its appearance that this is a river. In short all these different parts are now so well known to us, that they have been named after our great men. One place is called Copernicus, another Archimedes, another Gabilus. Other parts have fancy names; there is a promontory of decams, a sea of nectar, and so on; in fact our description of the moon is so particular, that if a learned man was to take a journey there, he would be in no more danger of losing himself than I should in Paris.

But, said she, I should like to have a more detailed account of the interior of the country. The gentlemen of the observatory are not able to give it you, I replied; you must make enquiry of Astolfo, who was taken to the moon by St. John. That is one of the pleasantest follies of Ariosto,

cope, which was the case on the 7th of March, 1794. *Philos. Trans.*

I'm sure you will be amused with it. I confess it would have been better if he had not introduced in it so respectable a name as that of St. John; poets, however, will take licenses, and we may venture to excuse this, for the whole poem is dedicated to a cardinal, and one of our popes has honoured it with a particular eulogium, which in some editions is placed before the work. This is the subject of the piece: Orlando, nephew to Charlemagne, had lost his senses, because the beautiful Angelica preferred Medore to him. Astolfo, a valourous knight-errant was one day carried by his hippogriffe to the terrestrial paradise, which was at the top of a very high mountain: there he met with St. John, who informed him that it was necessary, in order to cure Orlando of his madness, for them to take a journey together to the moon. Astolfo, delighted with the opportunity of seeing a new country, needed no entreaty, and in a moment the apostle and knight took their course in a chariot of fire. As Astolfo was no philosopher, he was surprised to find the moon much larger than it appeared while he was on the earth; his astonishment however increased when he saw in it rivers, lakes, mountains, towns, forests, and, what I should have been equally surprised at, nymphs hunting in the forests. But the most curious thing of all he saw was a valley in which was to be found every thing that was lost on the earth: crowns, riches, the

rewards of ambition, hopes without number, all the time that had been devoted to gaming, all the alms men had ordered to be distributed after their death, verses dedicated to monarchs, and the sighs of lovers.

As to lovers' sighs, rejoined the Marchioness; I don't know what became of them in Ariosto's time, but at present I fancy there are none that go to the moon. We should find a great many, said I, were they only those that you have occasioned. In short, the moon is so careful in collecting all that is lost here that not a single thing is wanting of the number; Ariosto has even whispered that Constantine's donation is there: the popes have assumed the government of Rome and Italy by virtue of a donation from that emperor, but the truth is we can't tell what is become of it. There is but one sort of thing that has not escaped to the moon, and that is—folly: the people on earth have taken care not to part with that; but to make the moon amends, an incredible quantity of wit has taken its flight thither, which is there preserved in phials; it is a very subtile fluid, and easily evaporates unless carefully corked up: on each of these phials is written the name of the owner. I think Ariosto puts them together without any order, but I like better to imagine them placed neatly in long rows. Astolfo was astonished to find full phials belonging to many wise people of his acquaint-

ance. I am sure, continued I, mine has been considerably augmented since I began to indulge myself with you in philosophic and poetic reveries: but I console myself by supposing that after listening to all my fancies *your* wits must inevitably become so volatile that at least a little phial full will evaporate, and make its way to the moon.

Our knight-errant found his own among the rest, and by St. John's permission took possession of it and snuffed up all the bottleful like Hungary water: but according to Ariosto he did not carry it away with him; for, it soon returned to the moon, in consequence of an extravagance he was guilty of some time after. He did not forget Orlando's phial which had occasioned his journey; he had a good deal of trouble in carrying it, for the hero's wit was naturally weighty, and not a drop was wanting. At the end, Ariosto, according to his general custom of saying whatever he pleases, addresses, in beautiful language the following apostrophe to his mistress: "Who, my fair one, will ascend to the heavens, to restore the senses of which your charms has robbed me? Hitherto I have not complained, but I know not what may be the extent of my loss; should I continue the victim of your beauty, I shall in the end become what I have represented Orlando to be. However, I do not believe it is necessary for me to traverse the airy regions for

the recovery of my senses; all the faculties of my soul, instead of mounting to such unattainable height, are solacing themselves in the beam of your eyes, and hovering round your lovely mouth. Ah! have compassion on me, and suffer me to take them back with my lips." Is not the thought pretty? For my part, in adopting Ariosto's way of thinking, I should dissuade people from ever letting their wits escape, unless it were from the influence of love; for you see how near they then continue, and how easily they may be regained; but when they are lost in any other way, as we, for instance, are losing ours, in philosophising, they fly directly to the moon, and are not caught again at pleasure. Never mind, said the Marchioness; ours will have an honourable station among the philosophic phials; whereas, had we lost them in the poet's way, they might perhaps hover around some unworthy object. But, continued she, to deprive me completely of mine, tell me seriously whether you believe there are men living in the moon, for you have not yet given me a decided opinion. Do I believe it? replied I; oh no, I don't believe there are men in the moon. We see how much all nature is changed even when we have travelled from here to China; different faces; different figures; different manners; and almost a different sort of understandings: from here to the moon the alteration must be considerably greater. When

adventurers explore unknown countries, the inhabitants they find are scarcely human; they are animals in the shape of men, even in that respect sometimes imperfect; but almost devoid of human reason; could any of these travellers reach the moon, they surely would not find it inhabited by men.

Then what sort of creatures are they? asked the Marchioness impatiently. Upon my word, madam, said I, I can't tell. Were it possible for us to be endowed with reason, and at the same time not of the human species; were we, I say, such beings, and inhabitants of the moon, should we ever imagine that this world contained so fantastical a creature as man? Could we form in our minds the image of a being composed of such extravagant passions, and such wise reflections; an existence so short, and plans so extensive; so much knowledge of trifles, and so much ignorance of the most important things; such ardent love of liberty, yet such proneness to slavery; so strong a desire for happiness, with so little power of being happy? The people in the moon, must be very clever to imagine such a motley character. We are incessantly contemplating our own nature, yet we are still unacquainted with it. Some have found it so difficult to comprehend, that they have said the gods had taken too much nectar when they created men; and when they had recovered their calm reason, they

could not help laughing at their own work. Well, we are not in danger of being laughed at by the inhabitants of the moon, answered the Marchioness, as they would find it so impossible to imagine our characters; but I should be very glad if we could find out theirs, for really, one feels a painful degree of curiosity in knowing that there are beings in the moon we see yonder, and not having the means of discovering what they are. How is it, I replied, that you have no anxiety to be acquainted with all the southern part of the world which is yet unknown to us? We and the inhabitants of that part of the globe are voyaging in the same vessel, of which they occupy the head and we the stern. You see that the head and the stern have no communication with each other; that the people at one end know nothing of the nature or occupations of those at the other, and yet you want to be acquainted with all that is going forward in the moon, that separate vessel which is sailing in a distant part of the heavens.

Oh! replied she, I consider myself already acquainted with the inhabitants of the southern world, for they certainly must be very much like us; and in short, we may know them better whenever we chuse to give ourselves the trouble of going to see them; we cannot miss them, for they will remain in the same place; but these folks in the moon—I am in despair about them.

Were I, I replied, gravely to answer you, *we know not what may happen*, you would laugh at me, and I should undoubtedly deserve it; nevertheless I think I could defend myself in some measure from your ridicule. A thought has come into my head, which is whimsical enough, and yet there is a wonderful deal of probability in it; I don't know how it has acquired the power of imposing that on my understanding, being in itself so extravagant. I dare say I shall likewise bring you to confess, contrary to reason, that there may some day be a communication opened between the earth and the moon. Recollect the situation of America before it was discovered by Christopher Columbus. The minds of its inhabitants were involved in the most profound ignorance; far from having any knowledge of the sciences, they were not even acquainted with the most simple and necessary arts: they went without clothes; they had no weapon but the bow; they had no notion that men might be carried by animals; they supposed the ocean an immense space, impassable by man, and bounded only by the sky to which it was joined. It is true that after they had been several years in contriving to scoop out the trunk of a great tree, they ventured to commit themselves to the water in this rude sort of vessel, and went from one country to another, borne along by the winds and waves: but as their bark was very liable to be upset, they

were frequently under the necessity of swimming to overtake it, so that properly speaking they were oftener in the water than in their ship. You must suppose they would not have yielded a very implicit credence to a person who had told them that a navigation was carried on, incomparably superior to theirs; that by its means, every part of the liquid expanse could be resorted to; that the vessels might be detained at one spot whilst the billows were foaming around; that even the speed with which they moved might be regulated; in short, that the ocean, whatever its extent might be, was no obstacle to the commerce of different people. In a course of time, however, notwithstanding their incredulity, a spectacle new and astonishing presents itself to the eyes of these savages. Enormous bodies, extending their white wings to the blast, come sailing on the ocean with fearful rapidity, and discharging fire on every side: these tremendous machines cast on their shore men covered with iron; guiding with facility the monsters that carry them, and darting thunderbolts from their hands to destroy all who attempt to resist them.—“ Whence come these awful beings? Who hath given them power to ride on the waters, and to wield the thunder of heaven? Are they children of the sun? assuredly they are not men!” I cannot tell, madam, whether you feel as strongly as I do, the surprise of the Americans; surely no event could ever have excited

an astonishment equal to theirs. After thinking of that, I will not assert that no communication can be established between our world and the moon. Did the Americans ever conceive the idea that there would be any between their country and Europe, of which they had never heard? There is, I acknowledge, an immense space of air to travel through before we could reach the moon; but did those great seas appear to the Americans more capable of being crossed? Really, exclaimed the Marchioness, looking earnestly at me, you are quite mad! Who denies it? answered I. It is impossible you *should* deny it said she. The Americans were so ignorant that they could not imagine the practicability of crossing such an extent of water; but we have science enough to know that the air is passable, although we have no machine which can transport us through it. We do more than conjecture the possibility of rising in the air, I replied; we have actually begun to fly. Several persons have discovered a method of fixing on wings which supported them in the air, of moving these wings, and by their assistance, flying over rivers; these new-fashioned birds, did not, to be sure, soar like the eagles, and their flight has sometimes cost them an arm or a leg; but, however, these attempts answer to the first pieces of wood that were launched into the water, and which served for the commencement of navigation: there was a vast dif-

ference between these mere planks and great ships, capable of going round the world; nevertheless, by gradual improvements we have learned to construct such vessels. The art of flying is but in its infancy; in due time it will be brought to perfection,* and some day or other we shall get to the moon. Can we pretend to know every thing; to have made every possible discovery? Pray let us give posterity leave to make some improvements as well as ourselves. I won't give them leave, answered she, to break their necks by attempting to fly. Well, I replied, though flying be not perfected here, the inhabitants of the moon, may perhaps excel us; and it will be the same thing whether we go to them, or they come to us. We shall then be like the Americans who knew so little of navigation whilst it was thoroughly understood at the other side of the globe. Pugh! cried the Marchioness; if the people in the moon were so expert, they would have been here before this time. The Europeans, answered I, did not find their way to America till six thousand years had elapsed; they were all that time in learning the art of navigation so

* Montgolfier's balloons, invented in 1783, have gone a great way towards the fulfilling of this prediction, but it is evidently impossible for it to be accomplished; these globes can only carry us to a certain height, beyond that we could not breathe.

completely as to pass over the ocean. Probably the people in the moon are able to take little excursions into the air, very likely they are now practising; after they have acquired more experience they will pay us a visit, and heaven knows what surprise it will occasion us! You are insupportable, exclaimed she, to combat me with such chimerical arguments. Take care, said I; if you provoke me I shall easily corroborate them. Remember the earth has been made known to us by little and little. The ancients positively asserted that the torrid and frozen zones were uninhabitable from the excessive heat of the one, and cold of the others; and in the time of the Romans the general chart of the world was made little larger than that of their own empire, this at once shewed the grand idea they had of themselves, and their extreme ignorance of the earth. Men were however discovered, in these extremely hot, and intensely cold, climates, which discovery has greatly augmented the number of inhabitants on our globe. At one time it was believed that the ocean covered every part of the earth except what was then known. Antipodes had never been heard of, and who could imagine that men would be able to walk with their heads downwards? Yet after all, the antipodes were found out. Now the map must be altered; a new half added to the earth!—You understand, madam, what I am aiming at; these antipodes,

so unexpectedly discovered, should teach us to think modestly of our attainments: we may yet know much more of our own world, and then become acquainted with the moon; till that time we must not expect it, because our knowledge is progressive: when we understand our own habitation, we may be permitted to study that of our neighbours. In truth, said she, viewing me attentively, you enter into the subject so deeply that one cannot but imagine you in earnest. Indeed I am not, answered I; I only wished to shew you the possibility of maintaining an extravagant opinion, so as to embarrass, though not convince, a person of sense. Truth alone makes her way to the understanding; she can even convince without exhibiting every proof: she is so adapted to our capacities, that when first discovered, we seem only to have met with an old acquaintance.

