"In A Beginning..." Quantum Cosmology and Kabbalah

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Modern cosmology--the scientific study of the universe as a whole--no longer sees the universe as an infinite, changeless arena in which events take place, the way Isaac Newton did. The universe is an evolving, expanding being, and its origin is the oldest mystery. For the first time in possibly a million years of human wondering, we are not simply imagining the beginning: We are observing it, in radiation that has been traveling to us since the Big Bang, possibly bearing information generated even earlier. Theorists are piecing the data together into humanity's first verifiable creation story.

Most educated people today have an essentially Newtonian picture of the universe as a place, devoid of all human meaning, in which we happen to find ourselves. If people come to understand the emerging scientific cosmology, however, they may see from what we know of the early universe that we actually are part of an extraordinary adventure. With its mind-expanding imagery, this emerging cosmology gives us a new cosmic perspective, a powerful source of awe, and a potential source of meaning in our everyday lives.

We will present the cosmological theory first directly, and then as if it were a creation myth, which it is. But here we encounter the limitations of the English language for the task: the universe is like nothing else. It's not a thing that exists at any point in time but includes within it all time and all concepts. We will therefore turn to Kabbalah, medieval Jewish mysticism, as a possible source of language and metaphor, because certain kabbalistic concepts fit our picture amazingly well. Moreover, Kabbalah's cosmology gave meaning and purpose to the everyday lives of its adherents, which we hope may become possible with the scientific cosmology emerging today.

The Large-Scale Structure of the Universe

While Newton believed that stars are randomly distributed through space, we now know that stars are organized into galaxies, and distant galaxies are flying away from each other as space expands. About ten percent of galaxies are in dense clusters, with many clusters linked by sheets or fine filaments of galaxies. Our own Galaxy, the Milky Way, is located in a small group of galaxies on the outskirts of the large sheet of galaxies (the local supercluster) in which the Virgo Cluster is embedded. On the scale of hundreds of millions of light years, there are millions of these enormous superclusters of galaxies; between them are great voids containing hardly any visible matter. Furthermore, vast flows of galaxies have been observed as a perturbation to the overall expansion of the universe. This is what astronomers call the "large-scale structure" of the universe, and much of it has been discovered only in the past decade.

As the universe expands, our neighboring galaxies will remain our neighbors forever, but farther out the expansion of space is carrying galaxies away so fast that we see their light stretched and reddened. The greater distance of expanding space we look across to see any particular galaxy, the faster that galaxy will be moving away from us. At last there is a distance where galaxies are being carried away by expanding space at the speed of light. This is our cosmic horizon. It is a spherical wall, and we are inside. Countless galaxies no doubt exist beyond, but they are whisked away by expansion. Their light cannot reach us, so we cannot see them. Every galaxy has its own horizon, its own "visible universe."

But visible matter, on scales of individual galaxies and larger, does not move as it should if it is all that exists out there. Stars in galaxies, and galaxies themselves in groups and clusters, move too rapidly to be held together by the visible matter. Something invisible is exercising enormous gravitational effects on visible matter. After eliminating all other possibilities, astronomers have in the last fifteen years accepted the weird idea that over ninety percent of the mass of the universe is not stars, dust, gas or anything we know, but instead some invisible substance called "dark matter." Dark matter does not emit or absorb any kind of radiation. Most of it is probably not made of electrons, protons, neutrons, or any of the familiar elementary particles. It forms an invisible halo around every galaxy perhaps ten times the radius of the disk of visible stars, and around every cluster of galaxies.

What is the dark matter made of? How much of it is out there, and where? How does it behave? There have been several competing theories that managed for years to agree with all the reliable data, because the data were so rough and incomplete. But most theories are now being shot down by new astronomical data which is rapidly accumulating from telescopes all over the world and in space. This has drastically narrowed the range of possibilities. Accordingly, coauthor Joel Primack has modified the theory he pioneered and which set the agenda for much of cosmology for over a decade, called Cold Dark Matter1. He is currently developing a new version of the theory, called Cold Plus Hot Dark Matter. "Cold" dark matter is some kind of hypothetical particles which were moving slugglishly in the early universe. "Hot" dark matter, which was moving relativistically then, may be composed of two kinds of neutrinos--at least, that is what's suggested by the latest data from the particle physics laboratories. Each component of dark matter has its own characteristics, and each no doubt plays a crucial role in the history of the universe.

