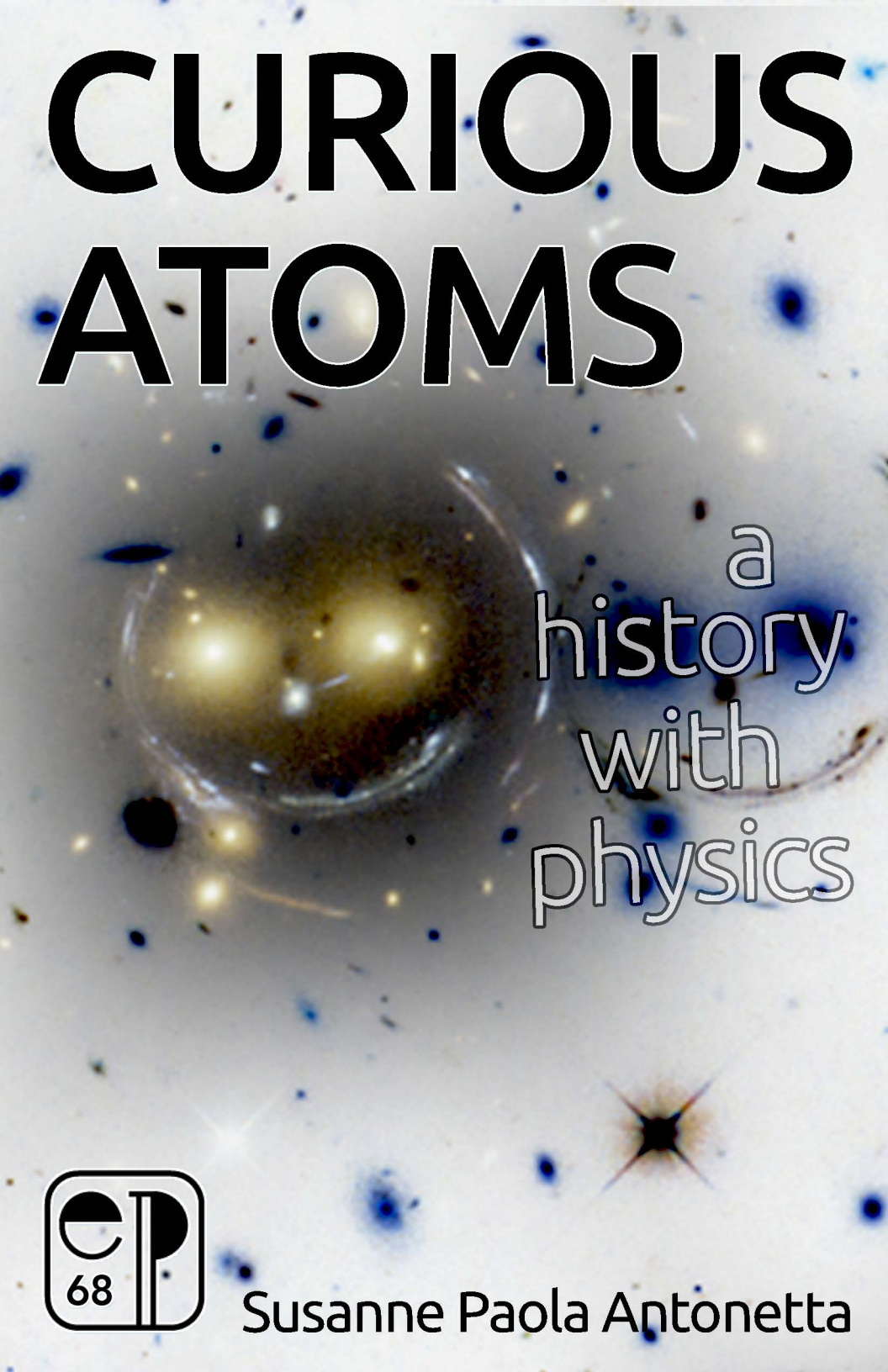
CURIOUS ATOMS



a history with physics

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Susanne Paola Antonetta

CURIOUS ATOMS:
A HISTORY WITH PHYSICS

SUSANNE PAOLA ANTONETTA

a winner of the 2015 Essay Press
Digital Chapbook Contest
selected by **David Lazar**

#68

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INTRODUCTION

– DAVID LAZAR

Susanne Paola Antonetta's essays are full of erudition and stunning self-appraisals, hair-pin turns between metaphysics and splintered pieces of autobiography, dark energy and light asides, tossed off like hand grenades. These essays are sculpted—I'm tempted to say forged (so necessary is each sentence, even each word one feels). Yet in the midst of work so exorbitantly cooked, the raw springs of the felt occasion drive the essayist through her thought-projects. I loved being in the company of this mind.

