



## Are Comets Habitable?

Anima Loci, July 2024

The question whether comets are habitable, and how their potential inhabitants would endure such unforgiving characteristics, was seriously considered by early modern speculators on extraterrestrial life. First published in French in 1875, this extract from Amédée Guillemin's book "The World of Comets" (*Les Comètes*) summarises a few of those views, ultimately providing an answer through the technological and scientific advancements of his own time.

*Keywords: Outer space, Science, Universe.*

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After Newton, and especially in the eighteenth century, by a not unnatural reaction of ideas from the Aristotelian doctrine of transient meteors, comets were regarded as bodies, stable and permanent as the planets; they were obedient to the same laws of movement, and differed only as regards appearance, by their nebulosities and tails.

The astronomers of that time, taken up with the verification and calculation of their positions and orbits, occupied themselves little or not at all with the study of details which were purely physical, such as are now called cometary phenomena. Regarding them as spheroids, solid like the planets, and similar to them in the constituents of their nuclei, to people them with inhabitants followed in the natural sequence of ideas.

Fontenelle, who, as we know, was a believer in the theory of vortices, and who, moreover, regarded the heads and tails of comets as

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simple optical appearances, thus expresses himself in the *Pluralité des Mondes*.

“Comets,” he observes, “are planets which belong to a neighbouring vortex; they move near the boundaries of it; but this vortex, being unequally pressed upon by those that are adjacent to it, is rounder above and flatter below, and it is the part below that concerns us.

Those planets which near the summit began to move in circles did not foresee that, down below, the vortex would fail them, because it is there as it were crushed. Our comet is thus forced to enter the neighbouring vortex, and this it cannot do without a shock.”

Also further on, Fontenelle observes, returning to the same point: “I have already told you of the shock which takes place when two vortices meet and repel each other. I believe that in this case the poor comet is rudely enough shaken and its inhabitants not less so.

We deem ourselves very unfortunate when a comet appears in sight; but it is the comet itself which is very unfortunate.” “I do not think so,” said the Marquise; “it brings to us all its inhabitants in good health. Nothing is so delightful as thus to *change vortices*. We who never quit ours lead a life wearisome enough.

If the inhabitants have sufficient knowledge to predict the time of their entrance into our world, those who have already made the voyage announce beforehand to others what they will see.” “You will soon discover a planet which has a great ring about it, they will say perhaps,” speaking of Saturn.

“You will see another which will be followed by four little ones. Perhaps even there are people appointed to look out for new worlds as they appear in sight, and who cry immediately, A new sun ! a new sun ! as sailors cry, Land ! land ! Believe me, we have no need to pity the inhabitants of a comet.”

Lambert in his *Lettres Cosmologiques* (1765) devotes a chapter to the question, *Are comets habitable?* Guided by considerations foreign to science, and dominated by a preconceived idea that all globes must be inhabited, he seeks to discover reasons which may permit us to believe that comets, more numerous than the planets in the solar system, are habitable celestial bodies.

A first difficulty arises from the extremes of temperature to which comets are subjected at their aphelia and perihelia. “How are we to conceive,” he observes, “that beings can exist in an abode which is subjected to the utmost extremes of heat and cold? The comet which appeared in 1759 (that of Halley) and which returns the quickest of all those whose periods are known undergoes a winter 70 years long. But there is even a greater extreme of heat”

Although Lambert objects to Newton’s calculation as to the heat to which the comet of 1680 must have been subjected during its perihelion passage, still he is obliged to admit that on the 8th December, 1680, “the comet being one hundred and sixty times nearer to the sun than we are ourselves, must have been subjected to a degree of heat twenty-five thousand six hundred times as great as we are.

Whether this comet was of a more compact substance than our globe, or was protected in some other way, it made its perihelion passage in safety, and we may suppose all its inhabitants also passed safely. No doubt they would have to be of a more vigorous temperament and of a constitution very different from our own.

But why should all living beings necessarily be constituted like ourselves? Is it not infinitely more probable that amongst the different globes of the universe a variety of organizations exist, adapted to the wants of the people who inhabit them, and fitting them for the places in which they dwell, and the temperatures to which they will be subjected?

Have we not in like manner abandoned the prejudice which for a length of time caused the torrid and frigid zones to be regarded as uninhabitable? Is man the only inhabitant of the earth itself? And if we had never seen either bird or fish, should we not believe that the air and water were uninhabitable?