The Blueprint Came First

In 1929, Edwin Hubble discovered the expansion of the universe by showing that the more distant a galaxy is from us, the faster it is moving away. Astrophysicists ran the movie backward and realized that the universe had to have started out extremely hot and dense. The earliest point was named--derisively by astronomer and novelist Fred Hoyle, whose Steady State theory it eventually replaced--the Big Bang. Standard Big Bang theory explains the creation of the light elements of matter in the first three minutes and seems to be right as far as it goes, but it does not explain what preceded that or what has followed.

Gravity alone could not have created the complex large-scale structures and flows of galaxies that are observed to exist. Gravity magnifies differences--that is, if one region is ever so slightly denser than average, it will expand slightly more slowly and grow relatively denser than its surroundings, while regions with less than average density will become increasingly less dense. But if matter after the Big Bang was absolutely evenly distributed, gravity would have done nothing but slow down the overall expansion. Consequently, either some unknown force acting after the Big Bang formed the giant structures we observe today--which looks increasingly dubious--or else gravity must have had some differences in density to work with from the beginning. What could have caused these differences in density? Big Bang theory is silent about its own initial conditions.

The theory of Inflation, proposed in the early 1980s by Alan Guth and others, says that for an extremely small fraction of a second before the Big Bang--much less time than it would take light to cross the nucleus of an atom--the universe expanded exponentially, inflating countless random quantum events in the process. The density differences in the universe reflect these quantum events, enormously inflated. This is the best theory cosmologists have for the origin of the needed density differences.

Inflation is exponential growth--the longer it goes on, the faster it gets. An old story illustrates its blinding speed:

> A Sultan's life was saved by the Grand Vizier. Overwhelmed with gratitude, the Sultan asked him to choose his reward.
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> "You may give me a chessboard," said the Grand Vizier, "with one grain of wheat on the first square, two grains on the next square, four on the next, and so on. That would be enough."
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> "Such a modest gift for so great an act?" the Sultan exclaimed. "You shall have it today!"
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> But when the Sultan tried to prepare the chessboard, he discovered that the amount of wheat needed grew faster and faster. By the sixty-fourth square, he would need about ten billion metric tons--twenty years' worth of the modern world's production of wheat.

The quantum events of cosmic inflation created the needed small differences in density from place to place, leaving space slightly wrinkled (in three dimensions). The wrinkles are extraordinarily subtle, like a hill 600 feet high compared to the 21,000,000 foot radius of earth, yet gradually they attracted particles of matter by gravity alone. The large-scale structures in the universe today--the clusters and walls built of thousands of galaxies--illuminate these ancient wrinkles like glitter tossed on invisible lines of glue.

If the theory of Inflation is right, then the blueprint for the large-scale structure of the universe existed before the Big Bang created matter.

Can Inflation be Right?

The central predictions of the theory of Inflation are: 1) that the universe has critical density (i.e., contains just enough matter to keep slowing down the expansion, but not enough to cause the universe to stop or fall together in a Big Crunch) and 2) that the wrinkles, regardless of their wavelength, all have the same amplitude when they cross the horizon. (This is called a "Zel'dovich spectrum," after the great Russian physicist and cosmologist Yacov Borisovich Zel'dovich).

Arno Penzias and Robert Wilson discovered in 1965 that heat radiation from the Big Bang itself, called cosmic background radiation, still fills the universe. This was the first light in the universe. The radiation just reaching us now has been traveling since the universe first became transparent only about 300,000 years after the Big Bang. This primal radiation would have to bear some trace of the inflationary wrinkles that were theorized to have filled the universe at that time. If it did not, then the theory of Inflation had to be wrong, and the large-scale structure of the universe could not have formed by gravity alone. Numerous observations from earth's surface and from planes and balloons detected no irregularity in the cosmic background radiation. Except for the effects of earth's motion, the radiation appeared to be a perfectly uniform 2.7 degrees above absolute zero in every direction, until 1992.

In 1992 NASA's Cosmic Background Explorer satellite (COBE), orbiting outside earth's atmosphere, detected tiny differences in temperature in the background radiation. If Inflation is right, these differences are a lightly traced but readable fossil record of the period before the Big Bang--from which the Big Bang emerged. This is spectacular evidence of the existence of primordial wrinkles in space. What COBE found was the equivalent of lost baby pictures of immense cosmic structures, showing that they were not created whole but grew from these infants; and revealing as well, if read backwards, very intriguing implications about the babies' parentage.

