

On God, Space & Time



**Akiva
Jaap
Vroman**

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Acknowledgments

Shortly before his death, on October 24, 1989, my father asked my husband Benjamin Levy, an artist, and me to ensure that his manuscript would be published after he was gone. His request was a great honor for both of us. A few years earlier, Benjamin, who had a unique relationship with my father, developed an interest in my father's writings and philosophical theories which my father usually kept to himself. As a result, we began having discussions at home with my father in which I became very involved.

Soon after, my husband and I organized discussion groups in New York City and Tel-Aviv where my father presented his scientific theories about God to various individuals in the fields of philosophy and theology. The last time my father spoke to the editor he worked with, Jeffrey Shapiro, his words were, "Our work will be completed on October 26th." He did not realize how prophetic his words would be for that was the day of my father's funeral.

Eventually, Benjamin and I took the manuscript to the United States. *On God, Space and Time* represents about a third of the material contained in the manuscript. When we started working with Transaction, through our dear friend Professor Haim Shaked, we began gathering all the necessary information with the help of my mother, Gonny Vroman, and my sister, Yemima Vroman Ergas, who contacted some of our father's former colleagues asking for their input.

I would like to take this opportunity to thank everyone who helped us keep our promise to my father: Professor Yaacov K. Bentor, for his close partnership with my father and contribution to the Introduction; Dr. Ofer Levy, my son who is so much like my father, for his editorial and scientific insights, who began drafting the Introduction with me between working at the hospital and attending to Sharon, his wife, who was in labor at the time; Alex Grey, the editor, for his meticulous work; and Amalia G. Pena, a dear family friend, for helping me with redrafts of the Introduction.

Hanna Vroman Levy
New York, October, 1998



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Introduction

Akiva Jaap Vroman was born in 1912 in Gouda, the Netherlands.* The highly gifted son of two secular high school teachers, one in mathematics, the other in physics, the young Akiva was pressed to excel academically. As a child, his parents took him on long hikes in the Swiss Alps where already the young Akiva started showing an interest in rocks. He studied geology, as well as theology, at Utrecht University, and participated in the University's theater groups. At this time, making a break with his family, he developed an abiding commitment to Zionism, and joined the Zionist movement. *On God, Space and Time*, an integration of science, philosophy, and theology, represents the culmination of Professor Vroman's work and thought.

In 1936, Akiva, having resolved to carry out his work in the Holy Land, went to Palestine, basing his geological work at Zichron Yaakov. Collecting rocks with a team of Jewish and Arab assistants, he outlined the geological history of the Carmel Mountains. At this time, Akiva became acquainted with Professor Leo Picard, head of the Department of Geology at Hebrew University, at Mt. Scopus, Jerusalem. Subsequently, Akiva returned to Utrecht University to complete his doctorate and, in 1939, published his thesis, entitled "Geology of the Region of Southwest Carmel (Palestine)." He became engaged to Gonny Betsy DeLeo who was preparing to become a Montessori teacher.

In 1940, with war erupting in Europe and Hitler's army pressing into the Netherlands, Dr. Picard invited Akiva, now Dr. Vroman, to work as a geologist in Palestine. The letter extending the invitation ensured that Dr. Vroman would receive an "entrance-certificate" into Palestine, which was then under British rule. Unfortunately, the letter was addressed by Dr. Picard's secretary simply to "Gouda," with no country name, and traveled the globe for four months before reaching its intended destina-

*The information set forth here is based, in large part, on *MONOgeoGRAPHY*, the personal memoirs and history of the geological mapping of Israel written by Akiva Jaap Vroman and published by Haifa University 1984. The authors of the introduction are the daughter and grandson of Professor Vroman.

tion, which delay very nearly cost the young couple their lives. When they learned they could both enter Palestine on the same “certificate” if they were wed, the young couple married and left for Palestine within days of receiving the letter.

Once there, Dr. Vroman joined Dr. Picard at Hebrew University where he continued his work in analyzing rocks, including rocks from all parts of the Middle East at the request of the British who, due to the war, were unable to send the rocks abroad. Dr. Vroman’s three daughters, Hanna, Yemima, and Ariela were born in Jerusalem.

Between 1945 and 1948, often walking for long distances in the desert with less than the basic necessities, Dr. Vroman searched for oil in and around Ein Gedi on behalf of the Jordan Exploration Company. As the company’s field geologist, Dr. Vroman created maps of the region, including Massada and Sodom.

