THE INSPIRATION AND COUNTER-INSPIRATION OF ASTRONOMICAL PHENOMENA

STANLEY L. JAKI

Astronomical phenomena are in a sense mere celestial phenomena, but actually much more. Suffice it to think of the enormous conceptual surplus which is seen in such ordinary celestial phenomena as comets, eclipses, and planetary conjunctions whenever they are seen through the eyes of astronomy and not merely with the naked eye, strengthened as this eye may be by geometry. The surplus in question should seem even more obvious in reference to such extraordinary celestial phenomena as supernovae. Whatever the relative unimportance of their motion through space, their mostly spectroscopic study too rests on the full formulation, since the times of Newton, of the three laws of motion.[1] It is on the application, immediate or remote, of those laws that all physical science, including astronomy, rests.

This distinction between mere celestial phenomena and astronomical phenomena bears also on the inspiration which they respectively produce. Let us take the respective reactions to the same kind of phenomena, supernovae, between 1054 and 1987. In June 1054 Chinese stargazers spotted a novel bright spot in the sky which, not surprisingly, they took for a guest star (*kho hsing*), the Chinese name for comets. The fact that it did not infringe on Aldebaran inspired in them the view that the rule of the emperor would be beneficial.[2] Such an inspiration belongs in the class of vain hopes and unnecessary fears triggered by comets and other celestial phenomena listed above. The prospect of removing such fears from the human mind was, in fact, a chief benefit which Halley celebrated in the ode he prefixed to Newton's *Principia*.[3] Inspiring as this prospect could be, it remained for long but a prospect and not a result to be shared broadly.

Considerable improvement in correlating positions, either through naked-eye observations and/or more refined geometrical methods, did not raise inspiration to a level

Stanley L. Jaki, a Hungarian-born Benedictine priest, is Distinguished University Professor at Seton Hall University. Winner of the Templeton Prize for 1987, he is an honorary member of the Pontifical Academy of Sciences.

much higher than the class described above. This is amply revealed in the reaction of Tycho Brahe, the most accurate observer of the sky prior to the advent of telescopes, to the second spotting, in recorded history, of a supernova. Not knowing anything of what those Chinese stargazers had seen in 1054, Tycho Brahe felt that he had made a truly historic first when, on the evening of November 11, 1572, he noticed a very bright star in Cassiopeiea. This novelty was in fact the very first item Tycho Brahe mentioned in the long-winded title of his *De nova et nullius aevi memoria prius visa stella...* , a book of 104 small quarto pages which he published in short order, excited as he was by what he had seen.[4]

As far as inspiration was concerned, the title of Tycho Brahe's book could seem promising on a superficial look. The new phenomenon, he stated, inspired him to engage in "mathematical contemplation." Of course, the contemplation had nothing to do with the kind of contemplation of which mystics are the best authority. Tycho Brahe's mental eyes were fixed on the astrological art of predicting the weather from the planets' positions. He felt that once those positions were related to the new star's position the credibility of that art would be greatly strengthened. In other words, Tycho Brahe's inspiration was an increased sense of job-security. Whatever the genuineness of such an inspiration, it certainly has a strong touch of modernity. Tycho Brahe was not, however, so modern as to see in the new star a refutation of the Aristotelo-Ptolemaic doctrine of the incorruptibility of the heavens.

Historians of science would look in vain for traces of some rationalist or iconoclastic modernity in the elegy with which Tycho Brahe introduced his booklet on the new star. The elegy betrays the kind of inspiration which would best be called lucubration. Indeed, this was the very word which Tycho Brahe, at the last moment, did not let grace, or rather disgrace, the title page of his hardly inspiring booklet.

Much more modern, and certainly far deeper, was the inspiration which Kepler derived from his observations of the nova of 1604. Excited he certainly was. Otherwise he would not have dashed off a book *De stella nova in pede Serpentarii*. But his excitement was that of a deep-seated concern. The new star could easily be taken for a disproof of the starry sphere and for a proof of the presumed truth of the idea that the universe was an indefinite, infinite agglomerate of stars. By 1604 Giordano Bruno had already created some excitement with his strange inspirations about infinite worlds, all forever changing into one another, with no basic difference between stars and planets. Kepler sensed that had Bruno not been burned at the stake in Rome in 1600 (a fate Bruno had escaped twenty or so years earlier in Geneva where he was forced to abjure his doctrines), he would have seized on the nova of 1604 as a licence for a reckless wandering across infinite spaces. To nip in the bud this kind of use of astronomy and its phenomena, Kepler felt that "astronomy was to be forced to return to its very confines. For certainly nothing good was to be gained by vagabonding through that infinity."[5]

Unlike Kepler, many modern astronomers love that vagabonding.[6] Often they register, with no trace of agonies, their view that the better the universe is known, the more purposeless it appears.[7] However, they fully share Kepler's excitement about the heuristic value of precise measurements. There is something mystical in Kepler's singing the praises of Tycho's measurements as the key to the breakthroughs which later became known as Kepler's three laws and greatly helped Newton to make modern scientific astronomy possible.

Precise measurements were in fact the basic reason for the variety of inspirations which suddenly filled astronomers in late February 1987. On February 24, to be exact, their instruments alerted them to the flare-up, in the southern hemisphere, of a supernova. Apart from the excitement felt over the novelty, the first data inspired them at least in the sense that they would not soon run out of research problems. The sense of job-security is not something to be taken lightly even when it is accompanied by the sobering realization that long-standing theories about the origin of supernovae would have to be drastically revised.