The theory of Inflation thus appears to be supported by the COBE discoveries and subsequent measurements by many other instruments. If we assume, and there is increasing evidence we should, that the density of cold plus hot dark matter is critical and that there is a Zel'dovich spectrum of wrinkles, the resulting theory produces large-scale structure like that which we actually observe. Since alternative explanations are perhaps possible, this does not prove that Inflation plus our dark matter theory are actually right, although if the predictions led to structures unlike what we see, that would certainly prove at least one of these assumptions is wrong. There are also potential stumbling blocks, such as some preliminary results from Hubble Space Telescope suggesting (based on assumptions that may or may not be valid) that the universe may not be as old as some of the stars in our galaxy. But on balance the theory of Inflation is so beautiful and solves so many problems which initially appeared to be unrelated, it is hard to suppress the thought that it might actually be true.

While Inflation provides an explanation for the irregularities in the Big Bang, what about the origins of inflation itself? It turns out to be more fruitful to ask instead, why did inflation end? Because if we extrapolate backwards to find the origin of inflation, the most likely possibility is that in most of the superuniverse, inflation never stopped. It is a state of existence that goes on forever. The theory of Eternal Inflation, largely worked out by Russian astrophysicist Andre Linde, now at Stanford University, says that inflation stopped only in the minute part of the universe we can see--within our cosmic horizon--and some unknown distance beyond that. Everywhere else it continues forever.

What Does It All Mean?

The ideas that follow are a sort of theoretical theology, a spiritual analogue of theoretical physics. A theoretical physicist's methodology involves choosing a set of hypotheses and working out the consequences to see what kind of world they describe and how close it is to what experiment has found. Hypotheses can be eliminated as wrong but cannot be proved right. Coauthor Joel Primack and other cosmologists test theories by creating theoretical universes in supercomputers and then comparing them with observations of the real universe to see whether the predictions of any set of hypotheses can survive confrontation with the increasingly detailed data. Several fundamental truths about the origins and composition of the universe seem to be emerging from this process, although they are still controversial and they will be constantly tested as new data become available from the latest ground- and space-based telescopes. This is a logical game, but amazingly, sometimes the universe actually embodies a theorist's dreams. When this happens, it can have the force of a religious experience--at least for the theorist involved!

So let us suppose--in the style of theoretical physics--that the theories of Inflation and Eternal Inflation are correct and then think through some of the possible consequences for religion and culture.

To experience the human meaning of the scientific story, we must translate it into myth, the traditional form for stories about the origin of the world. In common parlance, "myth" has come to connote the opposite of reality, or the simplistic fare of the hopelessly backward or quaint. But myths, as they function in human societies, actually are explanations of the highest order: the stories a culture communally uses in order to connect with and give meaning to its universe. Every traditional culture known to anthropology has had a cosmology--a story of how the world began and how human beings took their place within it. A functional cosmology grounds people's everyday expectations of each other in the larger patterns of the universe. Such a shared cosmology may be essential to successful human community and even to individual sanity. The understanding doesn't have to be scientifically accurate. None ever has been, until now. No description is ever totally accurate anyway, unless it is the universe itself. The map is not the terrain. What we humanly need is to know the truest story of our time.

As Plato taught, the answer to the question "What does it all mean?" can only be a myth. Unlike other myths, however, a scientific myth never stands still. As long as the universe of knowledge expands, the myth must absorb, be tossed out by, or else be enfolded in larger understandings. No myth is for all time, but myth-making is an ongoing human pursuit.

A Myth of the Origin of the Universe

In a beginning there was--and almost everywhere else there still is--nothing but creativity: infinite potential, hot and dense, wildly experimenting with every possibility quantum uncertainty can come up with, expanding faster and faster for all eternity, unlimited by the speed of light or by lack of space. In this everlasting acceleration tiny events are expanding from every "sparkpoint," which is what we call the smallest physical region that quantum physics allows.

