

KABBALAH AND CONTEMPORARY COSMOLOGY: DISCOVERING THE RESONANCE

Daniel C. Matt, Ph.D.

Daniel C. Matt, Ph.D., one of the world's foremost authorities on Jewish mysticism, served as Professor of Jewish Spirituality at the Graduate Theological Union in Berkeley, California for more than twenty years. He received his Ph.D. from Brandeis University and has also taught at Stanford University and the Hebrew University in Jerusalem.

This article is based on Dr. Matt's book God and the Big Bang: Discovering Harmony between Science and Spirituality, published by Jewish Lights. Dr. Matt is also the author of The Essential Kabbalah and of the multi-volume annotated translation of the Zohar entitled The Zohar: Pritzker Edition. Reprinted with permission of the author.



In the beginning was the big bang, fourteen billion years ago. The primordial vacuum was devoid of matter, but not really empty – rather, in a state of minimum energy, pregnant with potential, teeming with virtual particles. Through a quantum fluctuation, a sort of bubble, in this vacuum, there emerged a hot, dense seed, smaller than a proton, yet containing all the mass and energy of our universe. In less than a trillionth of a second, this seed cooled and expanded wildly, faster than the speed of light, inflating into the size of a grapefruit. The expansion then slowed down, but it has never stopped.

In its first few seconds, the universe was an undifferentiated soup of matter and radiation. It took a few minutes for things to cool down enough for nuclei to form, and at least 300,000 years for atoms to form. For eons, clouds of gas expanded. Huge glimmering balls of hot gas formed into stars. Deep within these stars, nuclear reactions gave birth to elements such as carbon and iron. When the stars grew old, they exploded, spewing these elements into the universe. Eventually this matter was recycled into new solar systems. Our solar system is one example of this recycling, a

mix of matter produced by cycles of stars – stars forming and exploding. We along with everything else are literally made of stardust.

The Earth took shape and began cooling down about four and a half billion years ago. By about a billion years later, various microorganisms had developed. Exactly how, no one knows. We do know that earth's early atmosphere was composed of hydrogen, water vapor, carbon dioxide and simple gases such as ammonia and methane. In such a climate, organic compounds may have synthesized spontaneously.

Or perhaps life drifted to Earth in the form of spores from Mars or from another solar system in our galaxy or another galaxy in the universe. However life began, all its forms share similar genetic codes and can be traced back to a common ancestor. All living beings are cousins.

We humans like to think of ourselves as the pinnacle of creation, and it is true that we are the most complicated things in the universe. Our brain contains one hundred billion cells, linked by one hundred trillion synaptic connections. Yet we are part of the evolutionary process, descended from

bacteria who lived three-and-a-half billion years ago. In our mother's womb each of us retraces the entire developmental span from amoeba to human being. Our species – *Homo sapiens* – is a primate that developed in Africa, splitting away from the chimpanzee line about seven million years ago. We still share with the chimps 99 percent of our active genes. If you'll pardon the expression, we are an improved ape.

The big bang is a theory, not a fact. To cosmologists, it offers the most convincing explanation of the evolution of the universe, "the best approximation to truth that we currently possess." It may be proven wrong. More likely, it will eventually be enfolded within a larger theory. The scientific consensus is that the big bang theory is correct within its specific domain: the evolution of our universe from perhaps one-billionth of a second after its origins up to the present. Whatever happened before that first fraction of a second lies beyond the limits of the theory. The term "big bang" suggests a definite beginning a finite time ago, but the theory does not extend that far. The ultimate origin of the universe is still unfathomed.

One version of the theory, known as eternal inflation was developed by Andrei Linde. This version portrays a universe that, by continually reproducing itself, attains immortality. Our universe is just one of countless baby universes, one of countless inflating, self-reproducing balls or "bubbles." In each of these bubbles, the initial conditions differ and diverse kinds of elementary particles interact in unimagined ways. Perhaps, different laws of physics apply in each.