Ah! this restores my tranquillity, said she. Your sophistry disturbed my imagination. Let us retire; I am now composed and inclined to go to rest.

THIRD EVENING.

THE Marchioness wished to pursue our astronomical researches during the day; but I told her that as the moon and stars were the subjects of our whimsical conversations, they ought to be our only confidants; we therefore waited till evening, and then took our usual ramble in the park, which thus became sacred to learning.

I have a vast deal of news to tell you, said I; I yesterday told you that the moon, according to all appearances, was inhabited; but I have recollected a circumstance which would expose its inhabitants to so much danger, that I don't know whether I shall not retract my former opinion. Indeed I will not suffer you to retract it, answered she. Yesterday you prepared me to receive a visit from the inhabitants of the moon, in a few days; now you are going to refuse them a place in the creation. You shall not trifle with me in this way. You told me the moon

was inhabited; I surmounted the difficulty of believing it, and now I will continue to believe it. Softly! said I; we should give but half an assent to an opinion of this nature, and reserve the other half in case we should find the opposite idea better supported. I am not contented with words, she replied; give me facts: remember your comparison of the moon with St. Dennis. But, answered I, the moon is not so similar to the earth as St. Dennis is to Paris. The sun draws out of the earth and water exhalations, which rise to a certain height in the air, collect together, and form themselves into clouds. These clouds hover about the earth in irregular shapes, sometimes shadowing one part, and sometimes another. In viewing the earth from a distance, the appearance of its surface would continually vary, because a large space of country darkened by a cloud would appear less luminous than the other parts, and as the cloud dispersed, would resume its brightness: from this cause the spots on the earth would be seen to change their places, assume different forms, and sometimes be entirely dissipated. If, then, the moon had clouds in its atmosphere, we should observe this variety of spots; but we find them always confined to the same place, which proves that the sun raises no vapours from the moon. It is then a body incomparably more solid than the earth, and its more subtile particles easily dissipated as soon

as they are put in motion by the heat. The moon, therefore must be a mass of rock and marble from which no evaporation proceeds; for exhalations so naturally arise where there is water, that we cannot admit the existence of water where they are not found. What sort of beings do you think could inhabit these barren rocks; this country without water? Ah! cried she, you forget that you have assured me the seas in the moon were distinguishable. It was a mere conjecture,* I replied; I am sorry to have led you astray. These dark places that have been taken for seas are probably only deep cavities: at so great a distance it is excusable if we don't always guess aright. But, said she, will your objections oblige us to conclude that the moon has no inhabitants? By no means, answered I, we will neither decide one way or the other. I must own my weakness, she replied; I cannot bear to remain in suspense. I must believe something: enable me to determine; let us ascertain the existence of these people, or let us annihilate them at once, and think no more about them. But preserve them if possible; I have formed an attachment for them, of which I shall

* This is not, now, even conjectured, for with a telescope we may see irregularities at the bottom of what were supposed to be seas.

not easily divest myself. I will not leave the moon without inhabitants then, said I; for your pleasure it shall be repeopled.

As the spots in the moon never vary,* we certainly, cannot believe that there are any surrounding clouds which successively obscure the surrounding parts; this however is not a proof that there are no exhalations; our clouds are formed of vapours, which at their first rising out of the earth, were in separate particles, too small to be visible to us; in ascending they meet with a degree of cold that condenses, and unites them into conspicuous forms; after which they float in the air till they dissolve in rain. But these exhalations frequently remain dispersed and imperceptible, and fall back on the ground in gentle dews. I suppose then that vapours of this kind are exhaled from the moon, for it is incredible that the moon should be a large mass, composed of parts all equally solid, all in a state of equal tranquillity, all incapable of being influenced by the action of the sun. We know of no body which has these properties, not even marble. The most dense bodies are subject to change, either from some secret and interior mo-

* M. Herschel has observed variations in them; which he, with certainty, attributes to the industry of the inhabitants.

tion, or from the action of external matter. As the exhalations from the moon, do not form themselves into clouds, and return in showers, they can only become dew; for that purpose it is not necessary that the atmosphere, which apparently adheres to the moon as ours does to the earth, should be exactly similar to our air, nor the vapours exactly like ours; and that I think is probably the case:* the matter must have a different disposition in the moon, from that in the earth; consequently the effects be different; however all that is of no importance; since we find that there is motion in the parts of the moon, either internal, or produced by foreign causes, we may again people it, as we have the means of affording them subsistence; of producing fruit, corn, water, and every thing that is needful. I mean fruit, corn, &c. such as the moon can produce, the nature of which I am unacquainted with; and all these in proportion to the wants of its inhabitants, of which I am likewise ignorant.

That is to say, answered the Marchioness, you are sure every thing is right, without knowing how it is; here is a little knowledge placed against a great deal of ignorance, but we must be

* The atmosphere of the moon, if there be any, is quite invisible to us.

content with it: I am very happy to have inhabitants restored to the moon; I am glad also that you give them a surrounding atmosphere, for it seems to me that a planet would be too naked without one.

These two different airs, said I, one belonging to the earth, the other to the moon, tend to prevent the communication between the two planets. If it merely depended on the power of flying, who knows, as I yesterday said, but we may at some future time be sufficiently expert? All things considered, I think we must not expect this communication; the amazing distance at which they are placed, would be a considerable difficulty; and were this obstacle removed; were the two planets nearer together, it would be impossible to pass from one atmosphere to the other. Water is the atmosphere of fishes; they never pass into that of birds, nor the birds into theirs: they are not prevented by the distance, but the existence of both depends on their proper element. Our air, we find, is mixed with more dense and gross vapours than that of the moon; therefore an inhabitant of that world would be drowned if he entered our atmosphere, and fall lifeless on the earth.

Oh! how glad I should be, exclaimed the Marchioness, for a shipwreck to cast a good number of them on the earth, we might then examine them at our leisure. But, I replied, if

they were clever enough to navigate the surface of our atmosphere, and from a curiosity to examine us, should be tempted to draw us up like fishes; would that please you? Why not? answered she, laughing. I would voluntarily put myself in their nets, just for the pleasure of seeing the fishers.

Remember, said I, you would be very ill by the time you reached the top of our air; we are not capable of breathing it above a certain height;* it is said that at the summit of some mountains we can scarcely do it. I wonder that people who are silly enough to believe that corporeal genii inhabit the purest regions of the air, should not tell us, as the reason for our receiving such short and unfrequent visits from these genii, that few of them understand diving, and even those who excel in it cannot remain long in our gross air.

We see then there are many things to prevent us from leaving our own world and going to the moon. To console ourselves let us guess all we can about it. In the first place I conjecture that the inhabitants must see the heavens, the sun and the stars of a very different colour from what they appear to us. We view those objects through a sort of glass which alters their appearance;

* Respiration is difficult at the height of a league. Half a league higher it must be impossible.

this glass is our atmosphere, pervaded with exhalations. Some moderns assert that it is blue as well as the sea, but we can only distinguish the colour in the parts of those elements that are most remote from the eye. The firmament, say they, in which are the fixed stars, has no light in itself, and consequently ought to appear black,* but as we see it through our blue air, it seems to us to be blue. If that is true, the rays of the sun and stars cannot pass through the air without receiving a slight tinge from its colour, and losing a degree of that which is natural to them. But supposing the air is not coloured, it is certain that through a thick fog the light of a flambeau, seen at some distance, appears of a deep red, which is not its real colour; if therefore our air be considered only a mist, it must necessarily alter the colour of the sky, sun, and stars. The celestial fluid alone could give us light and colours in their original state. Therefore as the atmosphere of the moon differs from ours, it is either of a different colour, or else it is another sort of mist, which varies the appearance of the celestial bodies. In a word, the glass through which the people in the moon view these objects is of a different nature to ours.

* Desaussure tells us it appears black when viewed at a league's distance from the earth.

On that account, replied the Marchioness, I prefer our world to the moon; I think it impossible for the assortment of colours presented to their sight by the heavenly bodies to be so beautiful as that they form when viewed through the medium of our air. Let us suppose a red sky and green stars; the effect is not so agreeable as golden stars and a blue sky. One would think, said I, you were chusing-clothes or furniture; but believe me, nature has a good taste; let us trust to her for providing a set of colours for the moon, there is no fear but it will be a pleasing one. She has undoubtedly varied the appearance of the universe at each different point of view, and in all these varieties there is great beauty.

I acknowledge her talents, answered she; at each point of view she has placed a different sort of glass, by which mean she has given the appearance of variety to objects which remain always the same. With a blue atmosphere, we have a blue sky, and perhaps with a red atmosphere, the inhabitants of the moon have a red sky; yet this sky is absolutely the same. In like manner she seems to have placed various sorts of glasses before the eyes of our imagination, through which the same object presents to each of us a different appearance. To Alexander, the earth appeared a proper place to convert into an empire, for his sway; Celadon, viewed it only as a fit residence for Astrea; a

philosopher considers it a large planet, travelling through the heavens, and inhabited by a number of madmen. I think the spectacle of nature cannot be more varied than the prospects of different imaginations.

The varied appearance of objects viewed by the imagination, I replied, is the most surprising, for they are exactly the same things though apparently so dissimilar: whereas there may be other natural objects visible to the moon, and some that are visible to us may not be seen there; perhaps, for instance, there is neither dawn nor twilight. The air that surrounds us, rises to some height, receives the rays of light that would not reach the earth, and by its density, detains, and conveys to us a part of this light which was apparently not destined for us: thus you see the dawn and twilight are particular favours conferred on us by nature; they are degrees of light to which we are not regularly entitled, and which are bestowed on us in addition to our share. But the atmosphere of the moon, being purer than ours, is probably not so well calculated to reflect the rays which it receives before the sun is risen, or after it is set. The poor inhabitants have not then this light, which by its gradual increase prepares us so agreeably for the brilliancy of the sun; and in the evening reconciles us to its loss, by a progressive diminution. The moon, after the profound gloom of

night, receives the ardent blaze of the sun, as if by the instantaneous drawing up of a curtain: on the contrary, whilst still enjoying the dazzling light of day, it is again plunged into extreme darkness: day and night are not connected by an agreeable medium, partaking of both. The people in the moon never see the rainbow; for as the dawn is produced by the thickness of our air and vapours, so the rainbow is formed in the clouds which are dispersed in rain; thus we are indebted for the most beautiful appearances in nature, to things, in themselves, far from agreeable. Since the moon has neither dense vapours nor rainy clouds, farewell to Aurora, and the Rainbow! Alas! to what can they liken the beauties of that country; what a source of comparison are they deprived of!

I should not much regret those comparisons, answered the Marchioness; and I think the inhabitants of the moon have ample amends made them for the loss of rainbows and twilight by being exempted from thunder and lightning; for these likewise are formed in the clouds. They have constant serenity of weather; never losing sight of the sun. They have no gloomy nights in which the stars are concealed. They are unacquainted with those storms and tempests; those elemental wars which seem to indicate the wrath of heaven. Are they then to be pitied? You speak of the moon as an enchant-

ing spot, said I; yet I don't know whether it is very delightful to be exposed throughout a day that is as long as our fortnight * to a blazing sun, without a cloud to temper the intensity of its heat. It is perhaps owing to this that nature has formed cavities in the moon, large enough to be seen by our telescopes; they are not valleys situated between mountains, but hollow places in the midst of large plains. How do we know whether the inhabitants, oppressed by the perpetual radiance of the sun, may not take refuge in these caverns? Perhaps they even build towns, and constantly reside in these parts. We see that here our subterraneous Rome is larger than the Rome which is built on the surface: we have only to remove the latter, and the other would be a city such as we should find in the moon. A large number of the people dwell in each cavern, and from one cavern to another is a subterraneous passage for the communication of the inhabitants. You laugh at this idea; I have no objection: but seriously, I think you are more likely to be mistaken than I. You believe the people in the moon must dwell on the surface, because we are on the surface of our globe; you should form quite a different opinion, and think

* During this time the sun rises and sets as it does in our day.

that because we reside on the surface they dwell in the interior parts; every thing must be very differently conducted here and in the moon.