Imagine a cosmic Las Vegas, its real estate inflating forever, lights flashing, money rolling out of slots, gamblers multiplying blindingly fast, everything hot and dense. Every point is a gambler, every gambler is flipping coins, every flip is a quantum fluctuation. But in eternal inflation, the rules are as follows: Every time a coin comes up tails, it becomes half its size; every time it comes up heads, it’s suddenly twice its size and there are two of them. There are minute holes in the floor. The probability is extremely small that a coin will fall through, since the rules favor inflation. Most coins grow enormously. But once in a while a coin will get small enough to fall through the floor. At that instant, it exits eternity and the realm of those rules, and time begins for it. It will fall forever.

In a chain of events as inevitable sooner or later as a losing streak to a gambler, one sparkpoint got tails every time. Each throw was a random event. A single heads could have pulled the sparkpoint back and vastly increased the probability of another speedup until it merged forever in the cauldron of eternal inflation. But that did not happen. Tails continued. The gambler had started with a trillion dollars and had lost all but one dollar. It was still possible to win back the trillion. Then the last dollar was gone. There was no turning back. The sparkpoint exited eternity. Quantum events had taken it, like Alice, through an invisible looking-glass.

This was the seed of our universe: a single creative sparkpoint--an almost vanishingly small capsule of eternal creativity. This sparkpoint we name "Hokhmah," a kabbalistic term whose choice we will explain later.

Hokhmah had not lost its creative character, any more than a child changes its character upon leaving home. It was still inflating and emanating quantum fluctuations. But when it exited eternity, its inflating was destined to die out. Down the hill of potential energy Hokhmah now rolled, unable to regain eternal potential, compelled to express its finite potential now. Hokhmah had only the blaze-out we call inflation--possibly as little as 10-32 seconds--to create the blueprint for a cosmos. And it did so. The region that would become our present horizon inflated from the size of a thought to that of a grapefruit wildly faster than the speed of light. In the process it spawned all the quantum impulses that will continue to reverberate for hundreds of billions of years, creating the wrinkles that are becoming all the cosmic structures in the universe from galaxies to superclusters and larger.

Eternal inflation is endlessly creative and lavishly profligate. Every sparkpoint in eternal inflation has the possibility of becoming a Hokhmah. In detail, every universe will be unique because the quantum fluctuations during each one’s inflationary epoch will be completely different. Each universe is a tiny bubble cut off from all other bubbles by eternal inflation. No one knows if the laws of physics are the same in other bubbles, nor do we yet have any way of testing. We may be further than ever from answering the question Einstein said was the one that really interested him: "Did God have a choice?"

On the scale of the superuniverse of eternal inflation, time begins an infinite number of times. The opening words of Genesis might be better interpreted, "In A beginning..." Very, very deep inside our bubble, hemmed in by a horizon probably as minuscule compared to our bubble as a child’s sandbox is to the visible universe, is the rarest of phenomena: the evolution of our universe. In eternal inflation, nothing persists. When all possibilities exist, none is realized. Time can never decide what direction to run in. Every sparkpoint can create infinite possibilities, but though those fluctuations expand at the speed of light, all other sparkpoints are expanding away so much faster that they are forever out of causal contact with each other. Our universe is vanishingly small compared to the superuniverse of eternal inflation, but in it effects reverberate! It takes time to play out the great possibilities, time to grow, to become something. The great miracle of our universe is that something is happening. Galaxies are evolving. Life is evolving. We are not just eternal potential--we are a story.

If you play a drum, the skin vibrates in waves. If you could get very close to it and slow things down considerably, you would see the skin forming troughs and crests, not just one at a time but different waves in different directions across it, the troughs and crests adding to each other. The sum of all the waves makes the "sound." The wrinkles of inflation were the primal, cosmic sound whose meaning the universe is still expanding to express. This gives a physical picture of the origin akin to the phrase at the opening of the Gospel of John: "In the Beginning was the Word."

The idea that God followed a blueprint which existed before the universe was created is also found in Jewish Midrashic literature. Genesis Rabbah 1:1 says: "A ruler building a palace consults an architect's plans. The Blessed Holy One, in creating the universe, also worked from a plan--the Torah."

Hokhmah and Kabbalah

Kabbalah, medieval Jewish mysticism, is the only traditional cosmology we know of in which the universe was understood to have begun in a point and expanded. We are not kabbalists, nor are we trying to promote Kabbalah. We are not arguing that Kabbalah was prescient or somehow knew mystically what science is now discovering. We are interested in Kabbalah because it developed a set of ideas describing the origin of an expanding universe and integrated these ideas into its religious worldview. Can Kabbalah help us to integrate the scientific concepts we have been describing into our own culture?