Not all the domains inflate into large bubbles, but those that do, like ours, dominate the volume of the universe and sprout other bubbles in a perpetual chain reaction. The entire universe is a tree of life, a cluster of bubbles attached to each other,

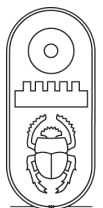
growing exponentially in time. Each baby universe is born in what can be considered a big bang – or should we say a little bang? – a fluctuation of the vacuum followed by inflation.

If Linde's speculations are correct, perhaps we should translate the opening words of Genesis not as "In *the* beginning..." but "In *a* beginning, God created heaven and earth." In fact, this represents a more literal rendering of the original Hebrew: *Be-Reshit*: "In a beginning."

Science has no consensus on the ultimate origin. Some theories espouse a well-defined beginning; others, like Stephen Hawking's, do not. But both suggest a radically new reading of Genesis. If God spoke the world into being, the divine language is energy; the alphabet, elementary particles; God's grammar, the laws of nature. Many scientists have sensed a spiritual dimension in the search for these laws. For Einstein, discerning the laws of nature was a way to discover how God thinks.

But does the universe have a purpose? Is there meaning to our existence? Why should we live ethically? Here, cosmology cannot help us very much. Darwin intensifies our problem. Are we different from other animals? Can we transcend violence and savagery? As the wife of an Anglican bishop remarked, upon hearing of Darwin's theory: "Descended from apes! My dear, let us hope that it is not true; but if it is, let us pray that it will not become generally known." Her comment echoes the fear that knowing the true nature of our ancestors threatens to unravel the social fabric.

We have lost our myth. A myth is a story, imagined or true, that helps us make our experience comprehensible by offering a construction of reality. It is a narrative that wrests order from chaos. We are not content to see events as unconnected, as



inexplicable. We crave to understand the underlying order in the world. A myth tells us why things are the way they are and where they came from. Such an account is not only comfortable, assuring and socially useful; it is essential. Without a myth, there is no meaning or purpose to life. There is just vast emptiness.

Myths do more than explain. They guide mental processes, conditioning how we think, even how we perceive. Myths come to life by serving as models for human behavior. On Friday evening, as my family begins *Shabbat* (the Sabbath), I sometimes imagine God, having created the world in one very packed week finally taking a break. According to the Bible, *Shavat va-yinnafash*, “God rested and was refreshed.” This mythical image enables me to pause, to slow down and appreciate creation. By observing *Shabbat*, I am imitating the divine. Order re-emerges out of the impending chaos of life.

What do we do when the myths of tradition have been undone, when the God of the Bible seems so unbelievable? Is there really someone “up there” in control, charting the course of history, reaching down to rescue those in need, tallying up our good and bad deeds for reward and punishment? Many people have shed the security of traditional belief; they are more likely to experience a gaping, aching void than the satisfying fullness of God’s presence. If they believe in anything, perhaps it’s science and technology. And what does science provide in exchange for this belief? Progress in every field except for one: the ultimate meaning of life. Some scientists insist that there is no meaning. As one leading physicist has written, “The more we know about the universe, the more it is evident that it is pointless and meaningless.”

The big bang is a contemporary Creation story. Energy turns into matter, which turns back into energy. There is no

precise plan for creation, worked out in advance. By an intricate and unrepeatable combination of chance and necessity, humanity has evolved from and alongside countless other forms of life over billions of years. Ultimately, our evolutionary history is uplifting: It enables us to see that we are part of a wholeness, a oneness.

To be “religious” means, in the words of a contemporary physicist, to have an intuitive feeling of the unity of the cosmos. This oneness is grounded in scientific fact: We are made of the same stuff as all of creation. Everything that is, was, or will be started off together as one infinitesimal point: the cosmic seed.

Life has since branched out, but this should not blind us to its underlying unity. The deepest marvel is the unity *in* diversity, the vast array of material manifestations of energy. Becoming aware of the multifaceted unity can help us learn how to live in harmony with other human beings and with all beings, with all our fellow transformations of energy and matter.

