Immaterial Miracles

The Cosmos of the Supersized Surprise

By

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There is a massive mystery hiding in science. A mystery called emergent properties. And because of the mystery of one of the most important of those emergent properties—you. Your identity. And how it has managed to sustain itself despite the fact that you’ve gone from a baby to a toddler to a child to a teenager, to a young adult, with middle age and old age in your future somewhere. Despite all of your physical properties changing dramatically—from your height and weight to your brainpower and your athletic abilities—the 80 trillion constantly changing cells of you have managed to pull off the illusion of being just one person, just one special person, with the name you go by. So which is really real, your constantly changing mass of cells and your steadily shifting physical properties or your identity, your you?

Aristotle said in his Metaphysics that to understand things, you need to break things down to their components, their elements. Then you must find the laws of those elements. You must find what we’ve called elementary laws. From those laws, said Aristotle, you will understand everything you need to know. For the last 350 years, science has followed Aristotle’s program—breaking things down to their elements, then probing those elements’ laws. We call the Aristotelian approach reductionism. And 350 years of reductionist science has produced some startling results. But it has never lived up to Aristotle’s promise. Why? Because of emergent properties. The properties that make 80 trillion constantly changing cells into you.

Let’s test Aristotle’s notion that by breaking things down to their elements and finding the laws of those elements, you understand everything you need to know. Imagine that you understand every nuance of the behavior of quarks. Then let a gaggle of quarks loose in your physics lab. What will they do? Quarks are profoundly social. And quarks are profoundly communicative. The quarks will immediately feel out who to gang up with and who to avoid. We call this attraction and repulsion. They will gather together in tight groups of three. Now according to Aristotle, if you understand the laws of the elements, you understand everything. Right? So if you understand the behavior of quarks, you should understand the behavior of quark threesomes. Just three times as much quarkdom, right? Three times as much quarkiness.

But that’s wrong. These quark threesomes produce supersized surprises, material miracles, startlingly new properties, properties you can’t possibly predict from quarkness. We call the properties of one of these threesomes a proton. We call the properties of the other quark trio a neutron. And there’s no way of predicting protons or neutrons from quarkness. Aristotle was wrong. And something crucial is missing from reductionism, the mystery of emergent properties. The mystery that makes the magic of a you.

So here is my best formulation of this mystery, a modification of my bookstore speech on The God Problem: How a Godless Cosmos Creates.

First, a joke. About God.

A couple had two boys, eight and 10, who behaved like children of the Omen. They stole anything that wasn’t nailed down. They lit fires in garages. And they tortured cats. When their mom and dad couldn’t take it anymore, the exasperated parents looked for a specialist in taming impossible kids and found a nun with a PhD in special education, a disciplinarian whose tough love methods were renowned from coast to coast for their powers to tame outrageous tykes.

The nun insisted on meeting with the kids one at a time. First she sat the ten year old down in the family’s empty living room. With her steel ruler in her hand, she started with an easy question, “Where is God, my son.”

The ten year old said nothing. So she tapped her palm lightly with the ruler and tried again. This time more firmly, “Where is God, my son.” Still no answer. And by now the boy was wriggling in his seat.

So the nun gave it her all. She slapped her palm with the steel ruler menacingly and brought out all the controlled ferocity that had disciplined impossible children from the South Bronx to Compton, California. “Where,” she said with contained fury, “is God?” This time the ten year old bolted from the room and hid in a closet.

Two minutes later the eight year old slipped into the closet to find out what was happening. Said the ten year old, trembling and on the verge of tears, “We’re in big trouble this time. God is missing, and they think we did it.”

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Now for a little mashup of material from The God Problem: How A Godless Cosmos Creates.