It does not signify, replied the Marchioness; I can't bear the idea of these people living in perpetual darkness. You would find it still more difficult to admit the opinion, said I, if you knew that a great philosopher of ancient times had informed us that the moon was the dwelling of souls who had on earth rendered themselves worthy of very exalted happiness. He supposes that their felicity consists in listening to the music of the spheres; but that when the moon comes under the shadow of the earth, they are no longer able to hear this celestial harmony, at which time they utter the most piercing cries, and the moon hastens on as fast as possible to relieve them from this agonizing situation. We may expect then, answered she, to have the virtuous spirits sent here from the moon, for I suppose they likewise honour our world by making it an abode of the blessed: so in these two planets it is thought a sufficient reward to superior goodness for the soul to be transported from one world to the other. Really, I replied, it would not be a trifling enjoyment to take a survey of different worlds; I often receive a great deal of pleasure from such a journey, although but in imagination; what must it be then to perform it in reality? It would be much more delightful than

going from here to Japan; in other words, than crawling from one end of the earth to the other with great labour, merely for the sake of seeing men. Well, said she, let us make this tour to the planets as we can; what should prevent us? We will place ourselves at all those different points of view, and at each of them survey the universe. Have we any thing else to see in the moon? You are not yet thoroughly acquainted with that world, I replied. You recollect that the two motions of the moon, by one of which she turns on her axis, and by the other round us, being equal, the latter always prevents the former from withdrawing any part from our sight, and consequently we always view the same side. That half therefore is the only part that can see our world, and as the moon, with regard to us, must be considered not to turn on her centre, the half to which we are visible, sees us always fixed in the same part of the sky.* When it is night, and the nights there are as long as our fortnight, she sees at first only a very small part of the earth enlightened; then a larger portion, and at length the light seems hourly to spread over the earth, till it becomes entirely luminous. On the contrary these changes in the moon are

* That is to say only at the same distance from the zenith and the horizon.

visible to us only from one night to another, because we are a long time without seeing her. I should like to hear the mistakes which the philosophers of that world fall into from the apparent immobility of our earth, whilst all the other heavenly bodies rise and set in the space of a fortnight. Probably they consider the earth immovable in consequence of her enormous size, being sixty times larger than the moon; and when the poets are disposed to flatter indolent princes, I have no doubt but they compare them to this orb in her state of majestic repose. It does not however appear an entire immobility. From the moon they must see the earth turn on her axis. Our Europe, Asia, America, present themselves one after another, in different shapes, nearly as they are represented on our maps. Only imagine what a novel sight this must be to travellers coming from the other side of the moon to that which is always facing us! How incredulously *they* must have heard the accounts of the first, that spoke of it, who lived at the opposite side. It is come into my head, said the Marchioness, that from that half of the moon to the other they make pilgrimages to come and examine us, and that particular honours and privileges are destined for those who have seen the great planet. At least, answered I, they who constantly see us have the privilege of being better illumined during their nights; the inhabit-

ants of the other side must be much less agreeably situated in that respect.

Now, madam, let us pursue our journey to the different planets; we have been long enough at the moon. Next, in the road from the moon to the sun, we find Venus. In talking of Venus I shall resume my argument concerning St. Dennis. Venus, as well as the moon, turns on her axis and goes round the sun: with telescopes it is seen that this planet, like the moon, is sometimes a crescent, sometimes on the decrease sometimes full, according to her different situations relatively to the earth. The moon, according to all appearances, is inhabited; why then should Venus be destitute of inhabitants? But, interrupted the Marchioness, with your *why nots* you will put inhabitants in all the planets. Certainly, I replied, this *why not* has the power of peopling them all. We find that they are of the same nature, all opaque bodies, illumined only by the sun, and the reflection of his rays on each other; and having all the same motions. So far then they are alike, and yet we are to suppose that these great planets were formed to remain uninhabited, and that such being the natural condition of them all, an exception should be made in favour of the earth—let who will believe it; I cannot. A few minutes, answered she, have wonderfully confirmed your opinion. Just now the moon was on the point of being quite

deserted, and you cared very little about the matter, and now, if one were to presume to deny that all the planets are as full of inhabitants as the earth, I see you would be quite in a passion. It is true, said I, that in the positive fit I had just now, if you had contradicted me on the subject of these said inhabitants, I should not only have maintained their existence, but in all probability have described their formation. There are certain moments when we feel assured of a thing, and I never felt so fully persuaded of my opinion as I was then ; however, though my ardour is now a little abated, I still think it would be very strange for the earth to be so well inhabited, and the other planets perfectly solitary; and numerous as we know the inhabitants of the earth to be, we do not see them all, our world contains as many species of animals that are invisible to us, as of those that we discern. From the elephant to the hand-worm we can examine them; there our sight is bounded: but after the hand-worm is an infinitude of little animals not discernible by the naked eye, and to which, in point of size, he is an elephant. With magnifying glasses, we may see a drop of water, vinegar, or any other liquor, filled with little fishes or serpents, which we should never have thought of finding there; and some philosophers suppose the taste of these liquors is produced by punctures which the little animals make in the tongue.

Mix these liquors with certain things, expose them to the sun, or leave it to corrupt, and you will find new sorts of animals.

Many masses, apparently solid, contains scarcely any thing but a heap of these small animals, which in so confined a situation find room enough for their little movements. The leaf of a tree is a world, inhabited by worms imperceptibly small, to which it appears an amazing extent, having mountains and caverns, and so large that from one side of the leaf to the other the little worms have no more communication with each other than we have with the antipodes. From such considerations I cannot doubt of a great planet being inhabited. There have been found even in very hard stones an endless number of worms lodged in every interstice, feeding on parts of the stone. Consider the countless numbers of these little beings, and how many years they could subsist on a quantity of food as big as a grain of sand; and then though the moon should be but a mass of rock, we may let it be eaten by its inhabitants rather than not assign any to it. In short every thing is animated; every thing is full of life. Associate in your calculation all the species that have been lately discovered, and those that we may suppose are yet undiscovered, with all that we are in the habit of seeing, and you will surely confess that the earth is amply stocked with living creatures; that nature must

delight in bestowing life since she has created such infinite variety of beings so small as to elude our sight. Can you believe that after the earth has been thus made to abound with life, the rest of the planets have not a living creature in them?

My reason is convinced, answered the Marchioness; but my imagination is overwhelmed with such an infinite variety and number of inhabitants existing in each of the planets; for as there is no dull uniformity in nature, the difference of species must be in proportion to the number of beings—how can imagination grasp such a vast idea? Imagination, I replied, is not required to represent all this to us; we can penetrate no farther than we are assisted by our sight; we can only perceive; from a general glance, that nature has established an inconceivable diversity in her works. The human face is formed every where on the same plan, but still how great is the difference between the visages of Europeans and of Africans or Tartars: not only in separate nations do we find a distinguishing character of countenance, even among the same people every family seems formed from a distinct model. How astonishing is the power of nature in giving such variety to so simple an object! In the universe we are but as a little family whose faces resemble each other; the next planet contains another family who have a differ-

ent style of countenance. Probably the variations are greater in proportion to the distance, and could we compare the inhabitants of the earth and moon, we should easily see that they were nearer neighbours than those of the earth and of saturn. Here, for instance, our thoughts are made vocal; the people in another planet only express themselves by gestures; farther off, they may dispense with any sort of conversation. Here our reason is matured by experience; elsewhere experience may add little to the understanding; at a greater distance, children may know as much as old men. In this world we give ourselves more uneasiness about the future than the past; on another globe, the past afflicts more than the future; on a third, the people are neither distressed by one nor the other, and they perhaps are not the most unhappy. It is said that we are possibly in want of a sixth sense belonging to our nature, by means of which our knowledge would be greatly augmented. This sense is most likely in some other world, where one of our five is wanting. There may even be a very great number of natural senses, but in the distribution of them among the planets, only five have fallen to our share, and with these five we remain satisfied because we don't know of any more. Our sciences have certain limits which no human understanding has exceeded: at a particular point we stop, the rest is reserved

for other worlds, where they are ignorant of many things that we know. This planet is blest with the delightful emotions of love, but at the same time desolated by the fury of war. Another enjoys perpetual tranquillity, but with this uninterrupted peace, love is unknown, and calmness degenerates into ennui. In short whatever nature has done on a small scale, for the distribution of happiness and talents among us, she has undoubtedly performed on a more extensive plan for the benefit of the universe; at once diversifying and equalizing all.

Are you satisfied, madam, said I? Have I given your imagination room to exert itself? Do you not already see the people of different planets? No, answered she, with a sigh: all you have been saying is so vague and unsatisfactory; there is nothing in it for the mind to fix on. I want something more determined; more marked. Well then, I replied, I will not conceal any particulars that I am acquainted with: I can give you some information that you will acknowledge to be undoubted, when I tell you my authorities. Prepare to listen patiently if you please, for it is a long story.

In one of the planets, I shall not at present tell you which, there is a people that are very active, laborious and skilful. Like some of our Arabs, they live by pillage, and that is their only fault. They live together in the most harmo-

nious manner, labouring incessantly and in concert, for the common good : above all their chastity is unexampled ; it is true they have no great merit in it ; they are all sterile ; there is no difference of sex among them. But, interrupted the Marchioness, were you not aware that the author of this marvellous story wanted to make a fool of you ? How could such a nation be perpetuated ? No, I replied, very coolly, they did not intend to make a fool of me ; all that I have told you is fact, yet the nation is perpetuated. They have a queen whose royalty consists, not in directing the business of the state, not in leading her subjects to the field of battle, but in her surprizing fecundity, she has millions of children ; in short the production of them occupies the whole of her time. She has a large palace, divided into a vast number of chambers, in each of which a cradle is prepared for a little prince, and she is confined successively in all these chambers, always surrounded by her courtiers who congratulate her on the noble privilege she enjoys exclusively of her subjects.

I see, madam, that you wish to enquire who are her lovers, or, to give them a more respectable appellation, her husbands. Some of the eastern queens have seraglios of men ; she apparently does the same, but she keeps it a greater secret than they ; this may arise from modesty, but it is acting with little dignity. Among these

Arabs who are always in action, are found a few strangers, in person very much resembling the natives of the country, though extremely different in disposition, for they are remarkably indolent; they never stir out nor engage in any business; and were not these persons kept for the pleasure of the queen, they would hardly be suffered to remain amongst so industrious a people. If, in reality, notwithstanding the smallness of their number, they are the fathers of many thousands of children, they deserve to be excused from any other employment; and it is a striking proof that this is their only function, that as soon as the queen has brought forth her ten thousand children, the Arabs kill, without mercy, the unhappy foreigners, then become useless to the state.

Have you done? enquired the Marchioness. Thank heavens! Let us now resume a little common sense, if we can. Where have you picked up this romance? What poet is the inventor of it? I again tell you, answered I, that it is no romance. All this takes place on our globe, even under our eyes.—If I must explain the mystery, These Arabs are no other than bees.

After this I gave her the natural history of bees, of which she had before scarcely ever heard more than the name. In concluding, you see, said I, that in attributing to other planets what is daily passing here, we should be accused of

telling the most extravagant falsehoods. The history of insects, in particular, is a collection of wonders. I have no doubt of it, she replied: the silk-worm alone, with which I was better acquainted than the bees, would afford abundant materials for your descriptions. A people undergoing such wonderful changes as to be totally unlike what they formerly were; at one part of their lives crawling, at another, flying: in short a thousand incredible things might be told of the character and manners of this nation.

My imagination continued the Marchioness, is beginning to work on the subject you have given me—the inhabitants of all the planets: I am conjecturing their figures; I can discern some of them very distinctly, but I don't know how to describe them to you. As to their figures, said I, I advise you to leave the formation of them to your dreams: we shall hear to-morrow what they have suggested, and whether they have been able to represent the inhabitants of any of the planets.

FOURTH EVENING.

PARTICULARS CONCERNING THE PLANETS VENUS, MERCURY, MARS, JUPITER AND SATURN.

THE dreams of the Marchioness did not assist her ; they represented nothing that did not bear a resemblance to what we see here. I had the the same complaints to make as certain people, whose paintings are always fanciful and grotesque, do at the sight of our pictures,—*Pshaw*, say they, *these are all men ; here are no objects of imagination.* We therefore resolved to content ourselves with the conjectures we should be able to make concerning the inhabitants of the planets as we continued our journey : we had last night got as far as Venus. We are assured, said I, that Venus turns on her axis, but it is not ascertained in how long a time, consequently we cannot tell the length of her days. Her years lasts but about eight months, as she is not longer than that in performing her revolution round the sun. She is of the same size as the earth, therefore the earth and Venus appear equally large to each

other. I am glad of that, said the Marchioness ; then I hope the earth is to Venus the shepherd's star, and the parent of love, as Venus is to us. These appellations can be proper only for a pretty little, brilliant, gay looking planet. True, answered I ; but do you know what makes Venus look so beautiful at a distance ?—it is the effect of her being very frightful when near. With good telescopes it has been seen that she is covered with mountains, much higher than ours, sharp-pointed, and apparently very dry.* This kind of surface is the best calculated to reflect the light with great brilliancy. Our earth, whose surface is very smooth, compared with that of Venus, and partly covered with water, probably looks less beautiful at a distance. So much the worse, said the Marchioness ; I should like her to preside over the loves of the inhabitants of Venus ; they must certainly understand what love is. Oh ! undoubtedly, I replied ; the people in that planet, are all Celadons and Sylvanders, and their every-day conversations are finer than the most admired in Clelia. Their climate is very favourable to the tender passion. Venus is nearer to the sun than we ; and receives

* M. Herschel's observations contradict this idea. Venus has a very dense atmosphere, which prevents us from distinguishing any thing on her surface ; the brilliant appearance of this planet arises from her proximity to the earth.

more light and heat : she is about two thirds the distance of the earth, from the sun.