If the big bang is our new creation myth, the story that explains how the universe began, then who is God? “God” is a name we give to the oneness of it all.

How can you name oneness? How can you name the unnamable? The Jewish mystical tradition, the Kabbalah, offers a number of possibilities. One is *Ein Sof*, literally: “there is no end.” *Ein Sof* is the Infinite, or, to borrow a phrase from the Christian mystic Meister Eckhart, the God beyond God.

Sometimes the kabbalists use a more radical name than *Ein Sof*. This is the name *ayin* – nothingness. We encounter this bizarre term among Christian mystics as well: John Scotus Erigena calls God *nihil*; Eckhart, *nihts*; St. John of the Cross, *nada*. To call God “Nothingness” does not mean that God does not exist. Rather, it conveys the idea that God is no thing. God animates

all things and cannot be contained by any of them. God is the oneness that is no particular thing, no thingness.

This mystical nothingness is neither empty nor barren; it is fertile and overflowing, engendering the myriad forms of life. The mystics teach that the universe emanated from divine nothingness. Similarly, as we have seen, cosmologists speak of the quantum vacuum, teeming with potential, engendering the cosmic seed. This vacuum is anything but empty—a seething froth of virtual particles, constantly appearing and disappearing.

How did the universe emerge out of prolific nothingness? According to Kabbalah and classical big bang theory, this transition was marked by a single point.

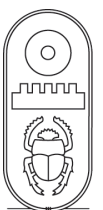
Physicists call this point a singularity: an infinitely dense point in spacetime. A singularity is both destructive and creative. Anything falling into a singularity merges with it, losing its identity, while energy emerging from a singularity can become anything. The laws of physics do not apply to the split second in which energy or mass emerges.

According to the thirteenth-century kabbalist, Moses de Leon,

The beginning of existence is the secret concealed point. This is the beginning of all the hidden things, which spread out from there and emanate, according to their species. From a single point you can extend the dimensions of all things.



Visible View of Pillar and Jets HH 901/902. NASA, ESA, and M. Livio and the Hubble 20th Anniversary Team (STScI).



As emanation proceeds, as God begins to unfold, the point expands into a circle. Similarly, ever since the big bang, our universe has been expanding. We know this thanks to the astronomer Edwin Hubble, who measured the speed at which other galaxies are moving away from us. In 1929 Hubble determined that the farther a galaxy is from us, the faster it is moving away. The universe is expanding in all directions. It's not that the universe is expanding *within* space. Space itself is expanding.

The most dramatic consequence of Hubble's discovery is what it tells us about the origin of our universe. Just play the Hubble tape in reverse: If the universe is now expanding, that means it was once much smaller. How small? According to classical big bang theory, if we go back far enough in spacetime and retrace the paths of the galaxies and their formation, the entire mass-energy of the universe contracts into the size of a singularity – the

infinitesimal point from which the cosmos flashed into existence.

One kabbalist, Shim'on Lavi, understands expansion as part of the rhythm of creation:

With the appearance of the light, the universe expanded.

With the concealment of the light, the things that exist were created in all their variety.

This is the mystery of the act of Creation.

One who understands will understand.

When light flashed forth, time and space began. But the early universe was an undifferentiated soup of energy and matter. How did matter emerge from the stew? The mystic writes that the light was concealed. A scientist would say that energy congealed. Matter is frozen energy. No nucleus or atom could form until some



Hubble's Largest Galaxy Portrait Offers a New High-Definition View. NASA, ESA, K. Kuntz (JHU), F. Bresolin (University of Hawaii), J. Trauger (Jet Propulsion Lab), J. Mould (NOAO), Y.-H. Chu (University of Illinois, Urbana), and STScI.

energy cooled down enough that it could be bound and bundled into stable particles of matter.

Einstein discovered the equivalence of mass and energy. Ultimately, matter is not distinct from energy, but simply energy that has temporarily assumed a particular pattern. Matter is energy in a tangible form; both are different states of a single continuum, different names for two forms of the same thing.