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Picture this. You and I are seated at a café table in the nothingness before the big bang. You are a wildly imaginative visionary and I am a hard-nosed, gotta-see-it-to-believe it conservative. You have extraordinary visions, and I am a stick-in-the-mud, a crust of toast committed to logic and to common sense. You and I have nothing better to do, so we’ve been sitting here at our outdoor table sipping one espresso after another and piling up empty coffee cups by the thousands ever since the nothingness began. You should see the size of our tab.

But here’s the point. Absolutely nothing is happening, right? Why? Because there is nothing, no thing, no action, no space, no time, no form, no substance, no shadow, no sunshine, no sticks, no stones, no bones, not a single solitary thing. And there never has been.

Suddenly you perk up. You have a nutty vision, an insane daydream. You point to a spot in the blackness a few feet away from our table. And you tell me that if I watch very carefully, I will see a pinprick infinitely smaller than a pinprick smash from the nothingness, then expand at superspeed. Blowing up like a hyperkinetic balloon. Sneezing forth like an expanding handkerchief. A speed-rush sheet on steroids, a manifold, of raw space and time.

The boredom must have gotten to you, I tell you. What you’re claiming is loony. And it defies the laws of logic. I’ve been sitting here across the table from you forever. I’ve kept my eyes peeled. And there has never been a pinprick of any kind. What’s more, this wacky stuff you call space and time has never existed either. Nor will it ever exist. Why? Because nothing comes from nothing. Zero plus zero equals zero. The idea that this basic fact could ever change is ridiculous. And it defies the first law of thermodynamics, the law of the conservation of matter and energy, a law so basic that every respectable twenty-first-century scientist will someday declare it thoroughly and completely right.

While I, in exasperation, am trying to get simple logic across to you, wham, a pinprick infinitely smaller than a pinprick suddenly shows its head. It’s what physicists like Stephen Hawking and Roger Penrose will someday call a singularity. I am stunned. This simply does not make sense. But you stay cool and act as if nothing is happening. Meanwhile, that pinprick blows up so fast that it makes me dizzy. And sure enough, it has three properties that have never existed before. Three properties that, if common sense prevailed, should not exist. Those properties are time, space, and speed—time, space, and energy. How in the nonexistent world did the nothingness pull this off?

The pinprick keeps whooshing outward like the rubber sheet of a trampoline on a growth binge, unfurling as a superspeed space-time manifold. I am stunned. What the heck is space? What in the world is time? And what is powering all this speed? Who in the world invented these peculiar things? And if they weren’t invented, how the hell did the utter emptiness burp them out?

While I’m sitting here with my jaw dropping, you are as cool as a scoop of gelato in a block of ice. Finally you open your mouth again. And you make another of your wacky predictions. That unfurling sheet, that giant sail of space and time, you say, is about to produce something called “things.” And those things are going to precipitate from the sheet of space, time, and speed the way that raindrops precipitate from a storm cloud.

Now I know you’ve lost it. You got me with your prediction about the pinprick. But that was beginner’s luck—and dumb luck of that kind doesn’t strike twice. Now listen to me very carefully, I tell you. There is no such thing as “things.” There have never been things. And there never will be things. That’s why this place we’re sitting in is called the nothing. The no thing. Get it? That sheet that’s speeding open a few feet away from us has only three properties: space, time, and energy. And those are wacked-out enough all on their own. Let’s get logical. Everyone knows that one plus one equals two. Garbage in, garbage out. Add space, time, and speed and what do you get? You get space, time, and speed—period!

Then, far less than a second into the existence of your blasted space-time-speed manifold, there comes a rain, a hail storm, a blizzard. Of what? Of things. Gazillions of them. Roughly 1087, 10with 87 zeros after it, to be a bit more precise. What are they? They’re elementary particles—quarks and leptons. All popping simultaneously from a mere whoosh. And it makes no sense. In fact, it is impossible. So why in the world have you been right twice? And why is my down-to-earth logic, my sturdy and sober rationality, my clear and sensible thinking, all wrong?