Before long this somber mood yielded to a sort of exultation. By June specialists in supernova structure and evolution felt confident that the data dramatically strengthened their theories, worked out over several decades. A reason for this was, as *The New York Times* reported, that already in early March "astronomers and technical experts, usually jealous of their findings, were pooling their observations" as they tried "to solve the supernova's many mysteries."[8] An inspiration certainly commends itself when it helps eliminate selfishness and promotes co-operation. Before long, still another kind of inspiration made itself felt as leading astronomers took the view that the data pouring in would shed much light on the ultimate fate of the universe.[9]

The history of modern astronomy shows many other cases about these two kinds of elation felt over a new astronomical phenomenon, or discovery. One such elation is felt over the fact that the astronomical phenomenon provides the seal of truth on a theory. The other form of such elation is related to the fact that the astronomical phenomenon opens vistas of further work which may carry the theorist far beyond the range of what has already been worked out. Take, for instance, the discovery by Leverrier, in 1845, of Neptune, a planet postulated by periodic disturbances in the orbit of Uranus. A stunning proof of the truth of Newtonian celestial dynamics, the discovery of a new planet produced so great an elation as to make Auguste Comte decry it as insane. But there was nothing insane in the heroic work of W. C. Tombaugh, which ultimately led to the discovery of Pluto.[10]

Comte had an ax to grind. Nothing was more dangerous for his positivism than anything really novel in science, especially in astronomy.[11] He did not live to hear the voice of jubilation that greeted Higgins' observation of traces of helium in the spectral lines of the sun. Here too an astronomical phenomenon provided an inspiring capstone on a work already under way, a work initiated by Fraunhofer. Higgins' work also spurred the registering, in vast numbers, of spectral lines. The theoretical co-ordination of those spectral lines began with Bohr's model of the hydrogen atom. When first told about it, Einstein was inspired to state: "But this is then the greatest of all discoveries."[12]

A capstone on the truth of theories about a very early hot state of the universe was provided by the discovery of the 2.7°K cosmic background radiation in 1965. The excitement went hand in hand with the inspiration to do further and extensive study, theoretical as well as experimental, on that radiation. But the inspiration had other aspects as well. Such a hot early state could not be reconciled with the steady state theory. While this and other consequences of that radiation exhilarated the proponents of what by then had been known as the Big Bang, it inspired the grim resolve of the champions of the steady state theory to keep working out alternatives to an apparent cosmic beginning.

Champions of the steady state theory disclosed only now and then that their opposi-

tion to the Big Bang was motivated by a counter-theological inspiration. The rank materialism of most champions of the steady-state theory dictated that the Universe was the ultimate entity and as such it had to be without a beginning. Unfortunately, only on rare occasions was that materialistic inspiration exposed by prominent astronomers. One of these was Arno Penzias, co-discoverer of that radiation.[13] He was, however, hardly right in buttressing the opposite kind of inspiration with his claim about Genesis 1. In the phrase of Genesis 1, "Let there be light!" Penzias saw an anticipation of the 2.7°K cosmic background radiation.[14] This was a most unfortunate echo of that blind inspiration which animates those who nowadays refer to themselves as creationists, that is, those who take Genesis 1 for a science textbook.

Counter-theological, or strictly materialistic, inspiration is not absent either in the effort to find the so-called missing matter. In itself the effort is purely scientific. Clearly, not enough matter is known to exist if the rotational dynamics of galaxies obeys Kepler's third law. But one wonders whether non-scientific inspiration is not strongly at work in sustaining the search for the missing matter.[15] A successful outcome of that search would be taken by not a few as a proof of an eternal cosmic dynamics. Had not such motivations been at work, less despondency would have greeted the news that the very first experiments completed with the Keck Telescope in Hawaii, the largest telescope in the world, yielded evidence about a surprisingly large abundance of deuterium in the distant, and therefore early, universe. This was inspiring news for advocates of the Big Bang, but very bad news for those searching for the missing matter, let alone for rearguard advocates of the steady-state theory.

For both camps there remained, of course, the excitement or inspiration, about the prospect of vastly improved observational possibilities. This is what John N. Bahcall seemed to have emphasized in saying that the result in question had astronomers "dancing in the dark corridors of their observatories." The new telescope was so great a success, he continued, that "some of the questions that astronomers have sought to answer for decades may be solved in a night's observations with these new eyes."[16]

It is not, however, easy to keep from view the religiously colored inspiration in reference to even the latest astronomical phenomena. A case in point is George Smoot's announcement of slight variations in the 2.7°K cosmic background radiation. The news produced an outburst of reactions, many of them inspirational in a religious sense. Smoot himself first took the view that, to quote his very words, "if you are religious, it's like looking at God." A week or so later, being reminded of this, Smoot tried to balance that religious inspiration with a distinctly secularist one: "What matters is the science; I want to leave the religious implications to theologians and to each person, and let them see how the findings fit into their idea of the universe."[17]

Underlying this balancing act is the fact that one and the same astronomical phenomenon can generate inspired states of mind which, differ as they may from one another, subjectively can be designated by the same word, inspiration. This can happen even when the same religious sentiments are intensely shared. While John Donne was downcast by the apparent vanishing of all coherence because of the rise of heliocentrism and atomism, both were taken by Pierre Gassendi, also in holy orders, for harbingers of good news. More wisely, Pascal, greater than those two as a philosopher, as a scientist, and as a

Christian, argued that science is absolutely impotent to deliver even a drop of that supreme inspiration which is genuine selfless love.[18]

