

creatures amidst invisible atoms. By changing his microscope into a Telescope, he communicates with the high Heavens; then returning home to his study, he prescribes laws to the celestial bodies; describes their paths; measures the earth, and weighs the Sun! By the admirable prerogative of reason, & the power of cloathing his ideas with speech, he forms a connection between them; and by the faculty of exhibiting thoughts to the eye, by means of writing; he brings all his faculties to a state of perfection; and thereby attains all the arts & sciences; & by means of them, subdues all other animals, and renders even the elements subservient to his use.

But above all he can, by contemplation, that peculiar attribute & ornament of human kind, familiarise himself with the Stars to which he cannot approach. Man, alone is capable of discerning the scale of beings, & their relations. He, alone is capable of surveying the Universe, and of elevating his mind to the mighty hand, which ^{sustains} holds the reins of the whole!

Altho' the scripture speaks of "worlds framed" "by the word of God" — and of the Earth, as hanging upon "nothing," yet we find no system of the Universe prior to

Pythagoras. [By "system" you will always understand that we mean a scheme w.^c reduces many things to regular dependence & co-operation]

In the system of Ptolemaeus, the earth was supposed to be fixed in the center of the Universe, and that above the planets was placed the firmament of stars, and then two crystalline spheres; all of which received their motion from some unknown First mover.

The system of Tycho Brahe approached one step nearer truth, but was still encumbered with the absurd supposition, that the earth stood still in the center of the stary firmament; and that the Sun revolved about the earth every 24 hours. -

At length, about the year 1500, a Prussian gentleman, named Nicholas Copernitzky*, restored the long forgotten system of Pythagoras; which system has been supported by the learning of Kepler, Galleo, Gassendus, and which has been established by Newton on the everlasting foundation of mathematic demonstration, the proof of which belong to another department; for here I treat the subject merely as a Naturalist & as a physician. -

* Copernicus -

We have already told you that a body at rest can never put itself in motion; and that a body in motion can never stop of itself. You know already, I presume, that all motion is naturally rectilineal, that a bullet discharged from a cannon would continue to move in the same direction it received at first, if no other power depressed its course. When therefore we see a body moving in a curve, we conclude that it must be acted upon by two powers, viz the original motive power, and another diverting it off from the rectilinear course, w^{ch} it would otherwise have continued to move in. We have, in a former lecture, explained & spoken of the ^{great} ~~greater~~ approximating principle of gravitation, & illustrated some of its effects; and as every particle of matter is impressed with the ^{or quality} power, so gravity, or weight, is always proportional to the quantity of matter in bodies, whatever ^{be} their bulks or figures. ~~are~~. This wonderful power would seem to arise from the agency of some subtle matter, pressing towards the Sun; and acting, like all mechanical causes, by contact; and yet it seems to surpass ^{the} all power of what we denominate mechanism. You will recollect, what was said when treating of fire, or calorique, and ^{it} would merely re-
mind

remind you now, that there are two original, or primitive forces in Nature, the one w^{ch} causes weight, and the other which causes heat; that the one tends from the circumference to the center, & is called gravitation, and the other, as naturally, ^{or expands} tends, from the center to the circumference, & is called fire. We told you that these directly opposite powers balanced each other, without being destroyed; and that from the wonderful operation of these two causes, all the phenomena of ^{the} Universe result. With these principles fresh

in our recollection, let us now take a rapid view of this lower apartment of the Orbit, called the Solar system; [Buffon, Bonnet, Goldf, Ferguson, Andfield]

To do this, with ^{most} advantage, we ^{should} ~~must~~ ^{must} wait till the Sun sinks below the horizon, and when the shades of night spread their veil over the blue expanse of Heaven; for then the firmament manifests to our view its grandeur & its glory. Those splendid bodies, which we then perceive, as wandering among the host of Heaven, are the Planets: The primary, or principal ones have the Sun for their common center of motion; while the others, w^{ch} are called secondaries, ^{move}

move round their primaries, accompanying them as satellites in their annual revolution.

1 The sparkling points with which the blue expanse is sown, are so many Suns, suspended by the Almighty in the immensity of space, to give light & heat to the worlds w^c roll around them; The assemblage of these vast bodies is divided into different systems; each system has its centre, or focus, a star, or more properly speaking a Sun; w^c shines by its nature inherent light; and round w^c several opaque bodies, or globes revolve, reflecting with more or less brilliancy, the light they borrow from their Sun, w^c renders them visible (Bon)

While these planets perform their periodical revolutions round the Sun, by which the course of their year is regulated, they turn round upon their own axes; a motion by which they obtain the alternate succession of day & night.

Attraction is the secret, silent, but mighty power, which retains them in their orbits, and enables them to circulate with so much regularity & harmony. By this power, they tend toward each other, in a proportion relative to their bulk.

We

We know that our solar system consists of (30²) planetary bodies; and more perfect instruments & more accurate observers may encrease their number. ~~At~~ Bonnet

The Sun gives heat (electron^{*}) and light, and cir-
-cular motion to the planets w^c surround it. Mercury,
Venus, the Earth, Mars, Jupiter & Saturn, to which we
must add that discovered by Herschel, perform their
constant circuits at different times & distances; each
taking up a time to complete its revolutions pro-
-portioned to the greatness of the circle which it is to
describe.