I can see, interrupted the Marchioness, what sort of people the inhabitants are. They are much like the Moors of Granada : a little dark, sun-burnt people, scorched with the sun ; full of wit and animation, always in love, always making verses, listening to music, having galas, dances and tournaments. Give me leave to tell you, madam, answered I, that you know but little of the inhabitants of Venus. Our Moors of Granada when compared with them would appear as cold and stupid as Greenlanders.

But what must the inhabitants of Mercury be ? We are above twice the distance from the sun that they are. They must be almost mad with vivacity, Like most of the negroes, they are without memory ; never reflecting ; acting by starts and at random : in short Mercury is the bedlam of the universe. The sun appears there nine times larger than it does to us : the light they receive is so brilliant that our finest days would be but twilight in comparison of theirs ; perhaps they would find them so dark as not to be able to distinguish one thing from another. The heat to which they are accustomed is so intense, that they would be almost frozen in our Africa. In all probability our iron, silver and gold would be melted in their world, and only be seen in a liquid state, as we in general

have water, which in some degrees of cold becomes a solid body. The inhabitants of Mercury would not imagine that in another world those liquors, which perhaps form their rivers, are the hardest of all bodies. Their year lasts but three months. The length of their day is not known to us, because Mercury is so small and so near the sun, that it exceeds the art of all our astronomers to observe him with sufficient accuracy to determine what sort of motion he has on his centre: the inhabitants, I think, must wish it to be performed in a short time, for scorched as they are with the fierceness of the sun, the coolness of night is undoubtedly very desirable to them. The part which by rotation is deprived of the sun's light, is illumined by Venus and the earth, which must appear very large. As to the other planets, being farther off than the earth, they, seen from Mercury, appear much smaller than to us, and afford very little light to that planet.

I don't feel so much for its inhabitants on that account, replied the Marchioness, as from the inconvenience they must suffer from such excessive heat. Let us try if we can't relieve them in some way. Is it not probable they have long and plentiful showers, such as we are told fall continually for four months together, in our hot countries, at the seasons when the heat is most intense?

It may be the case, answered I; and we have another way of giving them relief. There are some parts of China which from their situation ought to be very hot, and yet, even in the month of July and August the weather is so cold that their rivers freeze. This coldness arises from the quantities of salt-petre with which the countries abound; the exhalations, drawn up in great abundance by the heat are of a cold nature. Mercury, if you please, shall be a little planet made of salt-petre, and the sun, by attracting the cooling exhalations, will thus prevent the evil it would otherwise be the cause of. However, we may rest assured that nature would not place beings where it was impossible for them to exist; and that habit, and ignorance of a better climate, render this situation agreeable: Mercury therefore may perhaps do very well without salt-petre, or abundant rains.

After Mercury, you know, we find the sun. We cannot possibly place inhabitants there: the *why not* fails in this case. We conclude from the earth being inhabited that other bodies of the same nature must be so too: but the sun does not resemble the earth, and the rest of the planets. He is the source of all that light which the planets only reflect to each other after they have received it from him. They make exchanges, if I may so express myself, with one another, but none of them can bestow an original light. The

sun is the sole proprietor of that treasure ; which he distributes freely on every side. The light, thus issuing from the centre, is reflected from every solid body it meets, and from one planet to another it proceeds in bright streams that intermix, and cross each other in a thousand directions, forming a splendid tissue of the richest materials. The grand luminary by being placed in the centre is in the most advantageous situation for animating each planet with his heat and radiance. The sun, then, is of a peculiar nature, but what that nature is, we find it difficult to imagine. Formerly it was believed to be a pure fire, but lately we have been undeceived by observing spots on the surface. As certain new planets had just before been discovered, (I shall give you an account of these planets hereafter;) which entirely engrossed the attention of the philosophers, a sort of mania for new planets seized their minds, and they immediately concluded these spots were some; that they performed a circle round the sun, and necessarily concealed some part of his light by turning their dark side towards the earth. The learned already, through these planets, complimented the different princes of Europe. Some gave them the name of one prince; some of another, and perhaps in time there would have been a great contest to know who had the best right to name these spots.

I don't like their plan, said the Marchioness. You told me, the other day, that the different parts of the moon were named after learned men ; I thought that very proper : as princes monopolize the earth, it is but fair that astronomers should have the sky for their share, and not suffer princes to intrude on their domain. Allow them, however, I replied, if territory should be wanting, to consign to them some planet, or some part of the moon. As to these spots on the sun, they can make no use of them ; for instead of planets, we find they are only clouds of smoke or dross arising from the sun. Sometimes these clouds are greatly accumulated, sometimes we see little of them, and at other times they totally disappear. Sometimes a number of them are combined together, then they are separated into small parts ; at one time they are very dark, at another they grow pale. It appears as if the sun was some kind of liquid ; many people think it is melted gold, in a continual state of ebullition, producing impurities, which the rapidity of its motion casts up from the surface ; they are afterwards consumed and others produced. Only think what amazing bodies these are. Some of them are seventeen hundred times * larger than the earth, for

* The largest of the sun's spots are scarcely three times larger than the diameter of the earth, or twenty-seven times its bulk.

you must know, the earth is more than a million times smaller than the sun.* Imagine therefore what must be the quantity of this liquid gold, or the extent of this ocean of light and fire!

Other philosophers say, and with great plausibility, that the spots, or at least the greatest part of them, are not newly produced, and then destroyed after a certain time; but large, solid, masses, of irregular forms, always subsisting; sometimes floating on the surface of the sun, sometimes partly, or entirely buried in the liquid substance, and presenting to our view different projections according to the size of the part that remains uncovered. Perhaps they may be parts of some great mass of matter which serves as aliment to the fire of the sun. However, let the sun be what it will, it does not by any means appear habitable. † It is a pity; the situation would be advantageous: placed at the centre, its inhabitants would see the planets going round them in regular orbits, whilst to us their motions seem to have perplexing varieties, which are

* The earth is only a hundred, or to speak with more exactness, a hundred and eleven times, smaller.

† Some natural philosophers have however thought that the sun might be the cause of heat without being itself hot; and that there was a possibility of its being inhabited. M. Herschel believes its population very abundant. *Trans Philos.* 1795. *Décade Philosophique.*

merely the effect of our not observing them from the best place ; that is, the centre of their circles. What a sad thing it is: there is but one spot where the study of the celestial bodies would be extremely easy, and at that spot there is nobody to pursue the study. You forget yourself, answered the Marchioness. Were any one placed on the sun, he would neither see the planets nor the fixed stars; would not the light of the sun efface every other object? The inhabitants would doubtless think themselves the only people in existence.

I acknowledge my error, I replied: I was thinking of the situation of the sun, without considering the effect of such an excessive light: but although you have so properly corrected my mistake, yet you must allow me to tell you that you have fallen into one yourself. The inhabitants of the sun would not see any thing: they would be either incapable of enduring so immoderate a light, or, were their eyes sufficiently strong, of receiving it unless they were at some distance; therefore the sun could only be a habitation for people without sight. In short, we have abundant proofs that this luminary was not intended to be a dwelling-place; and therefore we may as well continue our planetary journey. We are now stopping at the central point which is always the lowest part in any thing that is round; and, by the way, I should tell you that in going from

our world to this centre we have travelled thirty-three millions of leagues. We must now return the way we came. We pass by Mercury, Venus, the Earth and the Moon; all which we have visited. Then we arrive at Mars. I don't know that there is any thing remarkable in this planet. The days there are about half an hour longer than ours; and the years twice the length of ours, except a month and a half. Mars is four times less than the earth,* and the sun appears rather smaller and less brilliant than it does to us.—In short, Mars contains nothing calculated to arrest our attention.

But what a beautiful object is Jupiter, surrounded by his four moons, or satellites! These moons are four little planets which, whilst Jupiter revolves in twelve years round the sun, constantly go round him as the moon does round the earth. But, interrupted the Marchioness, how is it that there are planets which go round other planets, no better than themselves? It seems to me that there would be much more regularity and uniformity in assigning to all the planets but one sort of orbit in which they should move round the sun.

Ah! madam, I replied, were you but acquainted with the vortices of Descartes; those

* Its volume, or bulk is five times smaller.

vortices, so terrible in name, and so charming in the ideas they give rise to ; you would not talk in this way. My wits must all go, said she, laughing. I must know what these vortices are. Make me quite mad at once : now I have dipped into philosophy I can't trouble myself about the care of my senses : spite of the world's laughter, we will talk of the vortices. I did not know you had so much enthusiasm, said I ; 'tis pity it has no other object than vortices.

What we call a vortex is a quantity of matter, whose detached parts move all in the same direction, but allowed at the same time to have some little movements peculiar to themselves, provided they still pursue the general course. A vortex of wind, for instance, is a vast number of little particles of air, turning all together in a circular direction, and involving whatever comes in their way. The planets you know are borne along by the celestial fluid, which is prodigiously subtle and active. All the celestial matter, from the sun to the fixed stars, constantly turns round, carries the planets along with it, and makes them proceed round the sun in the same direction, but in longer or shorter periods, according to their distance from the centre. Even the sun is made to turn on his axis by being exactly in the midst of this moving matter ; you will therefore observe, that if the earth were in the

not touch the water: but put a heavier body, of a certain weight, it will pass through the oil, which is too weak to stop it, and keep falling till it meets the water, which has sufficient force to bear it up. Thus two liquors put together, being of unequal weight, will not mix, but place themselves in different situations; and neither will one rise, nor the other descend: pour on these other liquors which are of a nature to remain separate, and the same effect is still produced. In like manner the celestial matter which fills this grand vortex, is in separate strata, encircling each other, and of unequal weight, like oil and water, and some other liquors. Some planets likewise are heavier than others,* each therefore stops in the layer which has the degree of force necessary for supporting it, and keeping it in a state of equilibrium; and you must be convinced that it can never go beyond this stratum.

I understand, replied the Marchioness, that the different degrees of weight are sufficient to keep them in their proper ranks. I wish with all my heart there was some such regulating power among us, that would serve to fix people

* The Cartesians carried their illusion so far as to believe that so solid a mass as a planet could be steadily supported by the ætherial fluid, the most subtle of all fluids.

in the situation most suitable to them! You have quite removed my uneasiness with regard to Jupiter. I am very glad he will let us remain quietly with our little vortex, and single moon. I feel very well contented with one attendant, and do not envy him his four.

You would do wrong if you did, said I; he has no more than are necessary. He is five times farther from the sun than we, that is, a hundred and sixty-five† millions of leagues distant from it, consequently his moons receive, and reflect, but a feeble light: the number therefore compensates for the little effect produced by each: were they not separately so inefficient, four moons would appear unnecessary, as Jupiter turns on his axis in ten hours, and of course the nights are very short. The satellite which is the nearest to Jupiter, performs its circle round him in two-and-forty hours; the next in three days and a half; the third, in seven; the fourth, in seventeen; and by the inequality of their progress, they form a most pleasing spectacle for this planet. At one time they rise all four together; then, almost immediately separate; sometimes they are all at the full, placed in a line, one above another; afterwards they are seen at equal distances in the sky; then when two are rising

* Calculating with more exactness, 179.

the other two will set. Above all I should like to see the perpetual variety of eclipses among them, for there is not a day passes in which they do not eclipse each other, or the sun.* Surely as eclipses are so familiar to the inhabitants of that world, they must be considered a subject of amusement, rather than terror, as they are here.

You will not fail, I suppose, said the Marchioness, to people these four moons, though they are only little subaltern planets, intended merely to give light to another during the night. Undoubtedly not, I replied. These little planets are not unworthy of inhabitants because they are unfortunate enough to be subjected to a larger planet.

I think, then, answered she, these satellites ought to be like colonies to Jupiter; that their inhabitants should, if possible, receive from him their laws and customs, and in return, render him some degree of homage, and always consider the great planet with respect. Would it not be needful, said I, for the moons occasionally to send deputies to Jupiter, who should take an oath of fidelity to him? I must own the little superiority we possess over the people in our moon

* Or; we may add, in which they are not eclipsed by the shadow of Jupiter, which happens the most frequently.

makes me doubt whether Jupiter has much influence over the inhabitants of his satellites, and I think the only superiority he can aspire to is that of impressing them with awe. For of what a terrific size he must appear ! To the planets nearest to him he looks sixteen hundred times larger than our moon appears to us.* Truly if the Gauls in ancient times were afraid the heavens would fall and crush them to death, the inhabitants of this moon may with greater propriety apprehend the fall of Jupiter. Perhaps, she replied, that is the subject of alarm to them instead of the eclipses, which you assure me they see without fear;† for as they are exempt from one folly, they must be subject to some other. Undoubtedly, answered I. The inventor of a third system, which I mentioned the other day, the celebrated Tycho Brahe, one of the greatest astronomers that ever lived, felt none of the vulgar terror at an eclipse; he was too much accustomed to study the nature of such a phenomenon; but what do you think he was afraid of instead?—If when he first went out of doors the first person he saw was an old woman; or if a

* Thirty-six times larger than we see the moon: and they receive from him one thousand two hundred and ninety times more light.