Of course, when religious sentiments, let alone the same religious sentiments, are not shared, it is almost inevitable that the same astronomical phenomenon will produce widely different inspirations. One such difference became a legendary page in the history of astronomy. To the question of Napoleon, who found no reference to God in Laplace's *Système du monde*, Laplace answered that he did not need that hypothesis. While this was a most defensible position, Laplace conveyed something of the practical atheism which animated him in those years. Indeed, countless writers and speakers took his words for a proof that atheism or agnosticism is the inspiration appropriate to the science of astronomy. It is rarely mentioned that when Laplace uttered those memorable words, Herschel was present and politely disagreed.[19]

There was no such confrontation between the Abbé Lemaître and Robert Millikan as they served on the panel which the British Association sponsored in 1931 on the latest in cosmology, the expansion of the universe and, by implication, its origin. This is not to suggest that the confrontation was not a distinct possibility and all the more so as both Lemaître and Millikan distinguished themselves with work on cosmic rays and both saw the question of the origin of cosmic rays as relevant to the question of the origin of the universe. Far from agreeing with the suggestion that perhaps "an infallible oracle" might provide the answer, Lemaître preferred the oracle's silence so that "a subsequent generation would not be deprived of the pleasure of searching for and finding the solution."[20] Millikan, however, suggested that if theories proved that annihilation processes went on in interstellar spaces and not only within the stars themselves, this would "obviously influence strongly not only present theories but also all future theories of the origin and destiny of the universe."[21] What Millikan expected was nothing less than a scientific proof of the view, hardly verifiable scientifically, that matter is eternal. Unlike Lemaître, who kept his philosophico-religious inspiration apart from doing science, Millikan readily grafted on science a counter-religious inspiration.

While Millikan, and like-minded scientists in the West, had the freedom not to do so, scientists in the Soviet Union were forced to mix their scientific inspiration with a materialistic counter-inspiration imposed on them. I was the personal witness of one such case, the last-minute appearance of V. A. Ambartsumian as member of the cosmology panel at the 17th World Congress of Philosophy in Düsseldorf in 1978. There, in order to reward the Party for the opportunity to go abroad, he suddenly departed from his topic dealing with stellar evolution. He did so in order to declare in a phrase or two that no scientific conclusion had better empirical foundation than the doctrine of dialectical materialism about the eternity of matter.[22]

But even when non-scientific sources of inspiration are kept out of focus, the inspiration sparked or sustained by work on much the same astronomical phenomena can reveal differences worth noting and all the more so because they clearly point beyond what is strictly scientific. Edwin Hubble concluded his classic *The Realm of the Nebulae* in words in which grim resolve to continue the exploration of space is coupled with scorn for theoretical reflections. What made Hubble scorn theories was not, however, his love for experimental work, but his infatuation with empiricism. At the dim boundary, or the

utmost limit of our telescopes, Hubble wrote, "we measure shadows, and we search among ghostly errors of measurements for landmarks that are scarcely more substantial. The search will continue. Not until the empirical resources are exhausted, need we pass on to the dreamy realms of speculation."[23] A philosophically very different end-note was struck by Richard C. Tolman in his equally classic *Relativity, Thermodynamics and Cosmology*: "It is appropriate to approach the problems of cosmology with feelings of respect for their importance, of awe for their vastness, and of exultation for the temerity of the human mind in attempting to solve them. They must be treated, however, by the detailed, critical, and dispassionate methods of the scientist."[24]

The contrast between these two grand conclusions should seem all the greater as both were first published about the same time, the mid-1930s. The second came from a leader in a highly theoretical relativistic cosmology who clearly relished the inspirational power of theorizing. The first came from one so disdainful of theories as to fail to acknowledge that all empirical observations are theory-laden and, indeed, to so great an extent as to beckon to domains open only to eyes which are inspired by much more than mere science. To treat with empiricist contempt such domains is no less mistaken even from the purely astronomical viewpoint than to wade into its vast reaches with the presumption that scientific skill is enough to do philosophy and theology even moderately well.

One need, however, be on guard against believing that the consideration of the history of astronomy may readily impose a fair measure of sobriety on students of the realm of the stars, nebulae, and, indeed, of the astronomical universe as such. And what if sobriety begins to parade in the garments of that subtle dizziness which is known as solipsism? Two highly regarded surveys of the history of twentieth-century cosmological theories fully illustrate this fearful outcome. For whatever the markedly pragmatico-idealistic philosophies of their respective authors, the theories surveyed by them provide ample material for supporting their doubts about the reality of the astronomical universe. They, however, failed to see that by taking the latent or unabashed solipsism of many a cosmologist and astronomer for science they not only did rank injustice to the cosmos or universe but also cast doubt on the merit of the very titles of their books. For if one could not have rational assurance in the reality of the totality of things which is the universe, there is clearly no such a thing as "the measure of the universe."[25] On the same supposition cosmic reality can but degenerate into "an invented universe" impossible to invent for the purposes of any science which cannot take its instruments for mere inventions.[26]

The author of *The Invented Universe* found that all modern cosmology tends to substantiate W. De Sitter's prediction that the universe is but a hypothesis which "may at some future stage of the development of science have to be given up, or modified, or at least differently interpreted."[27] This dispiriting prophecy can be seen to come true in that incoherent statistical ensemble into which the coherent totality of things, or Universe, is turned in quantum cosmological theories. Their proponents are signally oblivious to the fact that conviction about the rational coherence of all things, however distant from one another, has from the start been the great inspiration which propelled science, including astronomy. The inspirational lifeblood of astronomy depends indeed on giving a firmly affirmative answer to the question, *Is There a Universe?*,[28] taken that universe for the strict totality of consistently interacting material entities.