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It is probable that the scheme of physics will be enlarged so as to embrace the behavior of living organisms under the influence of life and mind. On the other hand it may be thought that those entities cannot be brought to book so easily, and that they will always elude our ken. If so, there will be a dualism in the universe, which posterity will find staggering.

—Sir Oliver Joseph Lodge

When this objective view is finally attained, and the mystery and majesty of matter are fully appreciated, to then turn the objective eye back on man viewed as matter, to view life as part of this universal mystery of greatest depth, is to sense an experience which is very rare, and very exciting. It usually ends in laughter and delight in the futility of trying to understand what this atom in the universe is, this thing—atoms with curiosity—that looks at itself and wonders why it wonders.

—Richard Feynman

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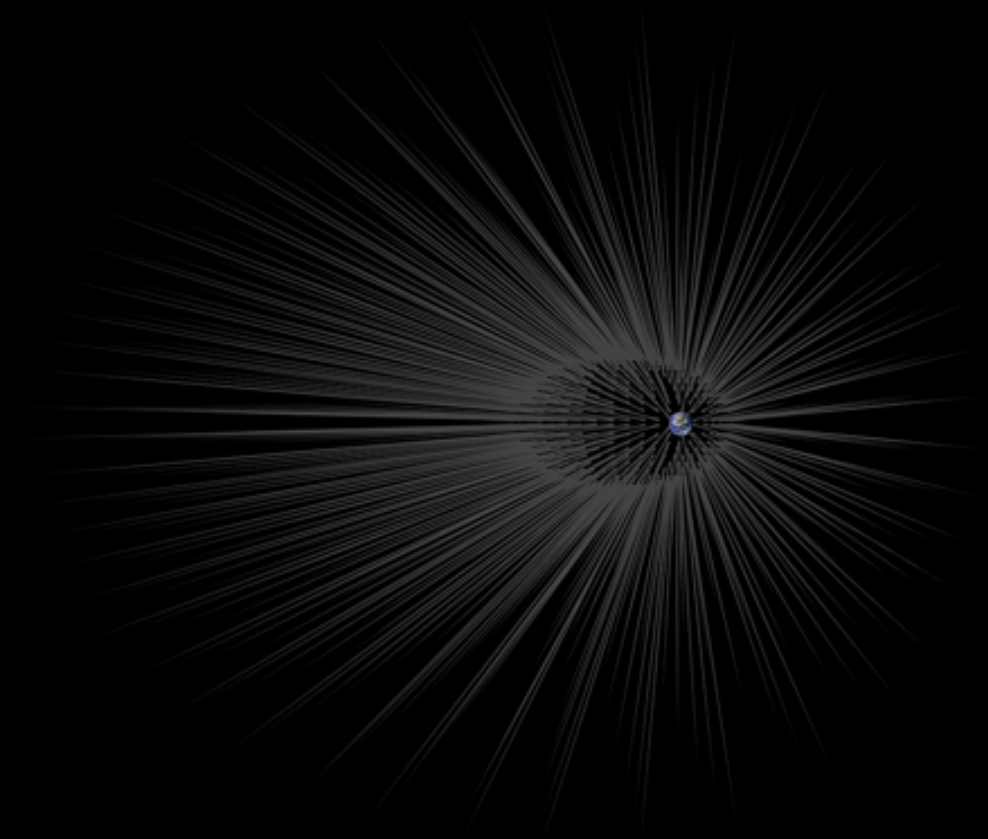

What does Athens have to do with Jeruselam?

—Tertullian

Earth in dark matter. Image courtesy of NASA/PL-Caltech.