Like the physicist, the mystic, too, is fascinated by the intimate relation of matter and energy, though the mystical description is composed in a different key. Material existence emerges out of *ayin*, the pool of divine energy. Ultimately, the world is not other than God, for this divine energy is concealed within all forms of being. Were it not concealed, there could be no individual existence; everything would dissolve back into oneness, or nothingness.

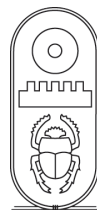
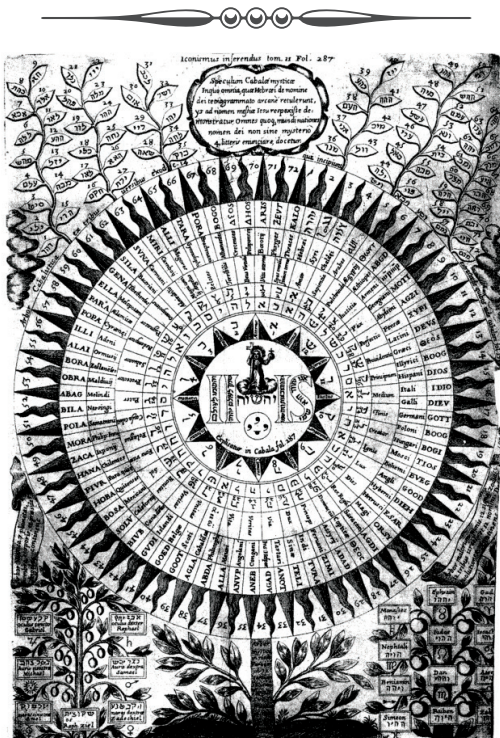
Around the middle of the sixteenth century in the mountaintop city of Safed

in Galilee, the most famous kabbalist who ever lived – Isaac Luria – pondered creation and asked himself, “What came before?” He believed there was only *Ein Sof*, God as infinity. But if *Ein Sof* pervaded all space, how could there be room for anything other than God? Luria concluded that the first act of creation was not emanation, but withdrawal: “Before the creation of the universe, *Ein Sof* withdrew itself into its essence, from itself to itself within itself. Within its essence, it left an empty space, in which it could emanate and create.”

This is *tsimtsum*, which literally means “contraction,” but here suggests withdrawal, a withdrawal by which God made room for something other than God. The primordial void carved out by *tsimtsum* became the site of creation: no larger than an infinitesimal point in relation to *Ein Sof*, yet spacious enough to house the cosmos. But the void was not really empty: It retained a trace, a residue of the light of *Ein Sof*, just as the vacuum preceding the big bang was not completely empty, but rather in a state of minimum energy: pregnant with creative potential and virtual particles.

As *Ein Sof* began to unfold, a ray of light was channeled into the void through vessels. Everything went smoothly at first, but some of the vessels, less translucent, could not withstand the power of the light. They shattered. Most of the light returned to its infinite source, “to the mother’s womb.” But the rest, falling as sparks along with shards of the shattered vessels, was eventually trapped in material existence. Our task, according to Kabbalah, is to liberate these sparks of light and restore them to divinity. By living ethically and spiritually, we raise the sparks and thereby bring about *tikkun*, the “repair” or mending of the cosmos.

If the vessels had not broken, our world of multiplicity would not exist. We exist because we have lost oneness.



Modern cosmology has a theory that parallels the breaking of the vessels: the theory of broken symmetry.

Symmetry can be unstable. Picture yourself at an elegant wedding dinner, sitting with a dozen other guests around a circular table. Champagne glasses have been placed precisely between each dinner plate and the next: perfect right-left symmetry. A waiter fills the glasses with champagne and everyone sits, waiting for someone else to lift a glass. You're a little thirsty and, realizing that the pink bubbles will not last forever, you decide to take a sip. But which champagne glass should you pick? Not fully versed in the rules of etiquette, you could as easily choose the glass to your left as the one to your right. Either way, as soon as you reach for one or the other, the symmetry is broken. Unless everyone else does what you do, someone will have to reach across the table to get a glass.