The Vroman family lived out the War of Independence in Jerusalem. During the war, Dr. Vroman, worked for the Israeli Army’s Mapping and Photography Services.

On the day Jerusalem was freed from siege, Dr. Vroman was asked to join Dr. Yaacov K. Bentor on a secret mission for the Israeli Army Science Corps, the “Negev Oil & Mineral Intelligence,” conducted at the Weitzman Institute. The mission, which was conducted over a period of ten years, entailed exploring the Negev desert in search of oil, springs, and mineral deposits. Dr. Vroman saw it necessary to redraw the maps of the whole Negev because the maps of the region made by the British were prepared using antiquated methods of mapping. Again, Dr. Vroman spent many months under difficult conditions of the desert and war.

Dr. Vroman, an excellent draftsman, drew his maps by hand, as he had throughout his entire career, by using different colored pencils to indicate the various minerals and layers of rocks. Dr. Bentor prepared the accompanying text explaining the maps and the results of their research.

In 1955, Dr. Vroman won the Israel Prize, the highest honor the country could bestow, in science for mapping the Negev. Dr. Vroman shared the prize with Dr. Bentor, who has said of him: “Akiva Vroman was a very modest person, but everyone who knew him was impressed by the breadth of his interests. He also was endowed with an unusual sense of humor.” Gony Vroman, herself an accomplished pianist who often played classical music in the adjacent room while he worked, always found her husband’s ability to concentrate so extraordinary that it never allowed the rest of the world to distract him from the task at hand.

Dr. Vroman also participated in the building of the road from Beersheba to Eilat. Beginning in 1950, when the Vroman family moved to Haifa, he taught at the Technion, Israel's leading engineering college. In the early 1950's, Dr. Vroman participated in the important endeavor of bringing water from the Jordan River and rain water to a reservoir in the Beit Netufa Valley to irrigate the Negev.

In 1953 and 1954, Dr. Vroman was asked by Lapidot, an Israeli oil company, to compile detailed maps of all of Israel and identify promising areas for drilling oil. A result of this work was the discovery of oil and gas in Hulikat and Rosh Zohar. Dr. Vroman made an invaluable, central contribution to Israel's search for oil through his pioneering development and use of aerial photographic techniques which, beginning in 1947, he had taught himself. These techniques enabled him to map efficiently and accurately the areas of the Negev which had previously been poorly mapped by the British.

In 1956, Dr. Vroman went to Mexico as the delegate of the Geological Institute to the 20th International Geological Conference. After the conference, on a fellowship awarded him by UNESCO, Dr. Vroman traveled to Harvard University to further his knowledge of geological structures spending most of his time in libraries copying geological maps of Arab countries.

Using the aerial photographic techniques he had developed during the Sinai Campaign, in 1957, Dr. Vroman prepared a geological map of the Sinai demonstrating how maps of otherwise inaccessible areas can be drawn efficiently and accurately. After the Six Day War, the maps created by Dr. Vroman, a pioneer in Israeli geology, were used by the Israeli Army which found them more accurate than those previously made by British and Egyptian geologists who had prepared theirs by working on foot.

Many years later, his friend and colleague Y. Bartov would say of him: "It was Vroman who recognized the vast possibilities of geological mapping by means of aerial photography. He did so at a time when aerial photography was almost unknown in the country, in any case, not for mapping purposes, and when in world-wide terms the branch of photo geology was still in its infancy.... With the barrier [of antiquated mapping methods] thus removed, there was no turning back."

As head of the Israeli Geological Mapping Department, in 1958, Dr. Vroman, now a professor, set about to create maps of Mt. Carmel and the region of the Galilee.

Professor Vroman's work extended to Africa and throughout the

Middle East resulting in maps as well as a published book on the tectonics of these areas which offered many original ideas. He once described these maps as the “instrument” of the scientific conclusions he set forth in *A Reappraisal of the Structure of the Earth*, which was published in 1973.

In 1964, as the first Israeli to do so, Professor Vroman went to France to study additional aerial photographic techniques. During the 1960s and 1970s, he continued to teach, among other subjects, his pioneering mapping techniques to a generation of Israeli geologists at Haifa University, Tel-Aviv University, and Beit Berl. During this period, he also published several scholarly articles and books on a broad range of subjects. His regional maps and his compiled map of Israel are still current and used by geologists today.