† Their solar eclipses are of much longer duration than ours.

had crossed the path he had taken, Tycho Brahe thought the day would be unfortunate, and returning in haste to his apartment, he shut himself up without venturing to engage in any occupation whatever.

It would be unjust, said she, if such a man as he could not with impunity overcome the fear of an eclipse, for the inhabitants of the satellite we were speaking of, to be exempted from it on easier terms. We will not spare them: they shall submit to the general doom; and if they escape one error they shall be liable to another.

A difficulty has just occurred to me, continued she, you must remove it if you can: if the earth is so small in comparison of Jupiter, are we visible to the inhabitants of that planet? I am afraid we are unknown to them.

Really I think so, answered I; the earth is certainly too small to be distinguished by them.*

We can only hope that in Jupiter there may be some astronomers who, after taking great pains to compose very excellent telescopes, and availing themselves of the finest nights for making their observations, may at length discover a very

* The earth at that distance must appear only three seconds and a half in diameter, as the planet Herschel does to us; but our nearness to the sun necessarily prevents them from seeing us at all.

little planet which they had never seen before. At first the learned give an account of it in their journal; the rest of the people either hear nothing about it, or laugh at it when they do; the philosophers are discouraged and resolve not to mention it again, and but a few of the inhabitants who are more reasonable than the others will admit the idea. By and by they examine again; they see the little planet a second time; they are then assured of its reality, and even begin to think it has a motion round the sun. After observing it a thousand times, they find out that this revolution is performed in a year: and at last, when the learned have been at great pains to investigate the subject, the inhabitants of Jupiter know that our world is in the universe. The curious eagerly look through their telescopes, and with all their looking, can scarcely discern it.

Were it not disagreeable, said she, to know that from Jupiter we can only be seen through telescopes, I should amuse myself with the idea of all the glasses being pointed towards the earth as ours are towards him, and the mutual curiosity with which the two planets examine each other, and enquire, *What world is that? What sort of people inhabit it?*

Your imagination is too rapid, I replied; when the astronomers of Jupiter become acquainted with our earth, they do not become acquainted

with us : they will not suspect the possibility of its being inhabited ; if any one should venture to express such an idea, how they would laugh at him ! Perhaps they would even persecute any philosopher who should maintain the opinion. After all I think the inhabitants of Jupiter are too much occupied in making discoveries on their own globe, to concern themselves about us, Jupiter is of such extent, that if they are adepts in navigation their Christopher Columbus must be fully employed. The inhabitants cannot know, even by reputation, a hundredth part of the other inhabitants. In Mercury, on the contrary, they are all neighbours, living familiarly together, and hardly considering the tour of their world more than a pleasant walk. If we are not visible to Jupiter, much less can Venus be so, who is at a still greater distance ;* and Mercury must be most out of its reach of all, being the smallest, and the most distant. However, the inhabitants can see Mars, their own four satellites, and Saturn with all his moons. Surely then they have planets enough to perplex their astronomers ; nature, in kindness, has hid from them the rest.

What ! cried the Marchioness ; do you consi-

* Venus is not farther from Jupiter, but more concealed by the rays of the sun.

der it a kindness? Without doubt, answered I. This great vortex contains sixteen planets; nature to spare us the trouble of studying the motions of so many, let us see but seven: is not that a favour? But not feeling the value of this mark of consideration, we have, with great pains, discovered the other nine, which had been concealed from us: our curiosity brings its own punishment in the laborious study which astronomy now requires.

I see, she replied, by the number of planets you mention, that Saturn must have five moons.* You are right, said I; and it is but just that he should have so many, as he is thirty years in going round the sun; and in some parts the nights last fifteen years, for the same reason that on our globe, which turns in a year, there are nights, beneath the poles of six months' duration. But Saturn, being at twice the distance that Jupiter is from the sun, consequently ten times farther than the earth; his five moons, faintly as they are illumined, would not give sufficient light during his nights, he has therefore a wonderful resource, the only one of the kind we have discovered in the universe: 'tis a large circle or

* He has seven, and Herschel six. In all there are twenty-five planets, without reckoning ninety-one comets known in 1800.

ring* which environs the planet, and which, being sufficiently elevated to escape almost entirely the shadow of Saturn, reflects the sun's light on the darkened parts, and reflects it more strongly than all the five moons, because it is not so high as the lowest of them.

Really, said the Marchioness, with an air of deep reflection and astonishment, all this is managed with wonderful order; nature had certainly in these instances a view to the wants of living beings; this admirable disposition of light was not the effect of chance. Only the planets which are distant from the sun have been provided with moons—the Earth, Jupiter, and Saturn; for Venus did not require any; nor Mercury who already has too much light; whose nights are extremely short, and probably considered a greater blessing than even the days. But stop—I think Mars, who is farther from the sun than we, is without a moon. We cannot conceal the fact, I replied; he has none; but he doubtless has resources for the night which we are ignorant of. You have seen phosphorus; matters of that kind, whether liquid or dry, receive and imbibe the light from the sun, which they emit with some force when in the dark. Mars perhaps has high

* Its exterior diameter is sixty seven thousand seven hundred leagues.

rocks of phosphorus that absorb, in the daytime, light enough to irradiate the night. You must own it would be an agreeable sight for the rocks to light up as soon as the sun was set, and without art, produce the most magnificent illuminations, that with all their radiance, would not have the inconvenience of casting any heat. In America, you know, there are birds which in the dark will afford light enough to read by : how can we tell whether Mars has not a great number of such birds, who, as soon as the night is come, disperse themselves on every side, and give an artificial day ?

I am not satisfied, answered she, either with your rocks or birds. They would be pretty enough to be sure ; but as nature has bestowed so many moons on Saturn and Jupiter, it shews that moons are necessary. I should have been very much pleased to find that all the worlds at a great distance from the sun had some, if Mars had not formed a disagreeable exception. Ah! replied I, if you were more deeply versed in philosophy you must accustom yourself to see exceptions to the best systems. We clearly see that some things are adapted in the most perfect manner to their end ; others we accommodate as well as we can, or perhaps are obliged to content ourselves with knowing nothing about them. Let us do so with respect to Mars, since

our researches are fruitless, and resolve to say no more about him.

We should be very much surprised, were we on Saturn, to see during the night a great ring, extending over our heads in a semi-circular form from one end of the horizon to the other; and by reflecting the light of the sun, would have the effect of a moon at every part of the circle. And are we not to have inhabitants in this great ring? said she, laughing. Though I am disposed to place them wherever I can, answered I, I confess I dare not tell you there are any there; this ring appears too irregular a dwelling. As for the five moons, we can't dispense with inhabitants for them. If the ring, however, were what some suppose, only a circle of moons, following each other very closely, with an equal motion, and the satellites, five of these moons escaped out of the ring, what numbers of worlds would the vortex of Saturn contain! Be that as it may, the people in Saturn are uncomfortable enough, even with the help of their ring. It gives then light, it is true; but what sort of light, at that immense distance from the sun? The sun himself, which appears to them a hundred times smaller * than to us, seems but a little pale star, emitting but a feeble light or heat. And could they be trans-

* Ten times less in diameter.

ported to our coldest countries, such as Greenland and Lapland, you would see them ready to expire with the heat. If water were conveyed to their planet it would no longer be water, but a polished stone, and spirits of wine which never freeze here, would become hard as diamond.

Your description of Saturn petrifies me, said the Marchioness; though just now you almost threw me into a fever in talking of Mercury. Two worlds, answered I, which are at the different extremities of an immense vortex, must be totally unlike.

Then, replied she, the people are very wise in Saturn, for you told me they were all mad in Mercury. If they are not very wise, answered I, they are at least, I suppose, very phlegmatic. Their features could not accommodate themselves to a smile; they require a day's consideration before they answer any question, and they would think Cato of Atica unmanly and frivolous.

I am thinking, said she, that all the inhabitants of Saturn are slow; all those of Mercury are quick; amongst us some belong to the former class, some to the latter; may not that be in consequence of the earth's being placed just in the middle situation and participating of both extremes? The men of our world have no determined character; some are like the inhabitants of Mercury; others resemble those of Saturn, in

short we are a compound of all the other planets. That's a good idea, replied I; we form such a ludicrous assemblage that it might easily be imagined we had been brought together from a variety of worlds. We are therefore very well situated for studying character, for this is an abstract of all the planets.

At any rate, rejoined the Marchioness, the situation of our world has one great convenience; the heat is not oppressive as at Mercury or Venus, nor the cold so benumbing as at Jupiter or Saturn. And we are in a part of the earth that is not subject to the greatest degrees of heat and cold experienced even on our own globe. If a certain philosopher returned thanks to his Creator for having formed him a man, and not a beast; a Greek and not a Barbarian; I think we ought to be grateful for being born on the most temperate planet in the universe, and in one of the most temperate parts of that planet. You ought likewise, madam, said I, to be thankful for being young, and not old; young and handsome, not young and ugly; a young and handsome French woman, not a young and handsome Italian: there are many things to excite your gratitude besides the temperature of your climate.

Ah! replied she, let us be grateful for every thing, even the vortex in which we are placed. The happiness we enjoy is but little, we must

not lose any of it; it is well to cultivate an interest in the most common things. If we are only alive to strong emotions our pleasures will be few, seldom attainable, and dearly purchased. Promise me then, said I, that when such animated pleasures are within your reach you will think of the vortices and me, and not neglect us entirely. Very well, said she: but will philosophy always afford me new enjoyments? For to-morrow, at least, answered I: I have the fixed stars in reserve for you, which surpass all that you have yet examined.



FIFTH EVENING.

EVERY FIXED STAR IS A SUN, WHICH DIFFUSES LIGHT TO
ITS SURROUNDING WORLDS.

THE Marchioness was very impatient to know what the fixed stars were. Are they inhabited, like the planets? said she, or are they not peopled? What can we make of them? Perhaps you would find out what they are, answered I, if you were to try. The fixed stars cannot be at less distance from the earth, than twenty-seven thousand, six hundred and sixty times * the earth's distance from the sun, which is thirty-three millions of leagues: perhaps some astronomers would tell you they are farther still. The space between the Sun and Saturn, the most distant planet, is only three hundred and thirty millions of leagues; that is but a trifle in comparison of the distance between the sun, or earth, and the fixed stars, in fact, we don't take the

* Or even two hundred thousand times.

trouble to compute it. Their light, as you perceive, is brilliant: if they received it from the sun, it must be very faint after travelling such an immense journey, and by reflecting it to us it would be still more weakened. It would be impossible for light, which had twice gone such a long space, to appear so bright as that of the fixed stars. They are therefore luminous in their nature, or in other words, they are so many suns.

Do I mistake, cried the Marchioness, or do I see your drift? Are you not going to say "the fixed stars are all suns: our sun is the centre of a vortex which turns around him; why should not each fixed star be also the centre of a vortex, turning round it? Our sun enlightens planets; why should not every fixed star likewise enlighten planets?" I need make no other answer, replied I, than Phœdrus made to Enone: *thou hast named it.*

But, rejoined she, you are making the universe so unbounded that I feel lost in it; I don't know where I am, not what I'm about. What! are they all vortices heaped in confusion on one another? Is every fixed star the centre of a vortex, as large perhaps as ours?*

* That may be the case, but we have no proof that there are planets turning round these stars.

comprehending our sun and planets is but a little portion of the universe? An equal space, occupied by each of these vortices? The thought is fearful; overwhelming! For my part, said I, I think it very pleasing. Were the sky only a blue arch to which the stars were fixed, the universe would seem narrow and confined; there would not be room to breathe: now that we attribute an infinitely greater extent and depth to this blue firmament, by dividing it into thousands of vortices, I seem to be more at liberty; to live in a freer air; and nature appears with astonishingly increased magnificence. Creation is boundless in treasures; lavish in endowments. How grand the idea of this immense number of vortices, the middle of each occupied by a sun, encompassed with planets which turn around him! The inhabitants of one of these numberless vortices, on every side behold the suns of surrounding vortices, although the planets belonging to them are invisible, as the light they receive from their suns cannot penetrate beyond their own vortex.