DARK MATTER

So many opposites in this our universe: matter and anti-matter, the Big Bang and the Big Crunch, dark matter and known. Athens and Jerusalem, cold intellection and leaps of faith. I've wondered why this bipole world of mine feels so normal. It has breathed through me lo these many years, and though people ask me the question, I can't even say if it's strange. I have two different names. My mail carrier, my bank, accept them, at times with a bit of mild interrogation: whom are you hiding, and where?

I lived under dual names even as a child. One girl with a short form of my given name, one with a name unrelated, signed not just my school papers but my diary, in different inks. Both of them, for completely different reasons, loved risk. They walked away from things (crumpled cars melded into trees, boyfriends who hung knives above their beds, a toxic milk shot into the blood) no one would seem likely to walk away from.

And later: there's an S------- who supernovas; physicists would call her a *standard candle*. And one scarcely knows where the rain stops.

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Perhaps it took a Carthaginian (which Tertullian was) to understand the terms of the world so wholly in terms of place, Athens at odds with Jerusalem. The Romans fetishized the destruction of Carthage, a destruction they pursued, several centuries before Tertullian, through the Punic Wars. The general Scipio finally defeated Carthage and sold every living inhabitant of the city into slavery, then sowed the ground with salt. The defeat of Carthage was an astonishing destruction, a creation of nothing out of something comparable in ways to what our modern bombs do, but slow and steady and requiring piecework, the loading of individual human beings onto ships bound for slave markets, the plowing of acre after acre of land.

Carthage rose again, as a Roman African city, home of saints: Tertullian, Augustine, who studied in Carthage and fathered an illicit child, a sin he would spend the rest of his life famously confessing.

An Augustinian prayer: *Light of my heart, do not let my darkness speak to me.*

*
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Nothing, true nothing, as the Romans learned, is hard.

Even the universe has errors of plenitude. There's far more matter in our cosmos than astrophysicists predicted, until they invented ways to measure the gravitation within galaxies and found far more matter than there is antimatter, though if two things existed that called out for symmetry, it would be these.

When I was a young woman and doctors went exploring in my body they found two uteruses, one dark, closed off, prone to illness. It seemed like a just physical architecture for a manic-depressive, and one that should have parallels all over: two hearts, one hard and dry, two spleens.

⁂

Space has its own attendant force, dark energy. Space comes into being all the time and as it does, it brings with it more and more dark energy and causes the cosmos to fly apart faster and faster. Space is probably flat, and it's plastic, bending, flexing. The universe and the space that makes up most of it have a place into which it expands, a strange fact that bothers nonscientists to death.

Popular shapes for the universe come and go—the sideways cone or, technically, Picard horn; the dodecahedron; the doughnut; an infinite flatness. If space didn't end, darkness would not exist, but every square arcsecond of night sky would reflect back some sort of light from somewhere. We would have the light of the sun during the day and the light of true infinity at night, and they would look much the same.

Here where I live, in the northernmost part of the Pacific Northwest, we have short days in winter, with dim skies all day and sunset at three, and long days in summer, the sun finally exhausting itself after 10 o'clock. It is, doctors warned me, a hard climate for a person with bipolar disorder, and, for that matter, everyone. Seasonal Affective Disorder touches much of the population; someone invented a baseball cap here with a lightbox built into the brim. Summer makes you giddy, like swallowing a lit bulb, while winter is live burial. These facts tell me if the universe were infinite I would be somebody else.

Two unknown pieces of the universe exist, dark matter and dark energy. Dark energy is a quantum force and constitutes about two-thirds of the cosmos: dark matter, which we cannot see or uncover, about 25 percent. Dark matter surrounds our Earth, sticking out in rays like light from the sun, though it's known as "hairy dark matter." It would be the hair of one with her finger in the light socket.

It may be shameful that we know only five percent of our universe well enough to label it star or galaxy or comet or supernova, little as we understand these. Five percent seems to be a threshold fraction of ignorance; I remember an aunt of mine saying we only use five percent of our brains, as she sat at her country-style kitchen table in her boxy suburban house, licking color over her fingernails with a brush. "If only we knew what the rest does, if only we could get at that part of our brain," she would say. "Probably an Einstein did."