Let's take a more mundane example. Imagine that you're holding a handful of sharpened pencils, just snug enough that they stand on their points. Now let go. For a moment, the pencils remain balanced and rotationally symmetrical. Looking down from above, you see a perfect circle of pencil erasers. But the symmetry is quickly broken, as the pencils fall into a tangle of thick pickup sticks.

The pencils are a metaphor for the universe. The jumble of fallen pencils is the universe today, while the symmetrical bundle is the universe in its original state. One of the challenges of science is to discover the symmetry hidden within the tangle of ordinary life.

The universe began in an extremely hot state of utmost simplicity and symmetry. As it expands and cools, this perfect symmetry is broken, giving rise to the world of diversity and structure we inhabit.

To us today, the fundamental forces of nature appear distinct: gravity, electromagnetism and two other forces known as the strong and weak nuclear forces. The balance between these forces determines the existence and behavior of everything in the visible universe. Originally all four forces were linked, and today scientists dream of finding a single set of equations describing all four. By colliding subatomic particles, physicists have discovered that at extremely high temperatures the differences between the forces begin to disappear.

One more act of imagination. Imagine yourself journeying back in time, closer and closer to the moment of the big bang. The further you go, the hotter and denser the universe becomes, and broken symmetries are restored. You go back millions and billions of years. Finally you reach the tiniest fraction of time a physicist can imagine: 10^{-43} second after the big bang, a ten-millionth of a trillionth of a trillionth of a trillionth of a second after the beginning. Earlier than this is hard to probe, because the density of matter becomes so great that the structure, and perhaps the meaning, of space and time break down. At this point, all interactions between the fundamental forces are indistinguishable. Perfect symmetry.

How did the symmetry of the beginning become so disguised over the course of time? As the universe expands and starts to cool, its radiation and particles lose energy. The various forces become distinct.

Meanwhile, matter is also losing its oneness. By the time the universe is just one billionth of a second old, there are four forces and two dozen kinds of elementary particles. This fracturing of symmetry creates the particles of matter and energy found today around us – and within us.

Perfect symmetry sounds alluring, but it is sterile. If the primal force had not broken



Shevirat haKeilim – Shattering of the Vessels. Original oil painting by Victoria Franck Wetsch, SRC.

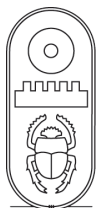
into four forces, the universe would be a very different place, if it existed at all. Tiny deviations from complete uniformity now give rise to nuclei, atoms and molecules; then galaxies, stars, planets and people. We exist today in our present condition, with all our flaws and imperfections, because of broken symmetry, just as Kabbalah teaches that our jumbled, blemished reality derives from the breaking of the vessels.

Broken symmetry and the breaking of the vessels are distinct theories, each generated by a different approach to the question of the origin of the universe: Yet, their resonance is intriguing. The human mind has devised alternative strategies – scientific and spiritual – to search for our origin. The two are distinct, but complementary. Science enables us to probe infinitesimal particles of matter and unimaginable depths of outer space, understanding each in light of the other, as we grope our way back toward the beginning. Spirituality guides us through

inner space, challenging us to retrace our path to oneness and to live in the light of what we discover.

As we have seen, the Jewish mystics picture divine sparks in every thing that exists. A scientist would say there is energy latent in subatomic particles. The spiritual task is to raise the sparks, to restore the world to God, to become aware that every single thing we do or see or touch or imagine is part of the oneness, a pattern of energy. Raising the sparks is a powerful metaphor; it transforms religion from a list of dos and don'ts or a list of dogmas into spiritual adventure.