These details, old and new, from the history of astronomy put one face to face with a wide variety of meanings which the word inspiration may carry. Therefore it may pay well to take a close look at the word itself. Otherwise this conference[29] too may suffer the fate typical of almost all of them. All symposia, so goes a slightly sarcastic remark, begin in confusion and end in confusion, though on a much higher level. Those who have already sat through a dozen or so symposia would hardly disagree with this far-from-flattering generalization. If one looks for the reason, one may find it in the failure of the organizers to call for a clear definition of basic terms. Or one may find it in the speakers' unwillingness to come clean. In modern academia, haziness, couched in convoluted language, has come to be taken for profundity.

Will that haziness be dissipated by consulting the 18-volume *Oxford English Dictionary*? On a first look, the effort may seem promising. The word inspiration, together with its verb form, to inspire, takes up five columns, or ten times the mere half a column which is the average space allotted to the 400,000 words listed in the 8,000 quarto pages of that truly magnum opus.

Should one therefore expect that the hundred or so uses of the word inspiration listed there would stand for a great variety of meanings? Far from it. All those meanings fall into three distinct groups, of which one, the physical act of breathing, or to breathe air into something, may be conveniently ignored for our purposes, unless boredom or the summer heat calls for in-spiration, that is, artificial respiration, or mouth-to-mouth resuscitation. Another meaning of the word inspiration is related to God who supernaturally inspires some thoughts or courses of action. This essentially theological meaning may also be ignored, at least for the moment. Of immediate interest is the third, or essentially figurative meaning. All the varieties of that meaning, filling most of those five columns, hinge on the last word of its definition: Inspiration is "a breathing in or infusion of some idea, purpose etc. into the mind; the suggestion, awakening, or creation of some feeling or impulse, esp. of an exalted kind."[30]

Inspiration is then connected, as was already surmised in the beginning of this paper, with a state of exaltation. Unfortunately, about that state the same vast dictionary does not offer the kind of enlightenment which is clarity. We are told that one is having an exalted thought when, figuratively speaking, one takes some higher ground or perspective. Herein lies hidden a sort of tautology, something even worse than a mere paradox. Taking a higher ground means exaltation which in turn is the principal ingredient of inspiration. Conversely, once one is inspired, one is exalted and therefore on a higher ground. One may indeed ask: When using the words excitement and inspiration are we not running in a circle? Is not the luxury of having two or three different words at our disposal a mere cover-up for intellectual poverty when those three terms—excitement, inspiration, and higher ground—define one another?

This hardly enviable situation is made worse by the fact that in reference to the state of excitement the dictionary makes no mention of the fact that in such a state one is usually animated with a strong sense of purpose, or at least by an illusion of it. In view of this connection, one is entitled to say that an absence of sense of purpose, a sense of being lost, would be on hand whenever excitement would yield to its opposite, namely, dejectedness or despondency. Therefore one could just as well coin a new word, counter-inspi-

ration, a word not listed in that huge dictionary, although it lists many composite words that begin with "counter-" and, assuming their meaning to be obvious, does not give their definition. Counter-inspiration would then mean to feel not only very low or dejected, but also to feel deprived of a constructive or abiding sense of purpose, or even more picturesquely, to feel one's self to be mere flotsam and jetsam on unfathomable cosmic waters. More of this shortly.

But first the so-called higher ground. It is a treacherous ground when claimed by science and scientists, even when they merely talk of being inspired. Charles Darwin fully recognized this when in 1845 he set himself the rule, "Never use the words higher or lower!" Darwin himself disregarded this rule more often than not.[31] At any rate, the rule meant that even though a monkey should seem to occupy a ground much higher on the evolutionary scale than a mouse, let alone a mollusc, no biologist should call one higher and the other lower for a simple reason: Such a grading is a kind of value judgment which has no place in empirical science.

Even more applicable should seem the same rule in the field of exact physical science, of which astronomy is a principal branch. Unlike biology, or life science, that deals with flesh and blood organisms, of which one is patently more complex and powerful than another, astronomy, like physics, is a systematic leveler. It only deals with lifeless entities, and is interested only in the quantitative properties of their motions. There is nothing higher or lower there, only bigger and smaller, longer and shorter, farther or nearer, but never anything that in purely astronomical terms could be seen evocative of "nearer to you, oh God," or even of nearer to you, oh man.

Such is at least the case as long as we define physical or astronomical science as was done above. On more than one occasion I have felt it appropriate to define physical science as the quantitative study of the quantitative aspects of things in motion. The reason for this was my resolve to save the sciences and the humanities from mutual encroachments and, if I may add, leave whatever inspiration they may offer, in compartments that are at least methodologically separate.

Since I doubt that Leon Lederman shared that resolve of mine, I was all the more pleased to find in his book, *God Particle,* a very similar definition of physical science: "Physics is a study of matter and motion. The movement of projectiles, the motion of atoms, the whirl of planets and comets must all be described quantitatively. Galileo's mathematics, confirmed by experiment, provided the starting point."[32]

Lederman's words are a combination of plain truth, of a rank half-truth, and of some basic assumptions that cannot be justified by physics, but without which physics (or astronomy) hangs in mid-air. The plain truth is that unless physics gives a quantitative account of what it deals with, it is not yet physics. The half-truth relates to Galileo's mathematics. It was not mathematics but, as Duhem showed already in 1913, a long medieval tradition that gave Galileo the idea of that accelerated motion which is the only kind of motion, be it the free fall of bodies, that obtains in the real world.[33] Moreover, it was neither mathematics nor geometry that assured Galileo in the first place that matter and motion invariably lend themselves to quantitative considerations. One could, of course, delight, as Galileo did, in the marvelous coherence of mathematics and become greatly excited on that score.