The notion of this dark matter in the brain (though the only-five-percent theory turned out not to be true) seized my imagination as a child. I don't think I ever dreamed of being an Einstein. This same aunt told riddles to pass the time: in one, a boy's father rushes him to the emergency room after an accident, where the surgeon says, *I cannot operate on him. He's my son.*

Who is the surgeon? riddled my aunt. This was during the 1960s. She gave us a day to come up with the answer but, stumped, my girl cousin and I never did: the surgeon was the boy's mother, my aunt finally told us, and we stared at her when she gave us the solution: absurd.

⁂

Whether the dark matter in the brain struck me as something that could help me, or something that had accidentally been unleashed, I don't recall. I was aware of being bipolar decades before receiving the diagnosis or understanding there could be a term for such a thing. In place of medicine I divided myself up: A moods and B moods, this girl and that one, Athens and Jerusalem. I separated compulsively, as if I knew I could annihilate myself and I needed to hold myself apart. Only a fraction of people have the condition I do, and a doctor warned my parents they would have to institutionalize

me. No one would be likely to give this advice now, not because we've learned more, but because we choose to spend less on care.

Too, I was born into the age of medical journal *Eugenics Quarterly*, when the thinking of the eugenics movement begun early in the century still knocked around. Five to 10 percent became a eugenics target, the fraction of the population who should not be allowed to continue their bloodlines, stopped from doing so by segregation, institutionalization (along with sterilization among the more hardcore eugenicists), discreetly putting people to death. Back then, in the 1960s, shutting people away for life smacked of sparing the general population from their quirks and their genes. Eugenics doctors did perform tens of thousands of sterilizations, some in institutions, some simply by telling patients they needed an operation without saying what, carting them to the hospital for the purpose, then releasing them.

Dark energy works mysteriously, free from gravity, and dark matter likely has a different atomic structure than ours, with our clingy electrons and stuck nuclei. If we could endow these dark forces with sentience I'm sure they would find us weak, swinging along with the nearest weighty thing, voids orbiting voids. We have failed to uncover their secrets. Unlike Augustine, we pray our darkness to speak to us.

⁂

Right now my darkness is the only voice I hear. My sweet girl, my candle, has gone. The one remaining dreams of tearing apart, turning a life (a job spent reading words, choosing and avoiding words; a history referred to by those who know it with the formula "your past," as in, *Does he know your past yet?*; cells that keep replacing themselves) into nothing.

I remember a look I used to get as a young adult, not an everyday occurrence but one that happened more than once: I would be out somewhere with my parents and we'd run across some acquaintance of theirs, close enough that we knew each other's stories, a person who happened to be a parent who'd lost a child. And this person would look at me and this person's fury at the nonsensical nature of things would be palpable, in the eyes, the slope of the mouth, this parent so conscious that it made no sense, me standing there alive and his or her child dead. I remember how badly I wanted to say *I'm sorry* and *I don't get it either* and instead, silent, I burned.

⁂

Tertullian had a knack for using logical forms to create absurdity. He made claims using the Latin *quia* or "because," a pivot where something causal appears to happen but nothing does. *Crucifixus est dei filius: non puden, quia pudendum est*, he wrote, or, the son of God was crucified: I am not ashamed, because it is shameful. *Et mortuus est dei filius; credibile prorsus est, quia ineptum est.* The son of God died; it is instantly believable, because it is inept (or, as the Latin can be construed, silly). Tertullian finishes his series of thoughts, *Et sepultus resurrexit; certus est, quia impossibile.* And he rose from the tomb; it is certain, because it is impossible.

That last statement often gets misquoted as *I believe because it is impossible* or *absurd*. No, Tertullian tells us nothing about why he believes.

⁂

Still Tertullian appeals to me somehow, his anti-logic, his refusal to connect, his allowing nothingness to exist. I dream at odd moments of his words, spinning them around in my head, without sense but with appreciation of his burned bridges. *I am not ashamed of my*