Professor Vroman retired in 1979, and devoted the last ten years of his life to philosophy. He started to write about his scientific concept of God. During this period of reflection and writing, Professor Vroman, a true Renaissance man, also found time to pursue his passions in music and art, creating some very beautiful drawings. As happens to many scientists in their mature years, he began questioning the creation of the universe. His long days of mapping connected him physically, intellectually, and spiritually with the terrain of the Holy Land and the region. Expanding the scope of his scientific work from the Holy Land to include the Sinai, Arab countries and Africa had led him to a “reappraisal of the structure of the earth.” This journey took him from examining rocks under a microscope to developing a scientific theory of how the universe came about.

Professor Vroman had very high moral standards which he preached and lived by. These standards were based upon what he believed was the most important message in the Bible and *On God, Space, and Time*: “Love thy neighbor as thyself.”

Hanna Vroman Levy and Ofer Levy

1

An Introduction to Reality and Imagination

We say a thing is real when we are convinced that it exists independently of the idea we have formed about it.

The term “exists” has been a source of much misunderstanding. To state that a thing “exists” does not contribute anything new about its characteristics. The German philosopher and mathematician, Gottlob Frege (1848–1925), counted existence among “second order predicates.” The statement “horses exist” belongs to the category “horses are numerous,” and it does not tell us anything new about horses per se. There have even been philosophers who included existence with occupation, and made statements such as “existing things are engaged in existing.” But the nonsensical statement “unicorns do not exist, they have better things to do” may open their eyes.

The term “existence” has very often been confused with “essence.” Essence delimits an object by its definitions; but even an exhaustive description of all its properties does not imply that the object really exists. We may imagine hobgoblins, but they will not be real—even if we ascribe to them all the attributes that may cross our minds, down to the last invented detail. The essence of hobgoblins has therefore nothing to do with their existence. But it is hardly possible to prove that hobgoblins do not exist. Tomorrow we may be shocked when we meet a real hobgoblin!

But this is an old story: the reasoning of German philosopher Immanuel Kant (1724–1804). He wrote: “Whatever and however much our concept of an object contains, we must go beyond it in order to ascribe existence to it.”¹ Nevertheless, we may demonstrate that our mind may imagine things that do not exist, and that we may even provide proof that they do not exist.

We are able to give free play to our imagination. We may keep our minds on a star of a galaxy in the remotest part of the cosmos, and entertain the illusion that it is over there in exactly the same state as we

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now physically see it. However, we must be well aware that this is nonsense because of the finite and constant velocity of light.

But we can just as well imagine a day in an infinite past as being an infinite number of days behind us—such as our day of birth. Our next step is to inquire if such a day in the infinite past can really exist. For example: we can check the next day and all the following days that move towards the present. The day in our minds becomes tomorrow, and after today it will retreat into the past and become yesterday. Then after the lapse of another day it would become the day before yesterday.

Time passes and we would expect that the lapse of every additional day would bring our day closer and closer to the day of our birth, to the point where the two days will coincide. But this first day of our existence will never arrive, for we assumed at the very outset of our reasoning that an infinite number of days separates the day we kept in mind from the day of our birth.

You must keep in mind that the passage of time does not skip even one day. Time counts all the days. There would be no end in time's counting of the succession of days if the counting would start at a day in an infinite past. The days would lapse, but the dawn of known history would never rise, and we and all previous generations would never have been born.

A day in the infinite past is therefore nonsense. So we are forced to accept the only alternative: all the days that have elapsed belong to a past of countable days. They belong to a past that started on a first day a finite number of days ago. Time was created with this first day. And, as we do not call our own existence into question, it follows indeed that an eternal past does not exist. Time must have a beginning. This reasoning is based on a simple mathematical law that is often ignored.

An infinite quantity remains the same infinite quantity if a finite quantity—however large—is subtracted from it.

Let us apply this law to our day in the infinite past. An infinite number of days has to elapse before the day of our birth will break. This infinite time will never decrease, hence it will never become finite and then become zero. This follows from the simple reasoning that the duration, which is the total length of elapsed time measured from our chosen starting point, can never grow into an actual infinite eternity. It must always remain a potential infinite duration.²

Time is not an independent parameter. We cannot imagine velocity without time. Velocity is the time in which a moving object covers a certain distance. There is no movement without time, and in the ab-

sence of time all the objects would be at a standstill. Stop reading for a moment and take a minute to try and imagine a world without movement. The atoms in crystal lattices would not oscillate with their clockwork precision, and would be in state of freeze at absolute zero degrees. Light would be absent, planets would not orbit around the stars, nor the stars around the neighboring stars. This would be an absurd situation. The force of gravity will draw all matter to one point and into naught. But this is equally absurd because such a process would need time which did not exist. The world is unthinkable without time. The world has a beginning, and it began to exist the moment time came into existence.