But what assumption justified for him the application of quantities to the physically real? Certainly not the quantities themselves, for this would be a begging of the question itself, a *petitio principii.* The justification can be made only on the basis of assuming that the human mind can know matter and motion, before saying anything quantitative about them. The justification would also imply the tacit acknowledgment that the human mind can validly talk about the totality of quantitatively coherent physical matter which is the universe. At any rate, Galileo found the justification with an eye on the Creator: nothing showed so much the excellence of the Creator than that created human mind with its ability to know quantities as "objectively" as God himself did.[34]

Such an inspiration was fraught with great perils. Galileo indeed claimed that quantities alone counted, and all secondary qualities (taste, colors etc.) had to be considered purely subjective.[35] The uninspiring cultural results are too well known to be detailed here. In sum, if Galileo's claim is correct one may just as well write off all humanities and take the plague of scientism for a sign of health. Since to that plague not a few great scientists gave, at least in recent times, an unwitting help, the most effective antidote against it may be best sought in statements made by eminent scientists.

The most impressive of those statements may be the one by Eddington, partly because of its succinct character. The line between the sciences and the humanities does not run, Eddington wrote, "between the concrete and the transcendental but between the metrical and the non-metrical."[36] This remark, carried to the four-corners of the scientific and academic world, did not inspire a climate of thought, although it should have. Yet only by keeping in mind that boundary is it possible to distinguish two kinds of ingredients in the inspiration felt by an astronomer about astronomical phenomena. Some ingredients are scientific, such as the mathematical simplicity of the explanation. Some other ingredients, which are often far more decisive, have nothing to do with the science of astronomy but almost everything to do with the ideology or religion, or perhaps plain counter-religion, of the astronomer.

For unless that distinction is made, there remains no remedy for a cultural disaster in the making. It is the flooding of the societal scene with the kind of inspiration of astronomical phenomena which is a rank counter-inspiration, in the sense defined above. A notorious example is a passage by a prominent humanist who clearly had no confidence in his métier which is obviously about the non-metric in human reflections. I mean Carl L. Becker, a leading American historian of the Enlightenment. To make matters more revealing, most readers of his *The Heavenly City of 18th-century Philosophers* have been more shocked by a factual truth than by a thorough misinterpretation of some very scientific facts. The factual truth was that the gurus of the Enlightenment were led not by reason but by a dream about heaven on earth. The misinterpretation of the facts is best given in Becker's own words, spread by now through more than thirty printings in twice as many years:

> Edit and interpret the conclusions of modern science as tenderly as we like, it is still quite impossible for us to regard man as the child of God for whom the earth was created as a temporary habitation. Rather we must regard him as little more than a chance deposit on the surface of the world, carelessly thrown up between two ice ages by the same forces that rust iron and ripen corn, a sentient organism endowed

> by some happy or unhappy accident with intelligence indeed, but with an intelligence that is conditioned by the very forces which it seeks to understand and to control. The ultimate cause of this cosmic process of which man is a part, whether God or electricity or a "stress in the ether," we know not. Whatever it may be, if indeed it be anything more than a necessary postulate of thought, it appears in its effects as neither benevolent nor malevolent, as neither kind or unkind but merely as indifferent to us. What is man that the electron should be mindful of him! Man is but a foundling in the cosmos, abandoned by the forces that created him. Unparented, unassisted and undirected by omniscient or benevolent authority, he must fend for himself, and with the aid of his limited intelligence find his way about in an indifferent universe.[37]

The entire passage is a valuational misinterpretation of facts, well established by science, and a presentation of some assumptions as if they were integral parts of science. One needs merely replace the ether with zero-point oscillations in the vacuum, the electron with Higgs bosons, the ice ages with periodic extinctions of life on earth, and Becker's passage would be wholly up-to date as well as wholly misleading with its counter-inspirational fallacies. No astronomer or cosmologist of note is known to have protested the passage above which countless undergraduates have had to swallow for the past sixty years. If prominent humanist admirers of Becker found fault with his book, it did not relate to his having fallen victim to a tactic which claimed him as he penned that passage.[38]

The tactic still works, although Pascal had already unmasked it three and a half centuries ago. He did so as he described the haplessness of the libertine, that is, of the agnostic or sceptic who, in looking out into the vast depths of the cosmos, was terrified by mere distances.[39] Pascal could have also remarked that already the Aristotelian universe was vast enough to unsettle those who sought comfort in short distances. Publications of prominent recent interpreters of astronomy can at most put a brave face to the terror they conjure up as they try to discredit common sense perception with intimations of the unimaginable magnitude of millions and billions of light years. They merely trigger misguided bewilderment.