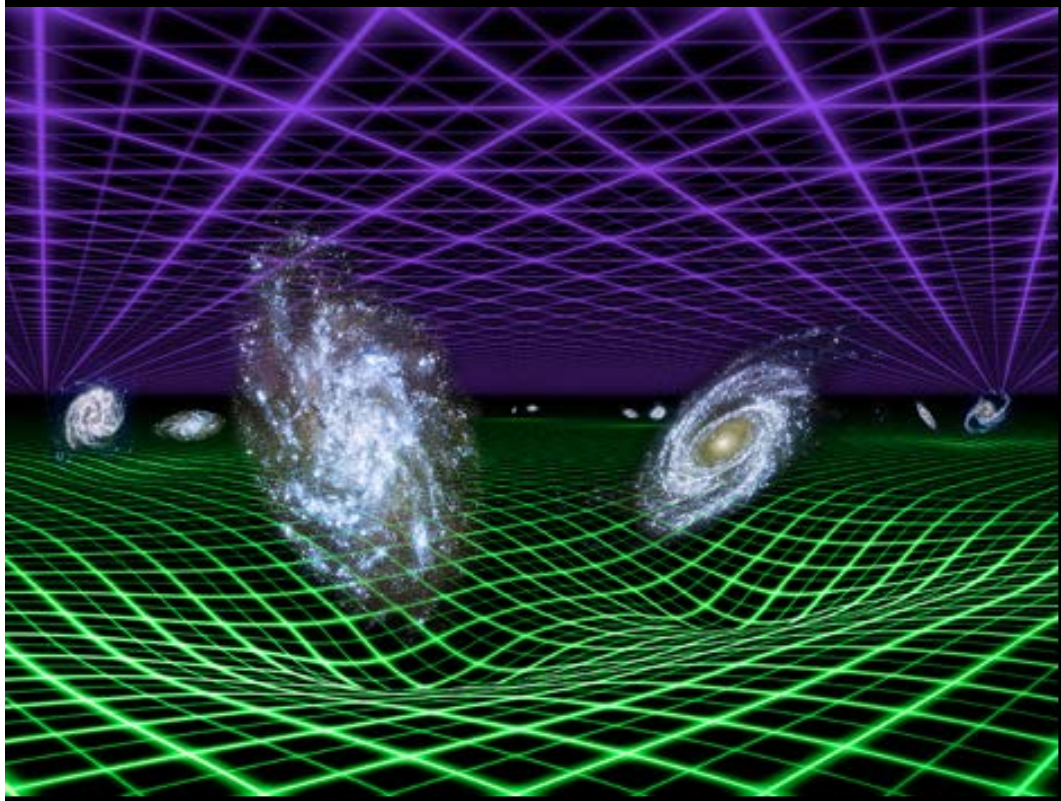
past, because it's correct to be ashamed. I have lived to my fifties: I find it easy to believe, because it was impossible once. I think, because I am unable to think.

What does symmetry have to do with Jerusalem?

⁂

Perhaps it would have mattered to have known Tertullian's thoughts when I was a child. Or to know physics, that most people live in a world in which they understand a tiny percentage of things, and they're content. I wanted badly to travel then, wanted to see among other sights Athens and Carthage and Jerusalem, and imagined each place you went gave you a piece of an answer, as if life would be one long scavenger hunt.

Dark matter remains a mystery, a choice between the preposterous and the impossible. It is winter, our dark time of year, when the reminders of the ludicrous limits of the universe are as close as three o'clock. Tertullian would call this Jerusalem season—Athens as bright and false as infinity.



The results from NASA's Galaxy Evolution Explorer and the Anglo-Australian Telescope atop Siding Spring Mountain in Australia confirm that dark energy (represented by purple grid) is a smooth, uniform force that now dominates over the effects of gravity (green grid). Image and caption courtesy of NASA/PL-Caltech.

Do not keep saying to yourself, if you can possibly avoid it, "But how can it be like that?" because nobody has yet escaped. Nobody knows how it can be like that.

Will you understand what I'm going to tell you... No, you're not going to be able to understand it... I don't understand it. Nobody does.

—Richard Feynman

DARK ENERGY

Do I understand it? No, and my not-understanding is orders of magnitude different from physicist Feynman's, his an expansive and appreciative not-understanding (a knowing minus some layer of complete intestinal comprehension), mine a not-knowing with a hard surface that lets nothing in. But. What draws me back: that dark energy accounts for 70 to 75 percent of the universe, as water accounts for 70 to 75 percent of our planet's surface, and the same percentage of our bodies, sloshing around and ready to be pearled off at the pores or voided or wept out.