The alternative is that there has been a time-interval, a duration between the moment time came into existence and the moment when the world came into existence. This is a strange supposition because we are unable to comprehend a time-interval that in the absence of moving and changing objects is immeasurable in principle.

Let me elaborate: Our mind is a rather odd machine which knows from experience that the world is not static, but that it changes all the time. On the other hand it refuses to accept changes—it deems them arbitrary and whimsical. Just as we do not accept different things on the two sides of the equal sign of an equation, we tend to eliminate change by accepting a cause that brings about the effect. Each cause is linked to its effect by time interval. The law of cause and effect is unthinkable without time. This conflicts with the law of logic. Time does not play a part in mathematical logic. If A equals B , A does not equal C after B equals C , but because B equals C .³

It is clear that an equilateral triangle did not obtain three angles of sixty degrees after the sides became equal, rather the triangle is equilateral because the three angles are equal. In contrast, water boils after it has been put on the fire. But a causal link is not merely a link of temporal sequence. Our mind turns the “after” into a “because,” which means that we infer that putting water on the fire brings about its boiling.

Our conviction that this causal link exists is not enhanced by repeating this experiment continuously. Professor Jean Piaget stated, correctly, that this conviction does not depend on our sense perceptions. The law of Leucippus⁴—that every change must have a cause—is something innate in our mind. It is a law of thought on an equal footing with our other laws of thought, such as the laws of thought established by Plato and Aristotle—the so-called three laws of logic. Immanuel Kant called these laws *a priori* synthetic judgment.

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The great miracle is that in our daily lives we are never disappointed by experience. The course of events always complies with our anticipation—in this case the anticipation that water will boil whenever we put it on the fire.

Why indeed should the external world be concerned with the laws of our anticipation? The mental law of cause and effect is so much part and parcel of our mind that it was taken for granted until the twentieth century. It is a law that has to be reappraised with the discovery that Kant's synthetic *a priori* is a valid mental instrument under normal circumstances; but that the rules break down in the world of very high speeds—of very large gravitational forces—where the geometry of space is curved. And equally so in the world of nearly infinitesimal smallness of subatomic dimensions, where the speeding particles have no exact location and may even exchange identity when one particle crosses the fairway of another.

Notes

1. *Critique of Pure Reason*.
2. A potential infinite is defined as a finite that grows and grows but can never become an actual infinite—although the end of its growth is never in sight.
3. The science of dealing with our innate ways of thinking is called epistemology. Immanuel Kant was one of its pioneers and the modern psychological aspects were studied by the Swiss psychologist, Jean Piaget (1896–1980.) Piaget was a professor of child psychology and wrote numerous books on the subject. See Bibliography.
4. Leucippus, a Greek philosopher, lived during the fifth century B.C. It is believed he proposed that matter is made up of indivisible and infinitely small atoms. He is regarded as the mentor of Democritus (c. 460–370 B.C.); but he lived in a past so dim that some doubt he ever existed.

2

The Modern Vindication of the Existence of the Creator

That the world must have a beginning and must have been created out of nothing, the *Creatio ex Nihilo*, was already discovered in the early Middle Ages and followed the lines of logical and causal thinking; that is, not all from the consequences of our sense perceptions (modern physical experiments did not exist then). It was the first instant that it was discovered that our innate laws of thinking are, in a way, deficient—that impeccably rational thinking leads to an irrational conclusion. That everything we perceive has been created out of nothing. The reasoning, nearly 1500 years old, opened with the book *Contra Aristotelem* by the monk John Philoponus. The issue was taken up anew by the Muslim Kindi and finally brought to perfection by Saadyah Gaon (882–942).¹

William Lane Craig described this history in *The Kalam Cosmological Argument*. This discovery was of tremendous theological importance, because of the association of the *Creatio ex Nihilo* with the principle of a First Cause. A term is very often used as a definition for God. God is a Something we experience as Nothing that created everything out of a Something—the same Something we experience as Nothing.