God is not some separate being up there. She is right here, in the bark of a tree, in a friend's voice, in a stranger's eye. The world is teeming with God. Since God is *in* everything, you can serve God *through* everything. In looking for the divine spark, we discover that what is ordinary is spectacular. The holy deed is doing what needs to be done now.



The world is fractured, and God needs us to mend it. By mending the world – socially, economically, politically – we mend God, whose sparks lie scattered everywhere.

But we shouldn't fool ourselves. There will never be a complete *tikkun*, a complete mending of the world. Things will never be perfect. Society will never be completely just. How will it all end? Is there a Messiah coming to redeem us? Messiahs captivate our imagination because the world is so unfair, history is so fickle. When the Messiah comes, we are told, everything will be set right: good will finally triumph and evil will be eliminated. That would be nice, but is it the way things work?

What is the long-range future of our planet, according to science? Here's the forecast:

Our sun is about five billion years old – middle aged and reliable. But five billion years from now, the hydrogen fuel in the sun's core will run out. The core will sag while the atmosphere of the sun will mushroom, engulfing several of its closest planets, probably including Earth. Gradually, most of this atmosphere will fall away, leaving a hot, dense ball of inert matter.

Life will not necessarily come to an end. By then, human beings, or whatever type of intelligent life evolves from us, will have developed the technology to move to another, safer solar system.

Meanwhile, here we are. We still have quite a while until the year 5 billion. There will be no final perfection. No one has arranged the future ahead of time; nothing is preordained. Chance will play a leading role in the way things unfold, as it always has. We should learn to negotiate with chance. We should work on mending our own brokenness, our social fabric, our planet as best we can.

What kind of God can we believe in? The Hebrew word *emunah*, "belief," originally meant trust and faithfulness,

both human and divine. Without trusting another person, we cannot love; without trusting others, we cannot build and sustain community. But how can we trust the cosmos, or this God of oneness?

We can trust that we are part of something greater: a vast web of existence constantly expanding and evolving. When we gaze at the nighttime sky, we can ponder that we are made of elements forged within stars, out of particles born in the big bang. We can sense that we are looking back home. The further we gaze into space, the further we see back into time. If we see a galaxy ten million light years away, we are seeing that galaxy as it was ten million years ago: it has taken that long for its ancient light to arrive here. Beyond any star we will ever identify, beyond any quasar, lies the horizon of spacetime, fourteen billion light years away. But neither God nor the big bang is that far away. The big bang didn't happen somewhere out there, outside of us. Rather, we began *inside* the big bang; we now embody its primordial energy. The big bang has never stopped.

And what about God? God is not an object or a fixed destination. There is no definite way to reach God. But then again, you don't need to reach something that's everywhere. God is not somewhere else, hidden from us. God is right here, hidden from us. We are enslaved by routines. Rushing from event to event, from one chore to another, we rarely let ourselves pause and notice the splendor right in front of us. Our sense of wonder has shriveled, victimized by our pace of life.

How, then, can we find God? A clue is provided by one of the many names of *Shekhinah*, the feminine aspect of God, the divine presence. In Kabbalah She is called ocean, well, garden, apple orchard. She is also called *zot*, which means simply "this." God is right here, in this very moment, fresh and unexpected, taking you by surprise. God is *this*.

IF A PHILOSOPHER YOU WISH TO BE,
 Where on this globe lives a man so wise,
 Who'll ever learn what four ones do comprise,
 And even if he'd know all this,
 He'd still always be an apprentice.
 Therefore, O human, with all thy might,
 Recognise God and thyself in God's and nature's light,
 Both these lights God pours into thee,
 That a likeness of him thou mayest be,
 He is one fourfold God, let thou be told,
 As thou art a piece of clay fourfold.
 This maketh nature to thee well known,
 With wisdom, light and understanding to thee is it shown.