The God Problem: How A Godless Cosmos Creates is a detective story. It’s a hunt for the answer to that question—how in heck does the cosmos create. If there is no god saying let there be light, how did light come to be? If there is no god parting the heavens and the seas, how did a mere lifeless universe cough up oceans and skies?

How did the cosmos herself become a heretic. How did she become the real breaker of the man-made rules of reason. How did this peculiar rule-breaking cosmos that you and I have been watching from our café table at the beginning of the universe churn out galaxies, stars, molecules, cells, and DNA. Not to mention thinkers, talkers, lollypops, common sense, croissants, cannibals, café tables, and you and me?

How does the cosmos create?

That’s not just any question, it is THE question.

It is the God Problem.

Let’s get back to the mystery of your identity. It’s a puzzle hidden in plain sight, hidden in one of science’s favorite fixations, the wave. Imagine that you and the woman or man of your dreams are flying back to the United States after a quick and totally self-indulgent weekend in London. You have a window seat on the right hand side of the plane. It’s midday. You look out the window of the plane at the Atlantic Ocean below you. What do you see? Waves. If you want, you can lock your eyes on just one wave and follow it for minutes. It has a distinct identity. It trails off to the north as far as your eye can see. And its hump seems as well formed as the back of a whale.

Remember when you were a kid and rolled a ball of clay out on a tabletop until it made a long, round clay rope? That’s what the wave looks like. But the wave has a peculiar property. Very peculiar. It doesn’t exist.

What? Of course the wave exists. If you were in a lazily moving blimp you could follow it for a thousand miles. You could follow it from the mid-Atlantic for days until it broke on the rocks off the shore of Maine. If you were in the water with a surfboard as the wave approached the shore, you could ride its hump. And if you carefully picked your way over the slippery rocks of a jetty off the Maine coast to the jetty’s farthest tip and you tripped or slipped while a breaker was smashing its fist against the granite, your body would register the wave’s power. The wave, in fact, would roll, mash, mangle, and kill you by merely rearing to a frothy peak and hammering you on the stone. As the survivors of the tidal waves, the tsunamis, that killed 230,000 people in Indonesia in 2004 and that killed 16,000 in Fukushima in 2011 could tell you. That’s real. Isn’t it? Very real!

Well, yes and no. Imagine that you are a molecule of water in the middle of the Atlantic Ocean. You follow what complexity specialists call “local rules.” You do what your neighbors hint that you should do. And what, pray tell, is that? You move in a circle that’s anywhere from three feet to 160 feet in radius. Three feet to 160 feet high. First you circle up to the surface. Then you circle back to the depths. You don’t go anywhere. You just keep making the same circular movement over and over again. You iterate. You repeat a simple rule. You rock and roll in place.

But there’s more. When you circle to the surface, you help make the peak of a wave. When you circle to the bottom, you help make that wave’s trough. The next time you circle to the surface you help make the peak of yet another wave. Yes, another wave. A wave with yet another distinct identity. A wave that will retain that identity for hundreds or thousands of miles. A wave that will do a heck of a lot of traveling. But do you ever travel? No. No thing travels to make the wave.

Like one of the cells in your liver, you—a water molecule in the middle of the Atlantic--are part of an architecture too big for you to see.

Now look at it from the wave’s point of view. You are a wave. What are your corpuscles, your particles, your atoms of being? They change every minute. You are nothing. You are no thing. Your equivalent of cells—your molecules of H2O—are never the same for more than sixty seconds. Bear with me while I repeat: no thing travels the 880 miles from the middle of the Atlantic to the coast of Maine. No thing at all.

Yet you, a wave, continue to be yourself. And you travel. But how? The matter that makes you up is constantly changing. From minute to minute, you reassemble yourself with new ingredients, with new water molecules. You are not a crew of unchanging particles. You are not a pyramid with an unchanging collection of stones. You are not an engine with an unchanging team of parts. You are a shape with power over substance. You are a pattern that retains its identity despite moving from one temporary team of draftees to another. You are something impossible: a shape without substance. You are, in fact, a seducer, a kidnapper, and a recruiter. You are a process. You are a form of organization passing over the landscape like a breeze. You are what my book The God Problem calls a recruitment strategy.