It took the medieval Cosmological Argument (CA) of the Kalam School² three centuries to ripen. Then it sank into a long oblivion of thousands of years. This misfortune was caused by the very man who started the argument, Aristotle (384–322 B.C.). The Greek philosopher was well aware that actual infinities do not exist. He knew they only exist in the mind of the mathematician; but he believed without any practical reason that he was permitted to exempt time from this rule. He disbelieved in the real existence of time, and I have summed up his superstition with the following poem:

*The past we forget
the future is not yet
the present is their joint
but it is just a point*

Hence he believed that there is nothing real in time—it exists in the imagination.

The second factor that buried the Kalam Cosmological Argument for so many years was the great respect for Aristotle among the thinkers of the Middle Ages. The CA was regarded as a revolt against Aristotle's garbled thinking about time. And it was so indeed. The modern view is that everything exists which is measurable, and that there is no other parameter that may be measured with greater precision than time. It is, moreover, a fact of life that there is no other parameter that kills more cruelly than the lapse of time—aging.

After a thousand years the Kalam Cosmological Argument has been resurrected as an archaeological curiosity by Dr. Herbert Davidson and by Harry Austryn Wolfson. William Lane Craig immediately recognized the enormous theological consequences.³

Albert Einstein (1897–1955) developed his own vision of time. He believed that time did not lose its reality, but the rate of its flow became dependent on the relative velocity of objects. It was realized that the Maxwell-equations⁴ of the electromagnetic field (light) imply that the velocity of light in space is invariable. As a consequence, the constant rate of flow of time went by the board, and a fourth linear dimension had to be added to the conventional length, width, and height that mark Euclidean⁵ space to describe the movements of objects. This fourth additional dimension contains the parameter time. But our imaginative faculties cannot conceive such a four-dimensional cosmos.

Albert Einstein's original idea was that the cosmos is invariable as to its volume—it could neither shrink nor expand. But that was his conclusion until corrected (independently) by the Dutch astronomer Willem de Sitter and the Russian Alexander Friedmann who drew Einstein's attention to a miscalculation.

Einstein was broad-minded enough to admit mistakes, but this one had deeper philosophical consequences. It meant that Einstein's universe must expand continuously.

I have reason to believe that it was not the future of the universe that annoyed him, rather it must have been the consequence of the "flash back" (what happened at the beginning). A cosmos expanding out of nothing. This conclusion went against the grain of his worldview, which

was purely an idealistic one, and the argument that God and nature are the same⁶ had suddenly to be rejected. God could no more be identified with the gigantic clockwork of the revolving galaxies. He must have created it.

It seems that Einstein was wise enough to quit in 1923 from his view that the cosmos is static as to its volume. But in that same year his theory of relativity⁷ (proposed in 1905) implied much more than the original Kalam CA. It established the creation of time and space in a distant past and it revealed an inkling about the circumstances. But it was still nothing but a brilliant theory. The world waited eagerly for corroborating facts.

The first confirmation came with American astronomer Edwin Hubble's⁸ discovery in 1930 of the red shift of the spectral lines from the light of the distant galaxies. The shift of the spectral lines to the red side of the spectrum (the side of the longer wave length) may only be explained as a speeding away of the radiating celestial bodies—the galaxies. This conclusion has been contested by several skeptics, such as Patrick Shaw (logics lecturer at the University of Glasgow).⁹

Shaw warned against the following reasoning: "Let us assume that the universe is expanding. If it were, then the spectrum of the furthest stars should show a shift towards the red. This redshift is precisely what we find. So we can assume that the universe is expanding."¹⁰ And Shaw added the following warning: "Invalid as it stands. We need a way of blocking alternative explanation of the shift."

Let us meet Shaw's request: the Dutchman Maarten Schmidt and New Yorker Jesse Greenstein calculated many years later (after 1930) that all the other known factors that might have been responsible for the redshifts—among them a very strong gravity field—are absolutely inadequate to account for the magnitude of the observed shift. Their paper has been regarded by all the former objectors against an expanding universe as "overwhelming evidence."

The discovery of the redshift was later complimented by other discoveries confirming an expanding cosmos. In 1965, American radio astronomer Arno Penzias (born in Germany, 1933–) and Robert W. Wilson (1936–)¹¹ of Bell Telephone Laboratories found a faint cosmic glow of barely three degrees above absolute zero temperature. It bears the characteristics of a so-called black body radiation—a feature that on a cosmic scale may only be explained as a late stage of the ever declining effect of an event of radiation of enormous proportions in the most distant past. It is the last sign of the "big bang," as the fireworks

of the creation of the universe is popularly called...following from the model proposed by Belgian physicist Georges Edouard Lemaitre (1894–1966).