The result is a feeling of utter dejection about being "lost in the cosmos," to recall the title of a much ignored book of Walker Percy. As a sane novelist, unwilling to play to the galleries, Percy put his finger to that sensitive spot which can never float into the focus of any telescope or microscope. That spot was fully alive in a Mount Wilson astronomer's wife who divorced him on the ground of "angelism-bestialism." The source of this strangely hybrid trait derived from a travesty of inspiration which the astronomical phenomena known as quasars could spark. The astronomer in question, Percy reported, was "so absorbed in his work, the search for the quasar with the greatest red-shift, that when he came home to his pleasant subdivision house, he seemed to take his pleasure like a god descending from Olympus into the world of mortals, ate heartily, had frequent intercourse with his wife, watched TV, read Mickey Spillane, and said not a word to wife or children."[40]

Clearly, in this case (and many others could be quoted) nothing was gained in the way of genuine inspiration by stretching the limits of the known universe from a few light

years to billions of times that amount. But the root of the loss of true inspiration lies not in the observatories. It lies with Christians "in whose eyes the traditional Christian content and promise had become 'absurd'." Such is the diagnosis of Hannah Arendt, an agnostic Jew. She also notes the laughable character of the excuse that either the atheism of the eighteenth century or the materialism of the nineteenth offered serious arguments against that content and promise. Those arguments, she notes, were "frequently vulgar and, for the most part, easily refutable by traditional theology."[41]

Whether Pascal was just as antirational as was Kierkegaard, both of whom Arendt blames equally for the introduction of the Cartesian *dubito* into religious belief, is a minor issue. The principal issue is that the Cartesian *dubito* set up mathematical logic as the only reputable form of cogitation. Precisely because of this, there followed a growing distrust in man's direct registration of external reality, be it a physical or an historical event. Among the results was a disregard for the factual historical origin or birth of science. In place of facts, myths came to be cultivated by historians of science. When Bergson wrote that science, the daughter of astronomy, "has come down from heaven to earth along the inclined plane of Galileo,"[42] he failed to realize that he had given an inimitably concise rendering of one such myth.

The origin of science had indeed much to do with the heaven, though with a distinctly Christian one, anchored in unique facts of salvation history. This is why the question of the origin of science has been a very upsetting topic for many a historian of science.[43] The counter-inspiration which exudes from their accounts of scientific progress has much to do with that unease of theirs.[44] But the disregard of the true origin of science meant also a disregard for the true source of inspiration that liberated science from its repeated stillbirths and provided its only viable birth.[45] Of course, once the basic laws of physical science were in place, it could further develop in terms of its purely scientific attainments, with no consideration for the inspirational spark of its origin.

The spark was belief in creation out of nothing and in time. This belief, because of the status assigned to Christ, worked within Christianity as a unique antidote against the pantheism which caused the stillbirths of science in all great ancient cultures and nipped in the bud the prospect of science even in the medieval Muslim context.[46] This is not to suggest that today one needs to be a Christian to do physics or astronomy or cosmology worth a Nobel Prize or two. But if the same physicist wants inspiration which is much better than Cartesian "angelism" or Darwinist "bestialism," or both fused into one, he or she will have to look in the direction specified by Arendt.

What happened to the attitude toward external reality should be of no less interest as far as the inspiration and counter-inspiration of astronomy is concerned. The *cogito ergo sum*, which was Descartes' resolution of the *dubito*, reached its ultimate unfolding in the principle, "I think, therefore the Universe is,"[47] a half-hearted spoof of the anthropic cosmological principle. The principle cannot do harm to the universe, but it is already ruining the minds of some professional stargazers and cosmologists. The same should seem to be true of quantum cosmology if it suggests that expertise with it enables one to create entire universes literally out of nothing.[48] Such an inspiration is the kind of hubris that opens wide the abyss of sheer counter-inspiration.

If history is a proof, latter-day astronomers and cosmologists will have no genuine inspiration, either for themselves or for the millions who gobble up their non-astronomical

words of wisdom, unless they take it with an eye on a very specific God. I mean the God whose very first recorded act in Genesis 1 was to let his breath, his inspiration, float over what was to become a universe. This remark may sound like plain sermonizing. If it does, I refuse to apologize. To support my refusal I could recall a Copernicus, a Galileo (yes, a Galileo!), a Newton for whom belief in the Creator of the astronomical universe was a signal source of inspiration to give a better scientific account of the starry sky. Why, one may ask with Galileo, was Copernicus so inspired as to be willing to commit a rape of his very eyes?[49] I hope that such and many similar details of the history of astronomy are not entirely unknown. At least they can be learned by anyone ready to consult well translated classics of its history.

Here, to support my refusal to apologize I would put the emphasis on a book which is the furthest possible cry from Christian, let alone from Roman Catholic, sermonizing. I mean Sigmund Freud's *Civilization and its Discontents*. To be sure, Freud still refrained from describing the Catholic Church as "the implacable enemy of all freedom of thought" which "has resolutely opposed any idea of this world being governed by advance towards the recognition of truth!"[50] While Freud could not be blamed for having been unaware of the Christian sources of belief in progress, he had no excuse for ignoring Bury's memorable unmasking the secularist idea of progress as a mere begging of the question.[51] At any rate, in *Civilization and its Discontents* Freud stated that "only religion can answer the purpose of life."[52] Not that he viewed the answer of any religion as satisfactory. Far from it. But, implicitly at least, he ruled out science, even his own science (or rather pseudo-science), of psychoanalysis, as a source of an answer about purpose. The most science could do was to palliate the discontent for some, though hardly for all.

If around 1930 Freud could be struck by a high-level of discontent in our increasingly scientific civilization, one wonders whether he would not be literally dumbstruck today. As an antidote to that grave discontent not a few astronomers, relatively greater in number than say thirty years ago, offer science. Carl Sagan is a prime example. He and others hope—perhaps against hope—that with more science there will be less religion. They all share something of the delusion, memorably voiced by Herbert Spencer in 1850, that once science-oriented education is universal, equally universal will be the disappearance of crime.[53] Actually, crime is becoming universal, owing in no small part to the misuse of tools provided by science and technology.