And they seem to have a rending heart in common, these forces, these rough three-quarterses: dark energy pulling the cosmos apart as our fluids will betray us at the slightest nick, and almost all our Earth's water mocks our collective thirst (now at crisis levels) with its salinity.

As we consider this strange gathering of seventies, do we mention the Hebrew seven, the *zayin,* which can be our four-plus-three, five-plus-two, or any ordinary seven reached by math, but that also represents infinity? (In its masculine form *zayin* appears as *shiva*, the same name as the Hindu god of destruction.) When the Bible orders us to forgive not seven times but 70 times seven, it means

forgive someone not 490 times but forever. That number pains me, though I have a teenage son, and find myself shocked (as a physicist discovering the cosmos flying apart must be shocked) at how much can be forgiven, how many *I hate yous, I wish you weren't my mothers*, even the nuanced meanness of the *You turned me into a pussy* I got this summer—all as simple to take in as the homework cluttering our tiny parlor.

⁂

Dark energy is now the mystery of mysteries in physics, more pressing than the graviton, more scintillating than the multiverse; it remains stubbornly hypothetical even as it pulls the universe apart. Yale physicist Meg Urry says "It keeps us up at night." It takes a lot to keep physicists up at night, they who have slept well through parallel universes and a spacetime that flexes and yields to gravity and quantum particles popping up, soda bubbles, in many places at once. It may well be, as physicists like to say, that dark energy is simply "the cost of having space": an energy woven into the fabric of space itself.

In the same way the cost of living on our Earth is ceding two-thirds of our space to oceans and other water, and two-thirds of our own bodies to their fleshly liquifactions, from the flumes of the arteries to the vitreous pools on the eyes.

Gravity slows down the expansion of the universe; dark energy speeds it up. This fact crashed down on researchers who'd set out to measure the slowing of the universe's expansion—which they had every reason to expect they'd find, trusting in gravity, which should have been putting the cosmic brakes on. (This same research team set out to weigh the universe, as if the universe were a bluish newborn having its health assessed.)

And though it has had a relatively small role in the universe's past, dark energy has the lead part in our future. If the universe were the movie *All about Eve*, gravity would be the aging actress Margo Channing, played by Bette Davis, and dark energy the ingenue Eve, played with dewy cunning by Anne Baxter, upstaging her older rival, stealing her starring roles. Dark energy is speeding up the cosmic expansion, which will go on (more rapidly than we ever guessed, and falling over itself to go faster and faster) likely until everything pulls apart.

In the same way that dark energy corrupts the universe, the water in our bodies causes us to decay much faster; a desiccated corpse, like the six-hundred-year-old preserved head of St. Catherine of Siena, which sits in a bell jar at San Domenico, can last in the same shape for ages.

⁂

Have I mentioned that I am afraid? All the time.

That I cannot *sleep* anymore because I wake up in order to be afraid? It's a chicken-and-egg kind of thing—I wake up because I am afraid, and stay awake because I'm afraid: of the implications of going to sleep and thus not being afraid for a while, which would signal to the cosmos that I need to be taught some deep lesson regarding fear.

I live on the water—the Puget Sound specifically, gray and with a foam like caul fat. It goes black at night, shiny and rounded as a crow's back, and like a crow, larcenous. It will take what you let go of, just for a second: earrings, an overstuffed wallet, even a child. A boy, a new freshman at the university here, walked out of a party and somehow wound up dead in the log pool at the waterfront, behind a chain-link fence. You can't imagine what it is to live where people drown, where

a monument to the drowned (a man in fishing slicks whose feet hover on a block of names) rises in copper by the water, where just a year ago my son heard a man's last cry, on a small but frigid lake across the street from my son's middle school: a brief "helphelp."

Just today I had blood drawn and the needlestick wouldn't stop bleeding, blood itching its way down my arm to my hand, darkening the yellow shirt. I bang something ever so slightly and the bruise spreads under the skin (the contusions seem to be waiting there) and such colors. All the khakis and plums and gnarled blues of water. "You have no clotting factor," a doctor told me once, after surgery, and I was groggy enough to ask "Is that a bad thing?" at which she shrugged, doctors often being resolute in their lack of opinions about bodies; they just are.