LET ONLY PATIENCE DWELL IN THEE.
 To nothing can thine eye be blind,
 Be it of body or of mind.
 Therefore be thankful to thy God,
 Who in time this before thee hast brought.
 Be thou not jealous of the scoffer's fame,
 Do not begrudge every mocker's great name.
 With sophisticated vanity they strut,
 Unbeknownst to them is what thou'st got.
 Be happy with what God to thee gave,
 Defy, that four in one they have.
 Fiat and Amen, be my treasure,
 A fourfold sphere always together.

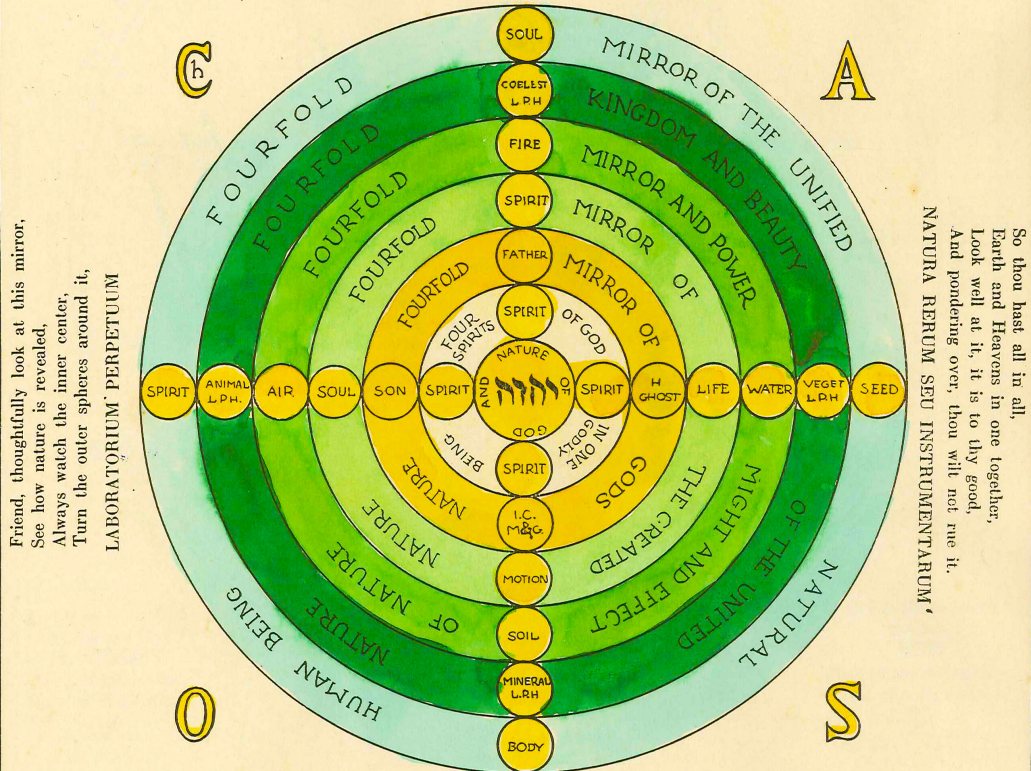
O DOMINE QUAM MIRABILIA SUNT OPERA TUA.

Lord, thine eternal Spirit is in all Things.
Salvator ♂ Mundi

Four fires are floating in this world,
 Wherein God holdeth a Center,

That is locked up in four,
 Out of which Heaven and Earth were poured.

SPECULUM DIVINUM OCCULTUM ATOUE



IGNEM PHILOSOPHORUM ET

Notice Nature in its strength,
 Look at its great life-power.

From God it, and all things spring,
 And return to their centers again.

Coel. & ♂ Terra.

There is never a Philosopher who Nature's ultimate Principle doth not know.

Look well for the golden Magnet. If thou findest it thou wouldst get rid of thy sorrows.
 Study well the law KNOW THYSELF, that thou may not be deceived any more.
 Unum sunt omnia, per quod omnia.
 Make known to thee the Terra Sancta, so that thou mayest not go astray.

Salvator Mundi. From the Secret Symbols of the Rosicrucians of the 16th and 17th Centuries, hand colored by H. Spencer Lewis.