Today, we have more science than ever and more scientific education than ever, but also a crime rate which is sky-rocketing. Partly because of this we have much more religion as well. The reason for this is the unquenchable hunger of mankind for a sense of purpose that can carry one through crimes, tragedies and abide even beyond that disaster which is the grave. No talk, however exquisite in its rhetoric, about cosmic brotherhood or a biocentric universe proves indeed to be of any personal comfort when, say, a promising young man puts his shotgun into his mouth and blows his brain to pieces.[54]

Science failed, miserably failed, to still that hunger for purpose. Not that it had ever been its task to do so. The task of science has indeed been greatly compromised by ever recurring efforts of scientists, especially during the last half a century, to force science to give what it cannot deliver.[55] But if scientists fail to gain a sense of abiding purpose from a source other than science, their scientific inspiration may not rise higher than the level of feeling some

excitement. From there it is but a short step to what I have described as the lowlands of counter-inspiration. Would that ever fewer would present it as a higher ground, let alone a genuine inspiration. As to those who are truly inspired may they never lose heart to keep breathing it far and wide.

NOTES

1. This emphasis on the *full* formulation should be a reminder of its long prehistory. Newton must have known that he owed the second law (action equals reaction) to Descartes who, in turn, could not be unaware of the late medieval origins (unearthed and documented by Pierre Duhem early in this century) of the first law. Thus Copernicus had relied on the notion of inertial motion given in terms of an initial impetus as an idea too familiar to his readers to demand justification or explanation.
2. Or in the words of the Emperor's Chief Calendrical Computer, "The guest star does not infringe upon Aldebaran; this shows that a Plentiful One is Lord, and that the country has a Great Worthy." Quoted in J. Needham, *Science and Civilization in China, vol. III, Mathematics and the Sciences of the Heavens and the Earth* (Cambridge: University Press, 1959), p. 427.
3. "Now we know/ The sharply veering ways of comets, once/ A source of dread, no longer do we quail/ Beneath appearances of bearded stars." *Sir Isaac Newton's Mathematical Principles of Natural Philosophy and His System of the World*, ed. F. Cajori (Berkeley: University of California Press, 1962), p. xiv.
4. For a full title as well as a detailed discussion of the book's content, see J.L.E. Dreyer, *Tycho Brahe: A Picture of Scientific Life and Work in the Sixteenth Century* (1890; New York: Dover, 1963), pp. 38-69.
5. Published in 1606. For details, see my *The Paradox of Olbers' Paradox* (New York: Herder & Herder, 1969), pp. 30-34.
6. And love it to an astonishing extent. A century ago Lord Kelvin declared finitude to be incomprehensible while at the same time writing off all infinity beyond the confines of our Milky Way as of no physical consequence. (For details, see my *Paradox of Olbers' Paradox*, pp. 168-70). Inattention to basic mathematical and logical problems inherent in the notion of the physically infinite mars F. J. Dyson's Gifford Lectures, *Infinite in All Directions* (New York: Harper & Row, 1988).
7. I have in mind Steven Weinberg's concluding words in his *The First Three Minutes*, for which he offered a lame apology in his *Dreams of a Final Theory* (New York: Pantheon Books, 1992).
8. See *The New York Times*, June 16, 1987, Section III, p. 1, and March 8, 1987, sec. I, p. 1.
9. The scientists quoted to that effect were John N. Bahcall and Sheldon L. Glashow. See *The New York Times* April 3, 1987, p. 16.
10. Heroic, indeed, as it implied the scanning, with a mere magnifying glass, of hundreds of thousands of photographic plates over a period of thirty years.
11. The reason for this was Comte's ambition to formulate a scientifically definitive form of sociology. Obviously, then, the prospect of new major breakthroughs in physical science had to appear most upsetting for Comte. For details, see my *The Relevance of Physics* (Chicago: University of Chicago Press, 1966; new ed. Edinburgh: Scottish Academic Press, 1992), pp. 468-77).
12. As reported by G. Hevesy in a letter of October 14, 1913, to Rutherford. See A.S. Eve, *Rutherford: Being the Life and Letters of the Rt. Hon. Lord Rutherford, O.M.* (Cambridge: Cambridge University Press 1939), p. 226.
13. In an interview with J. Dietch, "Tackling a Question: Why a Universe?" *The New York Times*, December 1, 1991, p. NJ 3.
14. See *The New York Times*, March 12, 1978, p. 1.
15. For details, see my *God and the Cosmologists* (Edinburgh: Scottish Academic Press, 1989), pp. 70-75.