Are we sure that fire has not its invisible inhabitants, whose bodies, made of asbestos, are impenetrable to flame? Let us admit that

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the nature of the beings who inhabit comets is unknown to us; but let us not deny their existence, and still less the possibility of it” Thus regarded as a matter of pure hypothesis, it is plain that the question of the habitability of comets may always be answered in the affirmative.

But we must not forget that at the time when Lambert wrote, comets were regarded as solid bodies enveloped by a considerable atmosphere, and the tendency to assimilate them to the planets was general ; add to this a few vague ideas upon the subject of final causes — such as Lambert held — and it was natural to people all the stars of heaven, and even the sun himself with inhabitants.

Andrew Oliver published nearly about the same date (1772) an *Essay upon Comets*, wherein he seeks to explain the formation of tails by a mutual repulsion of electric origin, between the atmospheres of the sun and the comet: he devotes the second part of his curious work to showing that the tails of comets are probably intended to render their bodies habitable worlds.

The enormous variations of temperature to which a comet is subjected in passing from one extremity of its orbit to the other, are exactly or at least suitably compensated by variations in the density of its atmosphere. This, together with the movements due to the action of the sun and the supposed velocity of rotation, prevents the extremes of heat and cold from becoming intolerable.

At the aphelion both its atmosphere and tail are condensed about the comet, and the air is in a state of perfect calm. In proportion as it approaches perihelion, the atmosphere becomes rarified, the equilibrium is constantly broken, and currents of fresh air temper the extreme ardour of the solar rays. These, as we see, are but physical romances composed by the partisans of a preconceived idea of the habitability of these bodies.

Neither Fontenelle, nor Lambert, nor Andrew Oliver would probably write at the present day as they did a hundred or a hundred and fifty years ago. And for this two reasons may be assigned, the one philosophical, the other scientific. In the first place the a priori has by common consent been banished from science, which leaves to metaphysics the task of supporting theses by arguments based upon ideas such as that of final causes.

We no longer ask for example how comets must be constituted to permit the existence of living beings, which Providence could not have withheld from bodies so numerous and important. But we seek by the study of observed facts and by the discussion of the probable physical consequences which must follow from these facts to form an approximate idea of the conditions — physical, luminous, calorific, and chemical — of known comets.

And should he then enter upon the question of the habitability of these bodies, we do not consider it in the absolute and unconditional manner in which it was entertained by Lambert. We merely compare the probable conditions as determined by observation with those which seem to be compatible on the surface of the terrestrial globe with the existence of organized living beings. In short, there has been a total change of method.

A second reason which would have brought about a change in the opinions of the eminent savants whose theories we have just quoted, is that within the last hundred years — as we have seen in detail — the physical and even chemical constitution of comets has been carefully studied. We no longer assimilate them to the planets except as regards their movement of translation.

Everything leads us to believe that the agglomerations of which they are composed are in a rudimentary state analogous to the rudis indigestaque moles of chaos. The incessant transformations which take place in their nuclei, their atmospheres and their tails indicate aii equilibrium eminently unstable, and which would be very difficult to reconcile with the known conditions of life.

After this, let all who please picture to themselves the comet which has lately paid us so brief a visit [July, 1874], peopled with astronomers such as those of whom Lambert speaks.\* We will not cavil cavith them; we do not fight with shadows.

\* “I like to picture to myself,” he says, “these globes, voyaging in space, and peopled with astronomers, who are there on purpose to

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contemplate nature on a grand scale, as we contemplate it on a small scale. From their moving observatory, as it is wafted from sun to sun, they see all things pass successively before their view, and can determine the positions and motions of all the stars, measure the orbits of the comets and the planets which glide by them, see how the particular laws develop into general laws, and know, in a word “the details of the universe.” In truth, I picture to myself that astronomy must be for the inhabitants of such a comet a terribly complicated science. But doubtless their intelligence is proportional to the difficulties.

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## Footnotes & references

The extract is taken from the original English edition, first published in 1877 by London Sampson, Low, Maeston, Searle, & Rivington. Available at: [<https://archive.org/details/worldofcomets00guiluoft/page/n9/mode/2up>].

Image from “Account of the Great Comet of 1858” by George Phillips Bond, first published in 1862 by Welch, Bidgelow, and Company. Available at: [<https://archive.org/details/accountofgreatco00bonduoft/page/n10/mode/1up>].