The Earth w^c we inhabit is one of those bodies ^{that} such
circulate in our solar system, I say our, because there
are other solar systems beside this to which we belong.
Since the fixed stars, are, we believe, prodigious spheres of fire, or
electron, like our sun, it is not irrational to conclude that
they are made for the same end; each to bestow light,
heat & vegetation on a certain number of inhabited worlds,
or planets, kept by gravitation, within the sphere of its ac-
-tivity.

On this view of the mundane system, I have heard
venerable preceptor, Turgurson, used to exclaim,
that an angust!

* For the Sun appears to act like a great Electron Machine

What an august! what an amazing conception does
this give of the works of the Creator! Thousands of thou-
-sands of Suns, multiplied without end, attended by ten
thousand times ten thousand worlds, all in rapid motion,
yet calm, regular, and harmonious, invariably keep-
-ing the paths prescribed them, and these peopled
with myriads of intelligent beings, formed for endless
progression in perfection & happiness!

But — to proceed in our rapid survey — The
Earth, is one of those bodies w^{ch} circulate in the solar
system. It is placed, says Buffon, at a happy middle
distance from the centre, that is, less distant from the Sun
than (Herschel) Saturn & Jupiter; and yet less parched
up than Venus & Mercury.

Besides that motion w^{ch} the Earth has round the
Sun, the circuit of which is performed in a year, it has
another upon its own axle, w^{ch} it performs in 24 hours.
This has ~~been~~ been aptly compared to the motion of a
chariot-wheel; for while it goes forward on its journey,
it is, at the same time, turning upon itself. From the first
of these two arises the grateful variety of the seasons; and
from the second that of day & night. Modern

Modern philosophy (says the elegant author of the view of earth & animated Nature) has taught us to believe, that when the Great Author of Nature began the work of creation, he chose to operate by second causes; and, that, suspending the constant exertion of his power, he endued matter with a quantity, by which the universal economy of nature might be continued, without his immediate assistance. This quantity is called attraction, a sort of approximating influence, w^{ch} all bodies, whether terrestrial, or celestial are found to possess; and w^{ch} in all, increases as the quantity of matter in each increases. Thus, the Sun, by far the greatest body in our system, is possessed of much the greatest share of this attracting power; & all the planets, of which this Earth is one, are of course entirely subject to its influence.

Were this power, therefore left uncontrolled by any other, the Sun must quickly have attracted all the bodies of our system to itself. But it is equally counteracted by another power of equal efficacy, namely, a propulsive force, which each planet received when it was impelled forward by the Divine Architect, upon its first formation.

The heavenly bodies of our system being thus acted upon by two opposing powers, namely, by that of attraction, w^{ch} draws them

them towards the Sun; and that of impulsion w. tends to drive them strait forward into the great void of space, they obey neither entirely; but pursue a tract between these contrary directions; and each, like a stone whirled about in a sling, obedient to two opposite forces, circulates round its great centre of heat & motion. (G.s.)

Every thing in these great outlines of the Universe is systematical; all is combination, affinity & connection. The Sun gravitates on the planets; the planets on the sun, and on each other. These taken together gravitate on their neighbouring systems; these again on more distant ones; while the ballance of the Universe remains in equilibrium, in the hands of the creator & legislator of all things! (Bon)

These are some of the wonders of the Universe! Should we allow Imagination to exert her wings, & fly to such a height, as to see our Sun but a star, nay more, our system itself as a point, even then, we should find ourselves but on the threshold of creation! How weak, how inadequate must the utmost stretch of the human faculties be to a conception of that amazing Deity who made & who governs the whole! — to a conception of that Primum mobile,

mobile, that Causa causarum, that ens Internum, that
Custos, Directorque universi mundani, hujus operis
Dominus et Artifex! Should not the narrow preju-
-dices, the littleness of Kings & Congressors, the contemptible
bubbles of human pride & party shrink into nothing at
the very thought! — [our solar system may be considered as only
one flower in the garden of the Deity!]]

'Tis a sublime observation of Goldsmiths; that
in those great outlines of Nature, to which art cannot
reach, & where our greatest efforts must have been
ineffectual, God himself has finished with amazing
grandeur & beauty! The firmament God has
made, like himself, perfect; because no subordinate
being could correct their defects. But on Earth,
man's habitation, tho' provided with all the conveniences
of air, fruits, pasturage & water, is but but a dreary
place without cultivation. The sentiment of
Dryden, that "God never made his works for man to
mend," is just, as it regards these great outlines of Nature;
but not so, as it regards the planet itself, on which we live;
for we find, that man is thrown into a world, that
stands

stands in need of his help; for tho' much is given him to enjoy, there is much more to mend; and this mending, or cultivation of the earth, is agriculture. A world, thus furnished with advantages on one side, & inconveniences on the other, is the proper abode of reason (of such a being as man, possessed of an improvable faculty), for a world thus furnished is the fittest place to exercise the industry of a free & thinking creature.