16. *The New York Times* April 15, 1994, p. 22.
17. See *The New York Times*, April 24, 1992, p. 1 and 16 and May 5, p. C9.
18. "All bodies together, and all minds together, and all their products, are not worth the least prompting of charity. This is of an infinitely more exalted order." See Pascal. *The Pensées*, tr. J. M. Cohen (Penguin Classics, 1961), p. 284 (#829).
19. See my *Planets and Planetarians: A History of Theories of the Origin of Planetary Systems* (Edinburgh: Scottish Academic Press, 1978), pp. 127-28.
20. *British Association Report for the Advancement of Science. Report of the Centenary Meeting. London, 1931 September 23-30* (London: Office of the British Association, 1932), p. 608.
21. Ibid., p. 597.
22. See my *God and the Cosmologists*, p. 61.
23. E. Hubble, *The Realm of the Nebulae* (New Haven, CT.: Yale University Press, 1936), p. 202.
24. R.C. Tolman, *Relativity, Thermodynamics and Cosmology* (Oxford: Clarendon Press, 1934), p. 488.
25. J.D. North, *The Measure of the Universe: A History of Modern Cosmology* (Oxford: Clarendon Press, 1965).
26. P. Kerszberg, *The Invented Universe* (Oxford: Clarendon Press, 1989).
27. W. De Sitter, *Kosmos* (Cambridge, MA.: Harvard University Press, 1932), pp. 133-34.
28. The title of my Forwood Lectures, given at the University of Liverpool (Liverpool University Press, 1993). There I offer a proof of the reality of the universe, a proof which, steeped as it is in considerations about quantities, is strictly philosophical.
29. Held on the theme, "The Inspiration of Astronomical Phenomena" in Castelgandolfo (Italy), June 25-28, 1994.
30. See p. 1036, col. 3, in volume 5.
31. Darwin wrote those words on a slip of paper which he kept in his copy of Chambers' *Vestiges of the Natural History of Creation* (1844), a book which presented evolution as a God-directed process toward ever higher forms of life.
32. L. Lederman (with Dick Teresi), *The God Particle: If the Universe is the Answer, What is the Question?* (Boston: Houghton Mifflin Company, 1993), p. 71.
33. Or to quote Duhem: "By the middle of the 16th century, Parisian scholastics had considered as banal these truths: The free fall of a body is a uniformly accelerated motion. The vertical ascent of a projectile is a uniformly retarded motion. In a uniformly changed motion, the path traversed is of the same length as its length would be in a uniform motion of the same duration, whose velocity would be the mean between the two extreme velocities of the uniformly changed motion.... In favor of these laws Galileo could provide new arguments, drawn either from reason, or from experience; but, to say the least, he did not have to discover them." *Études sur Léonard de Vinci. Troisième Série. Les Précurseurs parisiens de Galilée* (Paris: Hermann, 1913), pp. 561-62.
34. See Galileo Galilei, *Dialogue Concerning the Two Chief World Systems–Ptolemaic & Copernican*, tr. S. Drake (Berkeley: University of California Press, 1962), p. 103.
35. "I think that tastes, odors, colors, and so on are no more than mere names so far as the object in which we place them is concerned, and that they reside only in the consciousness." *The Assayer* in *Discoveries and Opinions of Galileo*, tr. S. Drake (Garden City, N.Y.: Doubleday, 1957), p. 274.
36. A.S. Eddington, *The Nature of the Physical World* (1928; Ann Arbor: The University of Michigan Press, 1958), p. 275.
37. First published in 1932 by Yale University Press. My reference is to the 27th printing in 1965. See pp. 14-15.
38. The blindness of those humanists is unwittingly documented in the symposium held on the 25th anniversary of the publication of Becker's classic at Colgate University on October 13, 1956 and published under the title, *Carl Becker's Heavenly City Revisited* (Ithaca, N.Y.: Cornell University

Press, 1958). Only one of them, R.R. Palmer of Princeton University, called attention to the counter-theological basis of Becker's despairing outlook, and even he did not want to appear to have endorsed thereby a genuinely supernatural Christian perspective.

39. Pascal. *The Pensées*, p. 57 (#91).

40. Walker Percy, *Lost in the Cosmos: The Last Self-Help Book* (New York: Washington Square Press, 1983), p. 116.

41. H. Arendt, *The Human Condition* (1958; Garden City, N.Y.: Doubleday, 1959), p. 291.

42. H. Bergson, *Creative Evolution*, tr. A. Mitchell (New York: Modern Library, 1911), p. 364.

43. As discussed in my Fremantle Lectures, Oxford University, *The Origin of Science and the Science of its Origin* (Edinburgh: Scottish Academic Press, 1968).

44. See in particular ch. XIV, "Paradigms or Paradigm," in my Gifford Lectures, *The Road of Science and the Ways to God* (Chicago: University of Chicago Press, 1978).

45. See on this my book, *Science and Creation: From Eternal Cycles to an Oscillating Universe* (1974; new ed.; Edinburgh: Scottish Academic Press, 1986).

46. See my Wethersfield Institute Lectures, *The Savior of Science* (Washington, D. C.: Regnery Gateway, 1987).

47. The title of T. Ferris' review of *The Anthropic Cosmological Principle* (Oxford Clarendon Press, 1986) by J.D. Barrow and F.J. Tipler in *The New York Times Book Review* Feb. 16, 1986, p. 20.

48. A claim of A.H. Guth, reported in *The New York Times* April 14, 1987, p. C1. For other claims of Guth along the same line, see my *God and the Cosmologists*, p. 258.

49. See Galileo's *Dialogues*, p. 328, 334 and 339.

50. S. Freud, *Moses and Monotheism* (tr. K. Jones; London: Hogarth Press, 1939), p. 90.

51. See my Farmington Institute (Oxford) Lectures, *The Purpose of it All* (Washington, D. C.: Regnery Gateway, 1990), pp. 19-23.

52. S. Freud, *Civilization and its Discontents*, tr. James Strachey (New York: W. W. Norton, 1961), p. 23.

53. Spencer did so in his *Social Statics*, published in 1851. For details, see my *The Purpose of it All*, p. 13.

54. The young man was the son of a friend of mine who until that tragic day found meaning for life in cogitation about extragalactic cousins.

55. As I have shown in my book, *The Relevance of Physics* (Chicago: University of Chicago Press, 1966, p, 452), the religious commitment of scientists changes in much the same way as does that of other professional groups. Those changes are not, however, reflected in superficial generalizations such as the often referred to materialism of the 19th century. Leading physicists and astronomers (as well as other scientists) of the 19th century professed Christian convictions in a surprisingly high proportion. See on this the reprinting, with my introduction, of A. Kneller, *Christianity and the Leaders of Modern Science* (Clinton, Mich.: Real View Books, 1995), originally published in German in 1902 and translated into English in 1911.