*
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Is it worse to admit that, though there's an eerie thrum from the idea of the Big Rip, the yanked-apart universe, I'm almost entirely fearful for my child? Who has done little to deserve my worry except to be 14 and in the path of the forces that seem ready to occupy any empty spaces in his life? His friends try suicide, get arrested stealing gadgets for their iPods, smoke and sell marijuana and God knows what else. One boy ran a knife across his own throat, longing for the outward touch of his deep rivers.

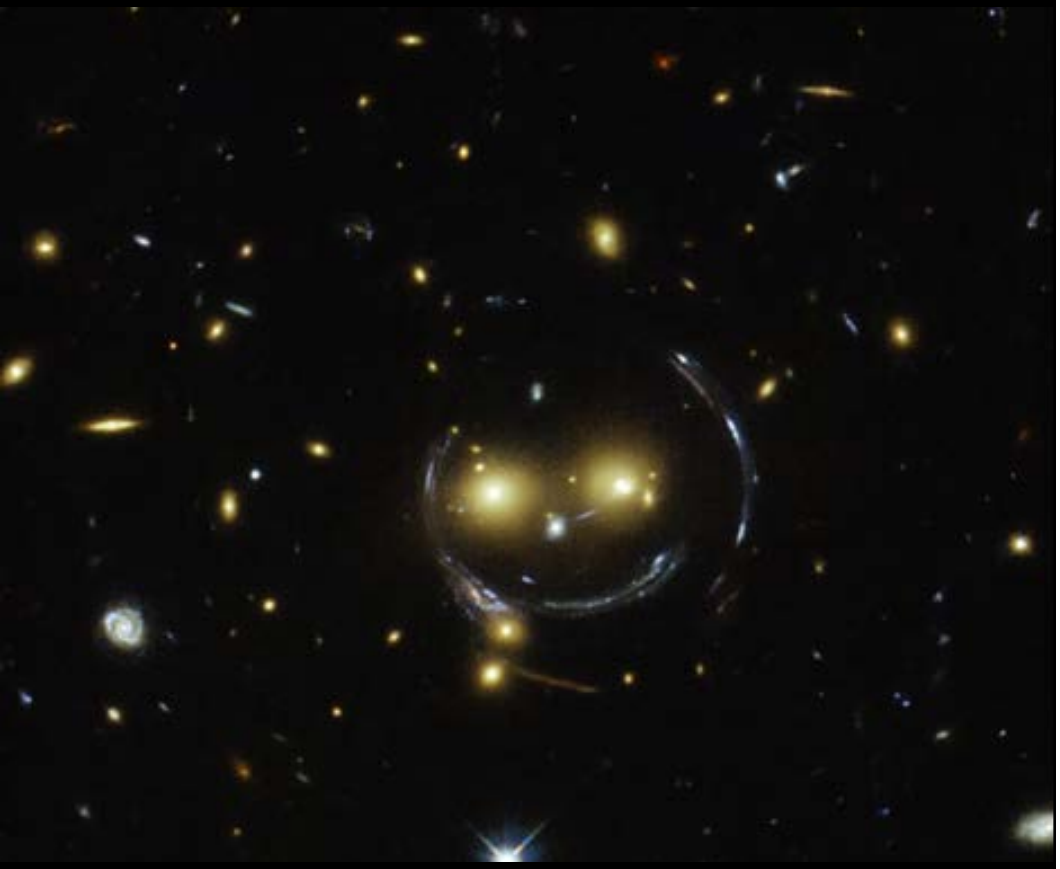
I may be down the drain.

It is I think the water I bear: so alert to its multiplicity of forms, the way it nags at the boundaries of what holds it, its cell-thin pipettes leading to the bulb of the heart. It shows as blue roads beneath the skin. Ice invades the fluids and crisps the bodies lost on the alpine tor of the mountains. Mountain-climbers try not to talk about this, that the bodies of those who don't make it are left on the slopes, too hard to remove, too beautifully preserved to disappear. If someone has climbed one of the earth's major mountains (I don't care how he or she tells the tale—how much heroism and endurance, how much frostbite, how many lost digits), that person succeeded by climbing past the blued, frost-furred bodies of those who didn't make it, choosing to go for the glory rather than bring those bodies home.