You are directing my eye, answered she, to an interminable perspective. I see, plainly enough, the inhabitants of the earth; then you enable me to discover, with somewhat less clearness, those of the moon and other planets contained in our vortex. After all that you require me to view the people that dwell in planets be-

longing to other vortices. I must confess they are so much in the back ground that with all my efforts they are scarcely perceptible to me. In short do they not seem almost annihilated by the very expression you are obliged to make use of in describing them? You must call them the inhabitants of one of the planets, contained in one, out of the infinity of vortices. Surely the very idea of ourselves is as nothing when such a description is applied to us, when we are thus lost amongst millions of worlds. For my part, the earth begins to diminish into such a speck, that in future I shall hardly consider any object worthy of eager pursuit. Surely people, who form unnumbered schemes of aggrandizement, who are wearing themselves out in following up projects of ambition, are ignorant of the vortices. I think my augmentation of knowledge will encrease my idleness, and when I am reproached for being indolent I shall reply, *Ah! if you knew the history of the fixed stars!* Alexander could not have been acquainted with it, answered I; for a certain author, who believes that the moon is inhabited, tells us very seriously that it was impossible for Aristotle to avoid receiving so rational an opinion, (could Aristotle be ignorant of any truth?) but that he never disclosed it for fear of displeasing Alexander, who would have been miserable to hear of a world that he could not subjugate. There would have been a still

greater reason for keeping the vortices of the fixed stars a secret; if any body in those days had known them, they would not have thought of ingratiating themselves with the monarch by talking of them. It is unfortunate that I who am acquainted with the system should not be able to reap any benefit from it. According to your reasoning it will only be an antidote to the inquietudes of ambition; that is not my malady. The weakness I am most addicted to is an excessive admiration of beauty, and I fear the vortices will have no power to assist me in overcoming it. The immense number of worlds destroys the grandeur of this, but it does not lessen the charms of a fine pair of eyes or a beautiful mouth, *they* retain their power in spite of all the worlds that can be created.

Love is a strange thing, said she, laughing; it escapes every corrective; there is no system that can abate its influence. But answer me seriously; have you sufficient reason for believing this system? To me it appears to rest on an uncertain foundation. A fixed star is of a luminous nature like the sun, therefore you say it must, like the sun, be a centre to a vortex containing planets which travel round the sun. Now, is that a necessary consequence?

Listen, madam, I replied; we are so naturally disposed to mingle the follies of gallantry with our gravest discussions, that mathematical rea-

soning partakes of the nature of love. Grant ever so little to a lover, and presently you are forced to grant him a great deal more, and so on till you don't know how to stop. In like manner admit any principle a mathematician proposes, he then draws a consequence which you are obliged to admit, and from that consequence another, and thus before you are aware he carries you so far that on a sudden you wonder where you have got to : these two characters always take more than you mean to give them. You must own that when two things are similar in all that I know of them, I may reasonably think them similar in what I am unacquainted with in respect to them. From that principle I draw the conclusion of the moon being inhabited because she resembled the earth ; and the other planets, because they resemble the moon. And because the fixed stars bear a resemblance to our sun, I attribute to them all that he possesses. You have already made too many concessions to draw back, you must go on ; do it therefore with a good grace. But, said she, in admitting this resemblance between the fixed stars and our sun, we must suppose that the inhabitants of another great vortex see it as a little fixed star, visible only during their nights.

That is indisputable, I replied. Our sun is so near to us in comparison of the suns belonging to other vortices that his light must be incompa-

rably stronger to us than to them. When he is risen we can discern no other heavenly body : so, in another vortex, another sun eclipses ours, and permits it to appear only at night, with all the other suns, then visible. With them, fixed to the blue firmament, our sun forms a part of some imaginary figure. As to the planets that go round him, as they are not seen at so great a distance, they are not so much as thought of. Thus all the suns are daily luminaries to their own vortex, and nightly ones to all the other vortices. Each reigns alone in his own system; elsewhere, is but one of a great number. Nevertheless, do not these worlds differ from each other in a thousand instances, notwithstanding this equality ? for a general resemblance does not exclude a vast number of dissimilarities.

Surely, answered I : but the difficulty is to find them out. For ought we know one vortex may have more planets revolving round its sun, another fewer. In one there are subaltern planets, turning round the principal planets ; in another they may be all alike. Here they all collect round their sun in a circle, beyond which is an empty space which extends to the neighbouring vortices ; in other parts of the universe they may have their orbits at the extremities of their vortex whilst the centre is left empty. And very likely there are some vortices without any planets ; others, whose suns, not being in the

centre, have a circular revolution, carrying their planets along with them; others, again, whose planets may rise and set with regard to their sun according to the change of that equilibrium which keeps them suspended—What would you have more? Surely here is enough for a person who has never been beyond one vortex.

All that is nothing, she replied, for the number of worlds. What you have been imagining would suffice but for five or six, instead of millions.

If you talk of millions now, said I, how will you count them when I tell you there are many more fixed stars than you discover; that with telescopes an endless number are seen which are invisible to the naked eye; and that in a single constellation, where we might before have counted a dozen or fifteen, there have been found as many as we were accustomed to observe throughout the heavens?*

Have pity on me, cried she; I yield; you have overwhelmed me with worlds and vortices. Ah! said I, but I must add something more still; you see that white part of the sky, called the milky-way. Can you guess what it is?—An infi-

* I conclude, from a pretty accurate calculation, that we may perceive a hundred millions with a telescope that has an opening of four feet; I have clearly distinguished fifty thousand, and my glass is but two inches and a half in diameter.

nity of little stars, invisible to our eyes on account of their smallness, and placed so close to each other that they seem but a stream of light. I wish I had a telescope here to shew you this cluster of worlds. In some measure, they resemble the Maldivia Isles, those twelve thousand little islands or banks of sand, separated only by narrow canals of the sea which one might almost leap over. The little vortices of the milky-way must be so close, that from one world to another the people might converse or shake hands. The birds, at least, I think, can go from one world to another; and pigeons may be taught to carry letters as they do in our Levant from one town to another. These little worlds must deviate from the general rule by which the sun of any vortex effaces, at its rising, all the other suns. In one of the little vortices contained in the milky-way the sun of that particular vortex can hardly appear closer to its planets, or more brilliant, than a hundred thousand other suns, in the neighbouring vortices. The sky, then, is filled with a countless quantity of fires almost close to each other. When they lose sight of their own sun, they have thousands still remaining; and the night is not less enlightened than the day; at least the difference is so trifling that we may say there is no night. The inhabitants of those worlds, accustomed as they are to perpetual light, would be very much astonished

to hear of miserable creatures who spend half their time in profound darkness; and who, even during the light of day, see but one sun. They would think we had fallen under the displeasure of nature, and shudder at our condition.

I don't ask you, said the Marchioness, whether they have any moons in the milky-way; they could be of no use to the principal planets, since they have no nights, and besides that, move in so small a space that they could not be encumbered with subaltern planets. But, continued she, by multiplying worlds so liberally, you give rise to a great difficulty. The vortices, of which we see the suns, touch our vortex: the vortices you say are round; can so many circles touch this single one? I can't understand how it is.

It shews a great deal of sense, answered I, to discover this difficulty, and even to be unable to solve it, for it is in itself well founded, and in the way you conceive it, unanswerable; therefore there would be but little proof of wisdom in finding an answer to what was incapable of any. If our vortex were in the figure of a die, it would have six flat sides, which is very far from a circle; on each of these sides might then be placed a vortex of the same shape. If instead of six, it had twenty, fifty, or a thousand, flat sides, an equal number of vortices might come in contact with it, each resting against one of these sides.

You know the greater number of flat sides a body has, the nearer it approaches in form to a circle ; so that a diamond cut into a great number of facets, if they were extremely small, would be nearly as round as a pearl of the same size. The vortices are only circular in this manner. They have an amazing number of flat sides, each of which is close to another vortex. These sides are very unequal ; some larger, some smaller. The smallest correspond to those of the milky-way. If two vortices leave any space between, which must often be the case, nature, to make the most of the extent, fills up the vacancy by one or two, or perhaps a thousand, little vortices, which without incommoding any of the others, form one, two, or a thousand more systems of worlds ; so there may be many more worlds than our vortex has sides ; and I dare say, though these little vortices are formed merely to fill up spare corners of the universe that would otherwise have been useless ; though they may be overlooked by the neighbouring vortices, yet they are quite satisfied with themselves. It is probably such little vortices whose suns we cannot discover without telescopes, of which there is a prodigious number. In short all these vortices are adjusted in the best order imaginable ; and as each of them must turn round its sun without changing place, it is formed to move in the most easy and commodious manner for that purpose.

They, as it were, catch hold of each other, like the wheels of a watch, and mutually assist the motion. It is likewise true that in a sense they counteract one another: each vortex if it had no external pressure would extend itself; but when it attempts to swell it is repelled by the surrounding vortices, which forces it to shrink back; then it extends again, and so on:* some philosophers think that the fixed stars give such a sparkling, intermittent light in consequence of this alternate expansion and contraction of the vortices.

There is something agreeable, said the Marchioness, in the idea of such a combat among the worlds, and the reciprocal emission of light produced by it, which apparently is the only communication carried on between them.

No, no, I replied, that is not the only one. The neighbouring worlds sometimes send us visitors, who come, in a very magnificent style. These visitors are comets,† ornamented with brilliant flowing hair, a venerable beard, or a majestic train.

Ah! what ambassadors? said she, laughing. We could dispense with their company, for they

* The preservation of the starry system is more satisfactorily explained by attraction; they are all kept in equilibrium by their mutual attraction.

† It is indisputably proved that the comets belong to our solar system.

only frighten us. They only frighten children, answered I, because their appearance is extraordinary; but there are many children among us. The comets are merely planets, belonging to another system. Their orbit was towards the extremity of their vortex, which was perhaps differently compressed by those that surrounded it; the lower side, on that account was flatter than the top, and the lower side was next to us. These planets, beginning at the upper part to form their circle, did not foresee that it would extend beyond the limit of their vortex, at the lower part; in order, therefore, to continue their circular journey, they were obliged to enter the extremities of the next vortex, which we will suppose is ours. They always appear to us extremely elevated, moving on the other side of Saturn. Considering the prodigious distance of the fixed stars, there must be between Saturn and the extremities of our vortex a great space void of planets. Our enemies reproach us with the inutility of this space, but we find there is a use for it, as it is devoted to the service of foreign planets that occasionally enter our system.

I understand, said she; we don't allow them to penetrate into the heart of our vortex, and mix with our planets; we receive them as the Grand Signior receives the ambassadors that are sent to him. He does not honour them with a lodging in Constantinople, but assigns them one

in the environs. There is another point of resemblance, I replied, between us and the Ottomans: they receive ambassadors without sending any in return; and we receive the comets without sending any of our planets to return their visits.

From all these circumstances, answered she, we seem to be very proud: yet we should not hastily form that conclusion; these strange planets have a very menacing air with their beards and trains; perhaps they are only sent to insult us; ours not having so imposing an appearance would not be so well calculated to inspire those worlds with awe. The tails and beards, I replied, are merely extraneous: the planets themselves do not differ from ours; but in entering our vortex they assume the beard or train from a certain illumination derived from our sun. This, by the bye, has not been very well explained by our astronomers; however, they are sure it is only some sort of illumination, and they must tell us more of it when they can. Then I wish, rejoined she, that our Saturn would take a beard or a tail, and frighten the other vortices; then laying aside his terrific appendages, return to us and perform his ordinary functions. He would do better to stay where is, answered I. You recollect I explained to you the shock produced by the repulsive power of each vortex: I think a poor planet must be violently shaken in

such a situation, and the inhabitants cannot feel much the better for passing through it. We think ourselves vastly unfortunate when a comet makes its appearance, whereas we ought to consider the comet most unfortunate. I am not inclined to pity it, said the Marchioness; I dare say all its inhabitants arrive here in good health, and it must be extremely entertaining to them to go into a new vortex. We who always remain in our own have but a dull life. If the people in a comet have the sense to know the time at which they shall pass into our vortex, those who have already been the journey, are just before busily employed in describing to the rest what they will see. Speaking of Saturn, they say: "You will presently see a planet with a great ring round it. Then, you will discover one followed by four small planets." Some of these people, perhaps are set to watch the moment of entering our system: when it is arrived they cry *new sun, new sun*, as our sailors exclaim *land, land*.