Another feature that supports the conclusion that the universe is expanding is implied in an old enigma: why is the sky black at night? The amount of starlight must be so great that the night should be as bright as the day. Heinrich Wilhelm Olbers (1758–1840)¹² asked this question—known as Olbers’ Paradox—more than a hundred years ago and could not solve the problem. Today the answer is clear: the universe needs an enormous quantity of energy to expand, and it borrows this energy from the radiation-energy of the stars.

A third and most striking discovery is the character of the so-called quasars studied by Allan Sandage in the late 1980s. The most distant objects in the universe do not bear the characteristic features of the much closer—and apparently normal galaxies—which turned out to be composed of billions of normal stars. The brightness of just one quasar is enormous. It outshines the light emitted by an entire group of galaxies by a factor of ten. Their redshift is outermost; they are extremely remote. It follows that the speeding away of any object in the universe is directly proportional to the distance from that point. The greater the distance, the greater the speed, and the greater the redshift.

Furthermore, one should realize that the radio telescope, through which the quasars are observed, not only looks very deep into the universe—it also looks far back into time. The velocity of light is constant but not infinite, and the quasars are so remote (the most distant objects we have yet seen) that their light has to travel billions of years before it reaches our eyes. We observe quasars not in their present state, but as they were billions of years ago. When we look at them we feel as though we were present at the very moment of the birth of the cosmos—a hot glowing crucible out of which the galaxies emerged.

Let us perform the following mental exercises: let us imagine people standing at this very moment on a celestial body we observe as a quasar. This is not an unreasonable proposal because our looking back in time means that the object we see is at this moment billions of years older than the quasar we see through the radio telescope. The people we imagine standing on it have the entire age of the universe behind them, just as we have. They might find themselves standing on a life-supporting planet like our earth. They peer into a telescope in their quest to explore our Milky Way and point it at us and lo! they do not see us standing on earth rotating around our sun. They do not even see

the Milky Way, which is our galaxy. They just see another quasar, for it is now their turn to look back in time.

Scientists rarely fix their eyes on the first cause. They restrict themselves generally to theoretical details of the first effect, which is the creation of the world—the big bang. A more sophisticated name for the big bang is the *space-time singularity*.¹³ A singularity is an object of infinitesimally small diameter and of an infinite mass. These two characteristics are—as I pointed out—taboo from a philosophical point of view. Paul Davies said in the preface to *The Edge of Infinity* that a singularity is rather “a non-place where all known laws are suspended.”

This taboo, which we deduced above, is the following: actual infinitesimals and actual infinities do not exist. However, Davies made it clear in chapter 4, “Towards the Edge of Infinity,” that nature does not need to transgress this taboo in order to create objects featuring all the strange side-effects that theoretical physics attribute to singularities. It only depends on their mass: the greater the mass the lower the critical density. For example: a star group of a million suns (not an outlandish feature in the skies) might collapse by gravity to a modest density of one kilogram per cubic centimeter. This is quite normal among ordinary stars and the whole compact mass would behave as a singularity of infinitesimal dimensions and infinite density.

I am thus strongly tempted to modify the definition of an actual singularity as actual bodies that behave as if they are infinitesimally small and of an infinite density. If armchair theoreticians would maintain that further collapse to infinite density is unavoidable, I would counter that there must be something amiss with our knowledge of matter.

Singularities crop up in purely mathematical calculations and emerge in two varieties: invisible Schwarzschild singularities, commonly called black holes, and fiercely radiating naked singularities. A black hole is a singularity encased within a surface marking the radius, or the distance from the singularity where the emitted light turns back into the singularity because of the tremendous gravitational attraction it exerts on the emitted light beams. This surface is called the “Schwarzschild horizon.”

It has been reasoned by Paul Davies that a singularity rotating at a high speed, or one charged with a very large amount of electricity, has no Schwarzschild horizon. Such a singularity is termed naked. Stephen Hawking pointed out that it follows from the laws of sub-atomic physics and from quantum mechanics that every singularity, whether attired in a Schwarzschild horizon or not, must emit some energy. The more energy emitted, the narrower the radius of the shield.

Hawking figured in 1974 that all the tiny black holes must have evaporated long ago and that hardly any leftovers of the space-time singularity—the big bang—are still alive. Further calculations lead to the conclusion that the force responsible for the creation of new black holes is gravity. Stars thirty times larger than the diameter of our sun must collapse under their own weight to an infinitesimally small point of infinite density.