What in the world is a recruitment strategy? A recruitment strategy is a process that keeps its shape second by second by second. A recruitment strategy is a pattern that imposes its identity insistently even if the matter flowing through it is constantly changing. A recruitment strategy is a pattern that makes matter and energy do a strictly patterned dance. A social dance. Remember Heraclitus, the Greek philosopher who said you can never put your foot into the same river twice? Heraclitus meant that when you dip your toe into the water the first time, you feel the flow of water around it. But if you dip your toe in again one second later, the water that has flowed around your toe the first time is already five feet downstream. And the water in contact with your toe on dip number two is water that was upstream just a second ago. Come back two months or two years later, and the water you saw in the river on your first visit has disappeared entirely and been replaced by all-new water. But something called the river is still there. And, strangely, it looks the same. As if nothing has changed. Heraclitus’s ever-changing river is a recruitment strategy. The whorl in a trout stream is a recruitment strategy. And Theseus’s ship is a recruitment strategy. What in the world is Theseus’ ship? It’s a philosophical brain-teaser that goes all the way back to the Greek historian Plutarch, who wrote up a version of it in roughly 100 AD.

Imagine that you are an ancient Greek ship captain. You plan a one-year voyage from the port of Piraeus near Athens to get rare and expensive commodities like copper, tin, and silver from the Spanish colony of Empúries roughly 1,164 miles away. Because the voyage from Greece to Spain will be long, you take lumber to replace any planks of your ship that become worm-eaten or waterlogged. And you budget enough coins to pay for more lumber along the way. You have been at sea for a month when, in fact, some planks become water sogged. So you replace them. Then you put the waterlogged planks on the deck in the sun to dry out. When they are nice and dry and toasty, you cover them with pitch to waterproof them. And when you have enough of these recycled planks, you begin to build a second ship. By the time you’ve been gone a year, you are no longer traveling with just one ship. You are traveling with two. The first ship is the one whose planks you’ve been replacing. And by now, you’ve replaced every single plank. Ship two, the empty ship you’re towing behind you, is built from the planks that you’ve dried out and recycled.

Now here’s the puzzle. When the two ships return to their home port, which ship is the original? Which is the ship you set sail in? Remember, the empty ship that you’re towing is really the old ship in disguise. It has every single worn-down board and plank of the original. And the ship your crew is hunkered down in has all new planks. It’s new from stem to stern. Yet your crew has never stopped sailing in it, sleeping in it, and eating in it. So is the ship with all new parts the original? Or is the original the ship you are towing on a rope behind you? Which ship is the real deal?

Theseus’ ship, like a wave, is a recruitment strategy. So is the **puzzle** of Theseus ship. In fact, the puzzle of Theseus’ ship is a recruitment strategy that’s been seducing, recruiting, and kidnapping minds for 1,900 years.

Recruitment strategies are everywhere you look. An atom is a recruitment strategy. A galaxy is a recruitment strategy. A star is a recruitment strategy. An atom imposes its spherical pattern of a nucleus and shells within shells on protons, neutrons, and fast-moving electrons. And it does it gazillions of times in gazillions of different locations. In very much the same way. What’s more, it somehow manages to do the same thing wherever you look despite the fact that it is not communicating with others of its kind to make sure they are all dancing to the same choreography. Then there’s a galaxy. A galaxy inflicts its potato-shaped ellipse and often its spiral arms on ten billion stars or more. What’s more, a galaxy imposes its pattern on masses of matter wherever you look in the sky. In fact, the recruitment strategy of a galaxy has imposed its pattern over 125 billion times in this universe. Why?