I find then, said I, it is useless to attempt raising your compassion for the comets: I hope, however, you will not refuse it to the inhabitants of a vortex whose sun has been extinguished, and who are thus condemned to perpetual darkness. Suns extinguished? cried she. Yes, undoubtedly, I replied. The ancients saw certain

fixed stars which are no longer visible.* These suns have been deprived of their light : ruin must have ensued throughout the vortex ; a general mortality on all the planets ; for how could existence be maintained without the sun ? The thought is too dreadful, said she ; is it not possible to evade it ? I'll tell you, answered I, what some very intelligent people have imagined. They think that the fixed stars that have disappeared are not extinct, but partly darkened ; that is to say, that they have one side obscure ; the other luminous : that as they turn on themselves, they first present the light part to us, and then the dark, when that is the case we cease to see them. Apparently the fifth moon belonging to Saturn is in this condition, for during one part of its revolution we entirely lose sight of it ; at which time it is not most remote from the earth ; on the contrary, it is then sometimes nearer than when visible. Though this moon is a planet, and therefore cannot exactly guide our opinion with respect to suns, yet we may suppose that a sun can be partly covered by fixed spots. To spare you the pain of believing the other opinion, we will adopt this, which is more agreeable : but I can only receive it when applied to such fixed

* In 1572 and 1604, some beautiful stars appeared to burst into light, and afterwards become extinct. Astron. Art. 792.

stars as have a regular time for appearing and disappearing, as some have lately been observed to do, otherwise we cannot suppose them half suns. What must we say to the stars that disappear, and do not become visible after a time that would certainly have been sufficient for turning on their axis? You are too just to require me to believe that they are half suns: however I will do all in my power to serve you; we will conclude that these stars are not extinguished, but plunged in the unfathomable depth of the sky, and thus become invisible; in this case the vortex would accompany its sun, and all go on as usual. It is true that the greatest part of the fixed stars have not any motion which removes them farther from us, for if they were not always equally distant, they would sometimes appear larger, sometimes smaller; but that is not the case. We will therefore suppose that some of the small vortices, being light and active, slip betwixt the others, and return after they have made their tour, whilst the larger systems remain immoveable. But there is one inevitable misfortune: there are some fixed stars, which for a long time are alternately visible and invisible, and at length totally disappear. Half suns would re-appear at a regular time; others that had retreated to an immense distance would at once disappear, and be concealed for a very long time: exert therefore all your resolution,

madam; these stars are certainly suns which grow so dark as to be invisible to us, then resume their brightness, and afterwards are entirely extinguished. How, exclaimed the Marchioness, can a sun, a source of light, become darkened? With the greatest ease, answered I, if Descartes be in the right. He imagines that the spots on our sun, being impurities, or vapours, may grow thick, collect together, form themselves into a mass, and continue to encrust the sun till it is quite hid. If, the sun is a fire connected with a solid matter, serving as its aliment, we are not in a better condition; the solid matter may be consumed. 'Tis said we have already had a fortunate escape: the sun during several years, (the year, for instance, after the death of Cæsar;) appeared very pale; owing to the encrustation which was beginning to form. The sun had sufficient force to break and disperse it; had it continued, we should have been lost. You make me tremble, said the Marchioness. Now I know the consequences of paleness in the sun, instead of going to my glass every morning to see if *I* am pale, I think I shall go and look whether *the sun* is so. Take courage, madam, I replied, it requires a good deal of time to ruin a system of worlds. But, answered she, it seems as if time would inevitably effect it. I cannot take upon me to deny it, said I. The immense mass of matter which composes the universe is in conti-

nual motion, even the smallest particles of it, and since there is this motion we are in danger, for changes must happen, either slowly or rapidly, but always in a time proportioned to the effect. The ancients were so vastly wise as to imagine the heavenly bodies were of such a nature as never to alter, because they had not observed any alteration in them. Had they leisure to assure themselves of this by experience? Compared with us the ancients were young: if flowers that last but a day were to transmit their histories to each other, the first would draw the resemblance of their gardener in a certain way; after fifteen thousand ages of these flowers had elapsed, others would still describe him in the same manner. They would say; "We have always had the same gardener, the memoirs composed by our ancestors prove this to be the case; all their representations exactly apply to him; surely he is not mortal like us; no change will ever take place in him." Would the reasoning of these flowers be conclusive?—it would have a better foundation than that of the ancients respecting the celestial bodies; and had there never to this day been observed any change in the heavens, though they should appear likely to remain much longer without alteration, I would not yet decide on them; I should think more experience necessary. Should the term of our existence, which is but a moment,

be the measure for other durations? Ought we to assert that what has lasted a hundred thousand times longer than we, must last for ever? No, ages on ages of our duration would scarcely be any indication of immortality. Truly, said the Marchioness, I think these worlds can have no pretensions to it. I shall not do them the honour to compare them with the gardener who outlives so many transient flowers; they are but as those flowers themselves, springing up and fading away, one after another: for I suppose, if old stars disappear, new ones become visible; the species cannot otherwise be continued. Yes, answered I, we need not fear the extinction of the species. Some will tell you these new stars are only suns which re-approach us after having been for a long time at a distant part of the heavens. Others think they are suns that have broken through the crust that began to cover them. I easily conceive the possibility of all this; but I think it equally possible for new suns to be created. Why should not the matter that is fit to compose a sun, after having been dispersed in various places, be at length gathered together in one spot and then become the foundation of a new system of worlds? I am the more inclined to this opinion because it answers better to the grand idea I entertain of the works of nature. Has she no way of producing and destroying plants and animals but by a con-

tinual revolution? I am persuaded, and I doubt not that by this time you are so too, that she exerts the same power with respect to the worlds. But on such subjects we can only form conjectures. The fact is that for nearly a century past, in which, by the help of telescopes, almost a new heaven has been discovered, unknown to the ancients, there have been few of the constellations in which some sensible alteration has not taken place;* the greatest number of changes is observed in the milky-way, as if more motion and bustle existed among this heap of worlds. Really, said the Marchioness, I find the worlds, in short all the heavenly bodies, so liable to change that I have quite overcome the horror I felt at the idea of the suns being extinguished. Well, replied I, to prevent you from relapsing, we will say no more about them, we are arrived at the uppermost part of the heavens, and to inform you whether there are any stars beyond that, exceeds my skill. You may place more worlds or not; just as you are disposed. These invisible countries should, in propriety, be left to the philosophers: they may imagine them to exist, or not exist, or to exist in any way they chuse. I shall content myself with having directed your mind to all that is discernible by your sight.

* This is not proved.

Ah! she exclaimed, then I am acquainted with the whole system of the universe! how learned I am! Yes, said I, you are learned enough in all reason, and your knowledge is attended with this convenience,—you may extract your belief of all I have told you whenever you think proper. I only ask as a reward for my trouble, that whenever you see the sun, the sky, and the stars, you will think on me.*

* As I have given these conversations to the public, I think it would not be right to conceal any thing which passed on the subject. I shall publish another dialogue of the same kind that we had a long while after these. It shall be entitled the “Sixth Evening,” as the rest were evening scenes.

SIXTH EVENING.

ADDITIONAL THOUGHTS IN CONFIRMATION OF THOSE IN
THE PRECEDING CONVERSATIONS.—DISCOVERIES THAT
HAVE BEEN LATELY MADE IN THE HEAVENS.

FOR a long time the Marchioness and I said nothing about the plurality of worlds, we had apparently forgotten that we had ever talked on the subject. I went one day to her house, and just as I entered, two men of some talents and celebrity were going out. You see, said she, what visitors I have had ; I assure you they are gone away with a suspicion that you have turned my brain. I should be very proud of such an achievement, answered I ; it would shew my power, for I think one could not devise a more difficult undertaking. Well, replied she, I am afraid you have accomplished it. I don't know how it happened, but whilst my two friends, whom you met at the door, were here, the conversation turned on the plurality of worlds ; perhaps they had an invidious design in directing it to that subject. I immediately told them all

the planets were inhabited. One of them said he was certain I could not be of that opinion : in the most unaffected manner, I maintained my sincerity ; he continued to think I was only feigning, and I believe he had too great a regard for me to admit the possibility of my having really adopted so extravagant an opinion. The other, from esteeming me less, did not doubt my veracity. Why have you made me obstinately adhere to sentiments which people who have the greatest friendship for me will not suffer themselves to believe me possessed with ? But, madam, answered I, why did you maintain these opinions seriously, when talking with persons that I am sure would not gravely argue on any subject ? Should we thus trifle with the inhabitants of the planets ? Let us, who believe their existence, be content to remain a little select band, and not disclose our mysteries to the vulgar. Vulgar ! exclaimed she ; do you reckon those two men among the vulgar ? They have good understandings, said I ; but they never reason. Grave reasoners, who are austere people, would not hesitate to place them in that class. They however take their revenge by ridiculing the reasoners. We should if possible accommodate ourselves to persons of both characters ; it would have been better to speak jestingly of the planetary inhabitants to such men as your two friends, since they are accustomed to pleasantry, than to enter on an

argument, for which they have no talents. You would have retained their good opinion without depriving the planets of a single inhabitant. Would you have meanly sacrificed the truth? answered she. Where is your conscience? I must own, I replied, I have not much zeal for truths of this nature; I would readily forbear to maintain them if it suited my convenience.

The cause which prevents people from believing the planets to be inhabited is, that they appear to them only bodies placed in the heavens to give light, instead of globes consisting of meadows and fruitful countries. We readily believe that meadows and fields are inhabited, but it is thought ridiculous to assert that mere luminous bodies are. 'Tis in vain that reason informs us of fields in the planets; reason comes too late, the first coup-d'œil has impressed our minds before-hand, and this impression is not willingly parted with. The planets, 'tis said, are only luminous bodies; what sort of inhabitants then can they have? Our imaginations do not enable us to distinguish their figures, therefore it is the shortest way to deny their existence. Would you require me, for the sake of establishing the idea of these inhabitants, whose interest cannot be very dear to me, to attack all the powers of the senses and the imagination? Such an enterprize would demand a vast deal of courage. Men are not easily persuaded to see

through their reason, rather than their eyes. Some few persons are rational enough to believe, after a thousand proofs have been given them, that the planets are worlds like ours, but they do not believe it in the same way they would do, if they had not seen them apparently so different; they always recur to the first idea they had formed, and can never wholly divest themselves of it. These people seem to *condescend* to our opinion, and only patronize it from a love of singularity.

Is not that enough, said she; for an opinion that is merely probable? You would be astonished, answered I, if I told you the word probable was too modest for the occasion. Is it merely probable that Alexander has been in existence? No, you consider it certain; and what is the ground of your certainty? Is it not that you have had every proof that such a subject requires, and that no circumstance leads you to doubt the fact? You have never seen Alexander, nor have you any mathematical demonstration of his existence. What would you say if this were the case with respect to the inhabitants of the planets? We cannot shew them to you, nor can you require us to demonstrate their being, in a mathematical way; but you have all the evidence that can be desired: the entire resemblance between the planets and the inhabited earth; the impossibility of imagining any other use for which they could be created; the fruit-

fulness and magnificence of nature ; the attention she seems to have paid to the wants of their inhabitants, such as giving moons to those planets that were very remote from the sun, and the greatest number of moons to the most distant : and it is an important consideration that every thing is on that side of the question, without any objections to counterbalance it ; you cannot for a moment doubt unless you resume the vulgar mode of seeing and thinking. In fact it is impossible to have more evidence, and evidence of a more determinate kind ; how then can you treat this opinion as a mere probability ? But do you think, said she, I can feel as certain that the planets are inhabited, as that Alexander has been in existence ? By no means, I replied ; for although, on the subject we are speaking of we have as many proofs as in our situation we can receive, yet these proofs are not numerous. I protest, exclaimed she, I'll renounce these planetary inhabitants, for I don't know whether to believe there are any or not — it is not certain, yet it is more than possible — I am quite perplexed. Do not be discouraged, madam, I replied. Clocks that are made in the most common manner shew the hour ; those only that are made with more exquisite art, indicate the minutes ; in like manner common minds see a great difference between probability and absolute certainty ; but it is only superior understandings that ascertain the degrees

of certainty or of probability, and who, if I may use the expression, can tell the minutes as well as the hours. Place the inhabitants of the planets a little below Alexander in point of certainty, but above a vast number of historical relations which are not entirely proved; I think that is their proper place. I love order, said she, you do me a kindness in giving arrangement to my ideas : why did you not do this before ? Because, answered I, whether you attribute to this idea a little more, or a little less certainty than it possesses is not of much consequence. I am certain you do not feel so assured as you ought to do of the earth's motion : are you the less happy on that account ? Oh ! as to that opinion, I am sure I do my duty ; you have no right to complain of me, for I firmly believe that the earth turns. Yet I have not given you the most convincing proof of it, answered I. You use me very ill, said she, to make one believe things without sufficient reason ; am I unworthy to hear the best arguments ? I wished to prove my opinions, I replied, by easy, entertaining arguments ; would you have had me make use of such solid, sturdy ones as I should have attacked a doctor with ? Certainly, said she ; now fancy me a doctor, and let me have this new proof of the earth's motion.