Let us therefore avert our eyes from the contemplation of "the dread magnificence of Heaven," where imagination itself is overpowered & sinks into undiscerning amazement; and let us retire to our proper station, the Earth, where man is placed ^{to labor} to enjoy, to ^{admire} adore & to be grateful.

Before we quit this subject, however, we beg you to recollect what we said when treating on Electricity, viz, that there was a vivifying something, w^c through the medium of the atmosphere gives life & beauty to this our world; for besides light there is a subtle electric fluid, w^c fills the immense space of the whole Universe, pervades all bodies, & actuates every particle of matter: by it the phenomena of magnetism, fire & electricity are produced, and on it the various & astonishing phenomena of

Vegetation and Animation depend. Now the Sun, the
"eye & soul of this our system" (Milton) is the efficient
cause of the motions of this fluid, and the various
phenomena of our system are the effects of these
motions. —

Let us next speak of this little speck of earth w^c we
inhabit. Altho' this little ball is too diminutive to be
miped, were it swept from the field of creation, it is
nevertheless of sufficient consequence to us to merit

a new ^{Lecture} ~~chapter~~; for, as the poet says,
These little things, are great to little Man!

There we shall see that the Earth is one of the primary planets,
being this terraqueous globe on which we live, ^{We shall see that} It is not of a
completely spherical form, but protuberates about the equator
and is proportionably flattened at the poles; we shall see
that its surface is marked with irregularities; in some places
we shall find vast plains, intersected by hills & vallies; in others
long chains of mountains, whence Rivers proceed, w^c; after
watering various countries discharge themselves into the sea
whence they originally sprang.

Consult this artificial globe and you will see —

In our last lecture, we took a glance or superficial view of the mundane system, or Universe. If the the description & economy of a seed & its expansion into a plant require 3 or 4 lectures, how imperfect must the description of the solar system be, that is, comprised in one! For a more ample survey we w^d. refer you to Buffon & his epitomiser Goldsmith, to Bonnet & Jurquison. The view we took of the system ^{the earth} was from the only observatory allowed to mortals this side of the eternal world. It would be a pleasing & grand speculation to take a view from some of the other planets were we provided with telescopic eyes. We took a rapid view &c. see last page.

Besides those bodies w^{ch} compose the celestial plane - Taurus, & which perform their circuits with so much order, regularity, stillness, & harmony, there are other bodies w^{ch} we know but little about; I mean Comets, w^{ch} sometimes appear, terrifying mortals & threatening to disturb, if not destroy the order of our system. In former times they were considered as meteors, lighted up by the irritated Prince of the power of the air. We are in -
-struck

instructed. However by modern astronomy that they are planetary bodies, whose long & astonishing routes our astronomers calculate, foretel their returns, and determine their place, appearances & tracks.

Upwards of thirty of these terrific bodies at present acknowledge the empire of our Sun; and the orbits w.^{ch} some have ^{are so extensive that they} traced round him do not complete their course for ages!

The orbits of comets are ellipses, having one of their foci in the center of the Sun; and being very long & eccentric, they become invisible, when in that part most remote from the Sun.

The tail of a comet is, according to Mr. J. Newton, a very thin vapour, emitted by the nucleus, or head of the comet, ignited by the neighbourhood of the Sun, and this vapour is furnished by the atmosphere of the comet. The vapour of comets being thus dilated, rarefied & diffused, may probably, by means of their own gravity, be attracted down to the planets, & become intermingled with their atmosphere. I suspect, says Newton "that the spirit w.^{ch} makes the finest, subtilest & best part of our air, and which is absolutely requisite for the life and being of all things, comes principally from comets." (But we must quit this subject & hasten to take a view of the terraqueous globe) —

→ We took a rapid survey of the solar system. In ~~the~~ contemplating these great outlines of Nature, the superiority of man ^{is remarkable} ~~must strike you~~. By a microscope of man's own invention, he is enabled to discover new, but diminutive worlds, and myriads of creatures amidst invisible atoms. By changing, as he easily can, this microscope into a Telescope, he opens a communication with the high heavens, then returning to his study, he prescribes laws to the celestial bodies, describes their paths, and weighs the Sun! What creature, on earth, but man, that is capable of measuring, calculating & foreseeing planetary revolutions & events ~~but man~~. By the admirable prerogative of reason, and by the power of cloathing his ideas with speech, he forms an admirable connection between these two ~~faculties~~ admirable gifts. And by the faculty of exhibiting thoughts to the eye, by means of writing, he brings all his faculties to a state of perfection, and thereby attains all the arts & sciences, and by their assistance subdues all other animals, & renders even the rude & boisterous elements subservient to his use.

But above all he can by contemplation, that peculiar attribute & ornament of human kind, familiarise himself with the stars, to which he cannot approach. Man alone, is capable of discerning the scale of Beings. He alone is capable of surveying the Universe, and of elevating his mind to the mighty hand, w.^c directs the whole! — But, let us without further preface, pursue our subject, w.^c is the examination of the earth, or terraqueous globe. 3 The knowledge of the original — see Cosmogony or Theories of the Earth.

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16.4