"Kabbalah" means "secret tradition," and its origins are uncertain. Though its earliest preserved writings date from the twelfth century, from Provence and later Spain, its adherents believed it derived from the secret Torah given to Moses and handed down orally through the most religious Jews ever since.

The early kabbalists were Jews living at the time when Moslem culture was transmitting the philosophy and science of Plato and Aristotle to Europe. Utterly committed to the reality of the infinite and singular God, Jews began applying Greek reasoning to long-standing problems of their religion, especially the question of the nature of God. The kabbalists used every resource they had--not only reason and logic but poetry, meditation, and mystical experiences--to try to understand the nature of God. They believed that they could learn about God through contemplation of God's relationship to creation. For this reason, they strove to grasp the hidden reality behind the opening words of Genesis.

At that time Moses Maimonides, the Aristotle of Judaism, was teaching that God could only be truly described by negatives: unknowable, incorporeal, unlimited, unchangeable. How, the kabbalists asked, could God be beyond human description yet walk with Adam and Eve and talk with Abraham and Moses, as Torah reports? How, if God is infinite, could there have been room for anything else to be created? In answer to questions like these, the kabbalists developed a theoretical system portraying God pictorially as having ten different aspects--in Hebrew, sephirot--with complex relationships among all the aspects. Beyond the picture was Ein Sof, "Without End," the unknowable God, which emanated the light that created the aspects of God knowable to humans.

Of ten sephirot, the first three deal with creation, and they correspond fairly closely to concepts from Inflation and Eternal Inflation, although these theories are being developed by cosmologists in response to completely different questions. The first Sephirah was Keter, meaning the Crown, symbolic of the unknowable God's infinite potential to create--to enter into some relationship with our universe. The second was Hokhmah, the bursting through of our universe. The third was Binah, the female womb in which creation expands from Hokhmah to become what it becomes.

Keter might be a thought-provoking name for the state of eternal inflation, which, like Keter, is infinite, the source of all that will come, yet Nothing, because no differentiation can exist within it. Hokhmah is the exiting from eternity, the beginning of time, the instant with no instant before it. Binah is expansion or spacetime. There could probably be no more accurate name for the Big Bang as we understand it scientifically today than to call it

Hokhmah-Binah.

Kabbalah is an example of a cosmology resembling our own which successfully penetrated and enriched the lives of a society. In the sixteenth century, the great kabbalist Isaac Luria developed the scheme further, teaching that at the initial point, Hokhmah, God began to withdraw into self-exile in order to make space for the universe. God envelopes the universe, in the Lurianic view, but when God withdrew, evil became possible inside. God sent holy light into the world, but the world was too weak to hold God's glory. Its cornerstones were vessels that shattered in the light. The role of the Jews is to repair the shattered vessels by re-collecting the sparks of God in the world. Tzimtzum is the name of God's self-exile. Tikkun Olam is the repairing of the world. For Jews in the century or so after the expulsion from Spain in 1492, the concept of a God in exile gave cosmic meaning to their people's traumatic and seemingly endless history of expulsions and exiles. The cosmology alone, however, did not provide the meaning. It came from the circumstances of their lives and their era, but it was expressible at a deep and satisfying level with the help of their kabbalistic cosmological myth. Can the same become true with modern cosmology?

Kabbalah was a cultural outgrowth of medieval European Jewish experience. By the time of the European Enlightenment, Jews who read Descartes and Newton considered the idea of Sephirot as absurd as angels dancing on the head of a pin. But Kabbalah is a metaphorical description of a set of fundamental universal relationships which in light of modern astrophysics appears closer to reality than the infinite rectangular space of the Newtonian worldview.

We do not argue that either kabbalistic cosmology or current scientific theories about the origin are "true" in some ultimate sense, but rather that by seeing each in light of the other, we begin to get some sense of what to demand of any cosmology intended to function for human society in the twenty-first century. Just as light cannot be described accurately as either a particle or a wave but only as something beyond either metaphor, the universe cannot be adequately described as either something scientifically observed or something spiritually experienced. A functional cosmology must do both. The reason kabbalistic terms are helpful to our account is that they bind together the search for truth with the search for the divine. If terms such as Hokhmah did not already exist bearing religious significance, we would have had to try to coin them--which would probably have been as successful as Esperanto. The emerging scientific cosmology and Kabbalah are two metaphor systems whose juxtaposition points toward a truth larger than either can express alone.