Meanwhile, a star forces its ball-like shape and its fiery way of crushing atoms on octillions of tons of matter. It does it over and over and over again in thousands of billions of separate locations. Simultaneously. Without communicating with other stars. A star, too, is a recruitment strategy.

And your body, which replaces over a billion cells a minute yet retains its identity, is a recruitment strategy. Your personality, a rapid-fire flood of changing communiqués between a hundred billion neurons, is an even more intricate recruitment strategy. So is mine. You are like a wave. A wave is independent of the water that it sucks in, then tosses out. So are you. Today you lunch on watercress salad. Tomorrow you dine on lasagna. The next you eat a steak. Yet you do not become a pasta, a cow, or a leaf. Instead, the pasta, cow, or leaf becomes you. Yes, you are very much like a wave. Every minute, every sixty seconds, you say good-bye to more than a billion combinations of postsynaptic receptors in your brain and replace them with new ones. You do the same with your red blood cells and the cells that line your digestive tract and that make up your skin. Like Theseus ship, you are changing your planks. Meanwhile, you constantly shift your mind from one obsession to another. Yet you retain an identity. Something more puzzling than mere substance continues to impose the shifting flicker of a you. No, it is not an immortal soul. And yes, it will cease when you die. But that does not diminish its mystery. That does not reduce its astonishing ability to persist as something beyond the atoms and molecules of which it’s made.

Why call these things recruitment strategies? Because a recruitment strategy is insistent. It is persistent. It is driven. A wave of yellow light, for example, will repeat its corkscrew dance 540 trillion times a second, always sticking with absolute precision to the limits of its amplitude and frequency. A recruitment strategy is not matter. And it is nowhere—no where. It is in no permanent location. Yet a recruitment strategy imposes its shape on matter over and over and over again. It imposes its way of doing things in location after location after location. But if a recruitment strategy is no where and no thing, then what the hell is it?

For ten years, from 1821 to 1831, in Berlin, the German philosopher Georg Hegel wrote a long and nearly incomprehensible book, *The Philosophy of History*, a book so hard to understand that few philosophers ever read it. But the central theme of the book was intriguing. Hegel said that all history is spirit becoming matter. Sounds spooky, right? Sounds superstitious and religious. And it certainly does not sound scientific. But in a sense Hegel was right. We’ve been certain that we can understand the cosmos based solely on material things. But we’ve missed the astonishing capacity of immaterial things. We’ve missed the importance of arrangements. Patterns. Shapes. Forms of social organization as stubborn and resilient as matter. Forms of social interaction with structures all their own. Structures that insistently sustain despite obstacles and the vagaries of time and space. Structures that sustain no matter what matter they contain. We’ve missed the secular mystery of a wave, a merry-go-round that masters matter, commands it, grabs it in a fist, then lets it go. We’ve missed the mystery of a you and a me. And we’ve missed the mystery that will someday replace Aristotle’s obsession with breaking things down to their smallest parts and will let science see the material miracles of what things bring forth when they combine. It will let science explain the astonishment of the supersized surprise.

You and I are patterns with ambition bursting forth in a cosmos devoid of gods, of afterlives, and of immortality. We are pyramid makers and palace creators on the prowl. We are atoms in multi-generational waves of culture, atoms in culture waves like science. No, we are not the first forms that immaterial pattern has donned. Immaterial identities also work their sorcery on quanta, quarks, atoms, stars, and galaxies. Recruitment strategies are alive in colonies of bacteria and hives of bees. They are equally alive in stock markets and trees. But we are the most complex social project that recruitment strategies have ever attempted to achieve. We are the repeaters of ancient patterns like attraction and repulsion, repeaters through whom the cosmos has sketched new spires and domes and woven whole new tapestries. We are the cosmos’s tools for fantasy. We are her first vessels of dreams. And yet we are only the foothills. Only the stepping stones. Only the starting blocks for the cosmos’s next big leaps.