The most conspicuous phenomenon of a collapsing, imploding, super-massive star is the supernova state¹⁴—the explosion of the outer shell of a giant star that collapses under its own weight, creating a tremendous amount of heat that causes a violent casting off of its outer sphere into space. New elements are created in the process—carbon among them, the element of our life-spring. The duration of one single supernova event is at least a billion years. The history of the supernova event is supposed to begin with a star that swells to giant hydrogen, becoming a red supergiant of 170 million degrees Celsius when gravity squeezes it, and its hydrogen atoms are fused into helium. The helium atoms are then fused to become carbon and oxygen. Nuclear fusion continues and carbon is bound into neon. Meanwhile the temperature rises to one and a half billion degrees. This occurs seven years before the last stage and oxygen is gradually turned into silicon. Four days before the great event silicon is bound into iron, the most stable among the chemical elements.

Further collapse cannot release more energy by simple fusion. The very cores of the iron atoms are crunched, releasing terrific amounts of the tiniest particles called neutrinos, which rip through the surface and cause a most violent shock wave. More than 99 percent of the star's energy is cast off.¹⁵ What remains at the core is what is called a black hole. Observed facts suggest that giant black holes rotate the luminous gas-arms of the quasars. Our knowledge about the big bang would be greatly increased if we knew more about singularities. Much of what I explained here is pure armchair science. What counts is the verification of all these theoretical deductions by facts in the physical world observed through our senses.

About twenty supernova are found each year in the more distant galaxies. We had the good luck to witness a much closer one on 23 February 1988 in the "Large Magellanic Cloud" at a distance of about 170,000 light-years from Earth. The message arrived that the blue star Sanduleak 69 degrees 202, which had a mass twenty times that of the sun, blasted into supernova. The analysis confirmed the expectations,

but the densest remnant of a supernova ever found was not a black hole or other singularity, but a body of a stage less dense called a “neutron star.” Special types of neutron stars are called “pulsars.” They emit an x-ray beam rotating like the light of a lighthouse. Neutron stars are composed of tightly packed building-stones of atom-cores—neutrons. Their density is so tremendous that a small marble of neutron stuff would weigh ten billion pounds. It’s not a toy to play with, but nevertheless it is of a density that falls short of the infinite.

As to the cores of quasars: I mentioned above that practically all scientists are convinced that such phenomena are super-massive black holes spinning like a turbine and gobbling up spiraling strands of gases that lit up a billion years after the big bang. But even the strongest conviction cannot compete with solid observed facts, and they are few. Quasars are too old and too far away to study in detail. Is there not a much closer and more suitable heavenly body such as the core of a nearby galaxy that may reveal the same features as the cores of quasars, though on a much more modest scale. Yes, the nearest one is the core of our own galaxy, the Milky Way, only 15,000 light-years away. Only the latest piece of equipment, the “Very Large Array” radio telescope near Socorro in southern New Mexico is able to peer into the overcrowded, glowing center of the Milky Way.

Scientists agree on the facts, but are not absolutely unanimous as to their interpretation: A giant central rotating gaseous shell of some ten to six light-years radius. It gobbles up spiraling streamers from a molecular cloud and whips them around at a velocity of ten kilometers per second on the periphery; and accelerating to 200 kilometers per second close to the central shell. If there was no giant black hole at the very center, the spiraling gas filaments would have flown off their paths long ago. Common sense tells us that the core of the Milky Way is a textbook example of a mini-quasar.¹⁶ It is the closest encounter with a true black hole.

But still there are other scientists who disagree. Such as the group around Hannes Alfvén. Here follows a short account of their views:

One calls the rotating ionized (electrically charged) molecular gases, such as around the cores of quasars and galaxies, a ‘plasma.’ This plasma may continuously be in a state of being discharged by an electric arc. This bolt produces a magnetic field at a right angle to the current. Laboratory experiments—computer models, and actual astronomical observations of the core of the Milky Way—confirm that the magnetic field causes the straight current to wobble and to turn it into a spiral.

Eric J. Lerner, a freelance researcher in Lawrenceville, New Jersey, deduced from his experiments that the first small random currents cause

the plasma to curdle into clods and that the clods tend to rotate around the merging currents. They are then drawn out into spiraled filaments, forming a pattern that brings spiraled galaxies to mind.