With all my heart, answered I ; it is this, and I am vastly pleased with it, because I think I

found it out myself ; but it is so good and so natural that I can hardly hope to have been the inventor. I am sure an obstinate learned man who wished to oppose it, would be forced to talk a great deal on the occasion ; and that is the only way in which a scholar can be overcome. It is evident either that all the heavenly bodies go round the earth in four-and-twenty hours, or the earth, turning on her axis, only imagines the motion in them. It is the most improbable thing in the world that they should in reality go round the earth in that short space of time, though we are not at first aware of the absurdity of such an opinion. All the planets certainly revolve round the sun : but these revolutions are unequal from the unequal distances at which they are placed from the sun : the most remote, as we might naturally suppose, take a longer time than the rest. This order is observed even in the satellites that go round a large planet. Jupiter's four moons, and the five belonging to Saturn, require a longer or shorter time to move round their planet according to their distance from it. It is further ascertained that the planets have a rotation on their own axis ; the time of this is likewise unequal ; we cannot tell the cause of such inequality, whether it depends on the different size, or the degree of solidity of the planets, or on the different degrees of rapidity of the vortices in which they are enclosed, and the liquid mat-

ter by which they are carried along ;* this inequality however is certain, and in general we find that the order of nature is such as to admit of particular variations in things that are regulated by the same rules.

I understand, said the Marchioness; I am quite of your opinion; if the planets moved round the earth, the time employed by each would be different, according to their various distances, as is the case in their revolutions round the sun: is not that what you mean? Precisely so, madam, answered I; their unequal distances from the earth would produce an inequality in their revolutions round her: and the fixed stars, being so extremely remote from us, so far beyond all that could have a general movement round us, at least situated in a place where such a motion must be very feeble, is there any probability of their revolving round us in four-and-twenty hours, like the moon which is so near to us? Ought not the comets likewise which do not belong to our vortex, which have such irregular courses, and such different degrees of swiftness, to be exempted from performing this daily circle round our world? No, planets, fixed stars, and comets too, must all turn round the earth! Were

* We can assign no reason; the irregularity depends on the original cause, whatever that cause may be, which at first determined their motions.

there but a few minutes difference in the time of their revolutions we might be satisfied with it ; but they are all exactly equal, never varying in the slightest degree ; surely this is a suspicious circumstance.

Oh ! replied the Marchioness, I could venture to say this exactitude existed only in our imaginations. I am glad that any thing inconsistent with the genius of nature, which this equality in so many moving bodies would be, should depend on our motion, and she, even at our expense, be free from the charge of inconsistency. For my part, said I, I dislike a perfect regularity, and I don't approve of the earth's turning every day on her axis in exactly twenty-four hours ; I am disposed to think the time varies. Varies ! she exclaimed ; do not our clocks shew that it is always equal ? Oh ! replied I, I don't depend on clocks, they cannot always be perfectly right ; and should they be so, and sometimes shew that the earth has made a longer or shorter tour in four-and-twenty hours than usual, it would be thought that we ought rather to suspect them of being wrong than to attribute any irregularity to the revolutions of the earth. That is paying an extravagant respect to her, I should depend no more on the earth than on a clock ; the one might be put out of sorts almost by the same causes as the other, only I think it would take longer time to produce a sensible irregularity in the earth ;

that is the only advantage I should allow her to have over a clock. Might not the earth by degrees get nearer to the sun, and then, finding herself in a situation where the matter was agitated with greater violence, perform her motion on her axis, and her revolution round the sun, in a shorter time? In that case the years would be shorter, and the days too, but we should not perceive the difference, for we should still divide the year into three hundred and sixty-five days, and the days into twenty-four hours. So that without living longer than we do now, we should live a greater number of years: and on the contrary, if the earth were to remove farther from the sun, we should live fewer years, although our lives would be as long. In all probability, said she, if that were possible, a long succession of ages would make but a trifling difference. True, I replied; nature does nothing abruptly, her method is to effect every alteration by such gentle gradations that it is scarcely perceptible to us. We hardly observe even the changes of seasons; others that are produced much more slowly must in general escape our notice. Nevertheless every thing is subject to mutability; even a certain lady who has been seen, through telescopes, in the moon for about forty years, appears considerably older. She used to be rather handsome; now her cheeks are fallen away, her nose and chin are beginning to meet; in short all her charms

are fled, and it is even feared that her life is near its close.*

What are you talking of? cried the Marchioness. I am not jesting, I replied. A figure has been observed in the moon which resembled a woman's head rising from among the rocks, and in that part an alteration is perceived. Some pieces have fallen off a mountain, and left the points which appear like the forehead, nose and chin of an old woman. Does it not seem, said she, as if some malignant power had a spite against beauty, since the young lady's head is the only spot in the moon that has undergone a change. Perhaps, answered I, to make amends, the alterations on our globe may give additional beauty to some face observed by the inhabitants of the moon, I mean some face formed like those of the people in that planet, for we always try to discover in distant objects, the resemblance of what we continually think of. Our astronomers discern young ladies' faces in the moon; probably if women were to examine it they would find handsome male faces. If *I* were to look, I don't know whether I should not see your like-

* We are not assured that this alteration has taken place in the part of the moon that has some resemblance to a woman's head: but there must be changes, if we judge by the volcano which has been repeatedly observed. Astron. Art. 3339

ness, madam. I must undoubtedly, said she, feel myself obliged to any body who could find me there; but let us return to what we were talking of just now; are there any considerable alterations on the earth? In all probability there are, answered I. Many high mountains, at a great distance from the sea, have on them beds of shells, which shew that they were formerly covered with water. Sometimes likewise, at a distance from the sea, are found stones containing petrified fishes. How could they have got to that place unless the water had been there? Fables* tell us, that Hercules separated with his hands two mountains called Calpe and Abila, which being situated between Africa and Spain obstructed the ocean; and the sea immediately rushed in violently, and formed the great gulph that we call the Mediteranean. Fables are not altogether fabulous; they are histories of remote periods, disguised by two very ancient and common defects; ignorance, and a love of the marvellous. It is not very credible that Hercules separated the two mountains with his hands; but I can easily believe that in the time of some Hercules, (for there have been fifty), the ocean may have torn asunder, perhaps with the assistance of an earthquake, two mountains more feeble than the rest and have by that means rushed in between Europe and Africa. Then a new spot was discovered on our globe, by the

people in the moon, for you recollect, madam, that the water forms a dark spot. It is the general opinion that Sicily has been separated from Italy, and Cyprus from Syria: new islands have sometimes been formed in the sea; earthquakes have engulfed some mountains, and produced others, as well as changed the course of rivers. Philosophers give us reason to fear that the kingdom of Naples and Sicily, being over great subterranean vaults filled with sulphur, will some time or other fall in, when the vaults are no longer strong enough to resist the fires contained in them, which now have vent at such openings as Vesuvius and Ætna. All this will be sufficient to diversify a little the appearance we make to the inhabitants of the moon.

I would rather tire them said the Marchioness, with a monotonous appearance, than entertain them by the ruin of provinces.

That is nothing, answered I, to what takes place in Jupiter. He appears to be surrounded with belts, which are distinguished from each other, or from the spaces betwixt them, by their different degrees of light. These are land and seas or at least parts of the planet differing in their nature. Sometimes these lands grow narrower, sometimes wider. New ones are formed in various parts, and some of the old ones disappear: and all these changes visible only through our best telescopes, are in themselves much more

considerable than if our ocean were to inundate all the land, and leave its own bed to form new continents. Unless the inhabitants of Jupiter are amphibious, and live with equal ease either on land or in water, I hardly know what can become of them.* We see likewise great alterations on the surface of Mars, even from one month to another. In that short time seas overflow large continents, and retire by a flux and reflux a thousand times more violent than ours; or if this be not the case, some change equivalent to it takes place. Our planet is very quiet compared with these; we have great reason to congratulate ourselves, especially if it is true that in Jupiter countries as extensive as Europe have been set on fire. Set on fire! cried the Marchioness; that would be a great piece of news there. It would indeed, answered I. We have observed in Jupiter, for perhaps twenty years, a long stream of light more brilliant than the rest of the planet:† we have had deluges here, but very seldom; perhaps in Jupiter they have now and then a large conflagration as well as frequent deluges. But be that as it may, the brilliant light I spoke of is very different from

* These lands surrounding Jupiter, which are sometimes few, and sometimes in great numbers, are apparently clouds.

† I don't know that this observation is authentic.

another, which apparently is as old as the world, though it has but lately been discovered.* How can a light be formed for concealment? said she, that is something quite out of the common way.

This light, I replied, is only visible at twilight, which it most frequently long enough, and of sufficient power to conceal it; and when it is not hid by the twilight, either the vapours of the horizon prevent us from seeing it, or without great attention we may even mistake it for twilight. However, about thirty years since it was discovered with certainty, and for some time gave great delight to the astronomers, whose curiosity wanted stimulating by something new. They might find as many new subaltern planets as they chose without feeling any interest in them. The two last moons of Saturn, for instance, did not enrapture them as Jupiter's satellites had done; custom destroys the power of every thing.

We see, during a month before and after the equinox of March, when the sun is set and the twilight disappeared, a sort of whitish light resembling the tail of a comet. It is seen before the dawn and sun-rise, towards the equinox of September, and morning and night towards the winter solstice. At other times, as I have before said, the twilight conceals it; for we have

* The zodiacal light. Astron. Art. 844

reason to believe it always exists. It has lately been conjectured that it is produced by a large mass of matter, somewhat dense, which environs the sun for a certain extent. The greatest part of his rays penetrate this covering, and come to us in a straight line; but some of these rays by striking against the internal surface are reflected back to us, either before the direct rays can reach us in the morning, or after they have ceased to enlighten us in the evening. As these reflected rays come from a higher region than the direct ones, it is therefore earlier when we receive them, and later before we lose them.

On this ground I must retract what I said on the probability of the moon having no twilight, for want of a surrounding atmosphere as dense as that of the earth. She is no loser by it, if she can receive a twilight through this thick air which surrounds the sun, and reflects his light to places which could not have his direct rays. Then, enquired the Marchioness, will not this be a source of twilight to all the planets, without the necessity of a dense atmosphere to environ each, since that which surrounds the sun may produce the same effect for all the planets in the vortex? From the frugality of nature, I am disposed to believe she has effected the purpose by this mean only. Yet, said I, in spite of this frugality, the earth would have two causes of twilight, one of which (the dense air before the

sun), would be useless, and could only serve as an object of curiosity to the frequenters of the observatory: but it may be that the earth alone sends out exhalations sufficiently gross to produce twilight; and therefore a general resource has been provided for the other planets, if their evaporations are more pure and subtile. We, perhaps, of the inhabitants of all the worlds in our vortex breathe the grossest air; did the people of the other planets know that, with what contempt they would survey us!

That would be wrong, answered the Marchioness; we are not contemptible for being surrounded by a thick atmosphere since the sun himself is in the same situation. Tell me, is not this air produced by certain vapours that you formerly told me issued from the sun; and may it not be to moderate the power of the first rays which perhaps would otherwise be excessive? I think it probable that the sun may be thus veiled, to accommodate it to our use. That is a happy idea, madam, said I; you have founded a pretty little system. We may add that this vapour possibly falls back in a sort of rain to refresh the sun, in the same manner as we sometimes throw water into a forge when the fire becomes too fierce. We cannot attribute too much to the power of nature; but all her operations are not made visible to us, therefore we cannot feel assured of having discovered her designs, or her

manner of acting. We should not consider any new discovery a certain foundation for reasoning on, though we are very much inclined to do it: philosophers are like elephants, that in walking never put one foot to the ground till they feel the other firmly supported. That comparison, said she, is the more just because the merit either of elephants or philosophers does not consist in external charms; we shall however do well to imitate the superior judgment of both: inform me more of the new discoveries, and I promise not to be in a hurry again to form systems.

I have told you, I replied, all the news I have heard from the sky, and I believe no later intelligence has been received. I am sorry it is not so entertaining and wonderful as some observations I read the other day in an abridgment of the Annals of China, written in Latin. They there see a thousand stars at a time fall from the sky into the ocean with an amazing noise; or dissolve and disperse in rain. This has not merely been seen once in China; I have met with the same account given at two remote periods of time, besides that of a star which goes towards the east, and bursts with the noise of a gun. It is a pity such sights should be confined to China, while this part of the world is never favoured with them. It is not long since all our philosophers thought they had had sufficient ex-

perience to pronounce the heavens and all the celestial bodies incorruptible and incapable of change ; and at the same time people at the other end of the world were seeing stars dissolve by thousands : there appearance must have differed very much from ours. But, said she, I never heard that the Chinese were great astronomers. No, answered I, but the Chinese are gainers by being at so great a distance from us, as the Greeks and Romans were by being separated by a long space of time ; whatever is remote assumes the right of imposing on us.

Really I am more and more of opinion that Europe is in possession of a degree of genius which has never extended to any other part of the globe, at least not to any distant part. It is not perhaps able to diffuse itself over a great proportion of the earth at once, and some invincible fatality prescribes to it very narrow bounds. Let us then make use of it while it is in our possession : and let us rejoice that it is not confined to science and dry speculations, but equally extended to objects of taste, in which I doubt whether any people can equal us. Such, madam, are the things that should engage your attention and constitute your philosophy.

THE END.

AN ELEGANT