Eternal Inflation, whether or not it turns out to be true, has opened a cosmic perspective on reality and the countless threads of connection, including the spiritual, weaving through. If Eternal Inflation eventually turns out to be wrong, whatever replaces it cannot explain less and will have to do better. A new standard has been set for creation stories.

If the theory of Eternal Inflation is correct, then there is an eternal blizzard of universes, in which our bubble is a single snowflake, an infinitesimal capsule of eternal potential, crystallized into unique patterns of matter and energy, which has set off from eternal inflation on its journey to realize itself in a universe. No one has thought of a way yet to test whether Eternal Inflation theory is right, but the expansion of perspective the theory requires certainly enlarges our idea of the physical universe. It may also enlarge our ideas of God, because regardless of how much reality one may ascribe to God, one can only speak metaphorically, and most metaphors are limited to the extremely narrow experience of earth. This does not make them wrong, but they are certainly limiting. Cosmology provides utterly different metaphors--eternal inflation, endless creation from every sparkpoint--that humans could not have dreamed up had theoretical physics not led them there. It seems to be a general rule that the more metaphor systems through which we try to understand non-human-scale realities, both large and small, the closer we come to truth.

Cosmology and Human Meaning in the Twenty-First Century

In a speech given in Philadelphia on July 4, 1994, on the state of the world and its prospects, Vaclav Havel said that the planet is in transition: as vastly different value systems collide, all consistent value systems are collapsing. We cannot foresee the results. Science, which has been the bedrock of industrial civilization for so long, he said, "fails to connect with the most intrinsic nature of reality, and with natural human experience. It is now more a source of disintegration and doubt than a source of integration and meaning... We may know immeasurably more about the universe than our ancestors did, and yet it increasingly seems they knew something more essential about it than we do, something that escapes us...Paradoxically, inspiration for the renewal of this lost integrity can once again be found in science...a science producing ideas that in a certain sense allow it to transcend its own limits... Transcendence is the only real alternative to extinction."

The search for scientific truth can be a form of guidance. It is as divine as any other. The foundation-building revolution that modern cosmology is undergoing today, as it seeks a verifiable description of the origin of the universe, requires that we transcend previous notions of space, time, and reality. This is the kind of science Havel is hoping for--a science whose metaphors may allow us to comprehend terrestrial problems from a cosmic perspective.

Exponential growth--like that of the wheat on successive squares of the Grand Vizier's chessboard--is the dominant characteristic of the industrial world. Not only is the human population inflating; simultaneously, so are the technological power and the resource use of each individual. Multiply these times each other: we are now processing a substantial fraction of the earth's entire crust. In population growth, resource use, pollution, and garbage production, the human race is addicted to exponential growth. Inflation is the controlling metaphor of our time.

In our kabbalistic creation myth, Tzimtzum--the withdrawal of God--occurred in Eternal Inflation. As the notion of a God in exile gave cosmic meaning to the lives of a people in exile, understanding cosmic inflation may give a new if sobering meaning to the lives of a people dependent upon inflationary growth. Inflation is a taste of what it is like to be God. It cannot be considered a normal human pace. In a finite environment, inflation cannot continue, however cleverly we may postpone or disguise the inevitable. This is a consequence of natural laws. That does not mean growth must stop, however, as many people genuinely trying to save the planet assume. The great transition model for the future of earth may be the universe. Inflation transformed to expansion can go on for a very long time. Expansion on earth can be sustained as long as our creativity lasts. Reality is not a zero-sum game, in which a gain one place must be paid for with a loss somewhere else. Creativity is what all tiny regions do in expressing their quantum nature. The stunning lesson of Eternal Inflation theory is that the fundamental nature of reality is not conservation of energy or increase in entropy but endless creativity.

The question for our time is, how can we end inflation gently on earth? How can we slow human inflation enough that creative restoration can overtake it? When we have developed a sustainable relationship with our planet, humanity and earth will be in balance, and the transition from inflation to stable expansion will have been achieved through the restoration of the world--Tikkun Olam.