I am always of the opinion that one should disregard the notion that dissidents are always in the minority. What counts is their arguments and how to deal with them, even when the proposals may turn out to be the mere hallucinations of some cranks. I even listened with attention to an old man, a certain E. Wexler, who defended the untenable position of the French scientist, mathematician, and philosopher René Descartes (1596–1650)¹⁷—that the universe is ruled by the churning of violent ether-storms. But Hannes Alfvén and some of his colleagues are certainly not cranks. They are lucid of mind and serious scientists who propose electromagnetic phenomena as an alternative to the force of gravity. On the other hand, the force of gravity rules the history of the universe according to the current standard model of the big bang. The most outrageous teaching of their model of electromagnetic plasma is that the universe should have an eternal past. We have seen that simple reasoning rules this absurdity out, though many agree that electromagnetic forces may have had some influence on the history of the cosmos. There is much evidence that electromagnetism is too weak to push matter around on a cosmic scale. I propose, therefore, that the plasma theory may explain the early germination of the quasars when the universe was still very young and in a dense plasmatic state.

But neither gravity nor electromagnetism can explain the enormous velocities reached by the fringes of the spiral nebulae's arms turning at a speed which seems to defy Newton's simple relations of the law of gravity. There is, therefore, still a frantic search in the skies for additional heavy matter that should account for this anomaly.

After the discovery thousands of years ago that time must have been created, and the hardly challengeable new discovery of the big bang, we have become too smug. We even disregard the most basic truth that the smartest intellect is unable to decipher the objective reality from the poor information we receive from our few and deficient senses.

All these discoveries, theoretical and practical, clinch the CA. Many theologians in search for God would certainly content themselves with the evidence of a First Cause as the appropriate, and even conventional, definition of God. There are, however, many others who worship their First Cause not so much as the Creator but as the "Almighty," the "All-Good," the "Bountiful," or the "Omniscient" to mention only a few of the endless string of divine perfections mentioned in the Bible and in daily prayers.

God did not only create what we call the cosmos of time, space, and matter but the mental world as well. He is the Creator of everything, including all the perfections that adorn Him in the text of Holy Writ. Did God create His own perfections? God defined as the First Cause can have no other predicates. My aunt happens to wear a jumper she knitted with her own hands. It is her legal property, but not her predicate, not her attribute.

There are numerous scholars who are well versed in theological problems and who try to seek confirmation of God's existence through other arguments. The Ontological Argument (OA) and the Argument from Design (AFD) are two such approaches with long histories.

Notes

1. Saadyah Gaon was one of the greatest of Jewish religious authorities, philosophers, and writers. He was born in Fayyum (south of present-day Cairo) and was the first translator of the Bible into Arabic.
2. Old Jewish and Arab philosophy.
3. See Bibliography on the works of these authors.
4. Scottish physicist, James Clerk Maxwell (1831–1879), unified in theory all the phenomena of electricity and magnetism.
5. Euclidean means “of Euclid” who was born from about 330 B.C. to 275 B.C. He was one of the great Greek mathematicians, and is best known for his book, *Elements*, concerning mathematical knowledge.
6. The philosophy of Baruch de Spinoza (1632–1677) is illustrated in his expression: *Deus sive Natura*—God alias Nature. It meant that God conjured Himself out of nothing.
7. The theory of the universe, based on the principle that measures of motion, space, and time are relative (*Oxford English Dictionary*).
8. Hubble (1889–1953) discovered millions of galaxies other than our own. Hubble's Law: the velocities of receding galaxies are directly proportional to their distance from the solar system.
9. Patrick Shaw, *Logic and its Limits*.
10. *Ibid.* p. 189 statement 15.2.
11. Penzias and Wilson shared the 1978 Nobel Prize for physics with Russian physicist Pyotr Kapitza.
12. Olbers was a German astronomer who discovered the asteroids Pallas and Vesta and rediscovered Ceres. He also found five comets and one is named after him.
13. Paul Davies, *The Edge of Infinity*; Stephen W. Hawking, *A Brief History of Time*.
14. Rick Gore, “The Once and Future Universe,” *National Geographic*, June 1983.
15. P. Kirshner, “Supernova, Death of a Star,” *National Geographic*, May 1988.
16. Marcia Bartuseak, “Coming Home,” *Discover*, September 1988, and “Feeding the Hole,” *Discover*, June 1989. I. Peterson, “Carrying Fuel into the Galaxy Center,” *Science News*, 14 January 1989.
17. Descartes, educated by the Jesuits, experimented with mathematical conclusions that he tried to make the basis of his philosophy.



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