No one knows why or how that boy, Dwight, landed down at the water in the chill hours of the morning (the university's a few miles inland, uphill), or how he got over the impossibly tall fence, or how he fell in. Or if his corpse simply drifted from some other point in the Sound to the log pond. He was alone: his death ruled an accident. His cell phone dialed a number from a downtown street just before he died. He was here, there, everywhere.

I have thought: *How can it be like that?* a bit too much.

People come up with crazy theories: Smiley Face killers who drown college boys and make it look like an accident, just identifying themselves with a smiley face scrawled at the crime scene; dark energy as proof humans were meant to exist, even that we cause the universe to assemble (to come out of its shimmy of multi-placed quantum particles) by perceiving it. Every possible explanation of things lures me in, at least once. Though then I have to be ordinary, to unthink, as mid-afternoon comes and the front door opens and in walks that quantum package of need and scattered anger I raise, and I turn, attempt escape from Feynman's alley (the one no one has escaped from before). Say "And what do you hear in school?"



This smiley face was captured by Hubble. The two bright eyes are galaxies, and the smile is caused by a phenomenon called strong gravitational lensing. Essentially, the gravitational pull of some galaxy clusters is so strong that it warps spacetime around them. Photo courtesy of NASA/ESA.

THE PROBLEM OF LIGHT

—for Bruce

is, what could it be? A wave? Or a particle? A shimmy, or a stick tracing Os in the mud? From Aristotle on people have argued this. Until Paul Dirac declared light to be both, not in a mystical way so much as a flirtatious one, light being a wave if you ask it a wave-like question, a particle if you ask it a particle-like question. The answer you get depends on the question you ask. This you can prove with the mathematical theory of quantum fields. Or this is how Dirac's research gets presented, though I imagine this formula too has its transcription—simply what you get if you ask Paul Dirac a paradox-like question.

Such power to the shape of our interrogatives.

If I ask you a soul-like question. Or one of dust.

All of us have a problem with light here. Very little nine months of the year: then so much. You asked me the other day why you see huge and absurd straw hats on everyone. We have a milder light, less heat, than many places. This is you humorous but it's true: hats like ribboned platters, round rafts. We dry up inside, my doctor tells me, through near-universal vitamin D starvation. Even a short sun exposure every day could heal our psyches and our bodies. But the light is fearful. Our scientists have interrogated it, trapped it, turned it solid, a hail of illuminating pellets.

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Early August: tomatoes small and hard, the color of limes; toadflax purple and girly pink; strep-throated lilies. The powder-blue ball on the flowering nettle a baby's rattle with a bite. So many flowers and foods, really—what good would it do to name them all? If I do it will only be because I like to say them: balm and toadflax and mallow. Lupine, lavender, Bishop's weed. I planted them; I care for them; I find excuses to say their names. They themselves have only their seasons, as things do, like the neighbor in my building in long-ago Elizabeth who beat his wife on a schedule. Every Friday. Or as your father beat your mother, evenings and weekends. To think we had our overlapping schedules of crying women.

The use of quarks for physicists has been an exercise in faith. These bits of being can't be known. They can't be proved. They can only make other parts of the universal equations work out. If a cabbage fit into those equations people would say look: here is the most fundamental thing, a cabbage. And on the tiniest level the things of the universe follow their own laws, or no laws, vibrating between wave and particle, jumping around.

The way you look down the street and see house after house, very similar, smallish houses built around the turn of the twentieth century, the same flowers and vegetables and fruits everywhere, even on the strip beside the road, a bantam hen or two cackling down the street. But within each house the quark of individual existence follows its own laws. Some have just a mother, always in a bathrobe, screaming. One has a man mourning his wife of 40 years. One offers a meal of fresh perch and morels and around it children group themselves.

Our sun, in summer, does not like to go away. It lingers until 10; it fades like a houseguest leaning on the doorframe. In the early

evening it pins our chairs to the walls and pings through the emptiness of the lace on the window. It pools on the kitchen floor. The kitchen of the duct-taped cabinets and scuffs on the floor, our own sub-subatomic parts. We gather around the table and have poultry and just-picked greens, eating with our hands.

At night, light seeping through his blinds, our son does not sleep. This too is a problem. As we sit with him he persists with questions: how can we be so sure we love him? Who were we before him? Have we taken drugs, been arrested? What bad things have we done?

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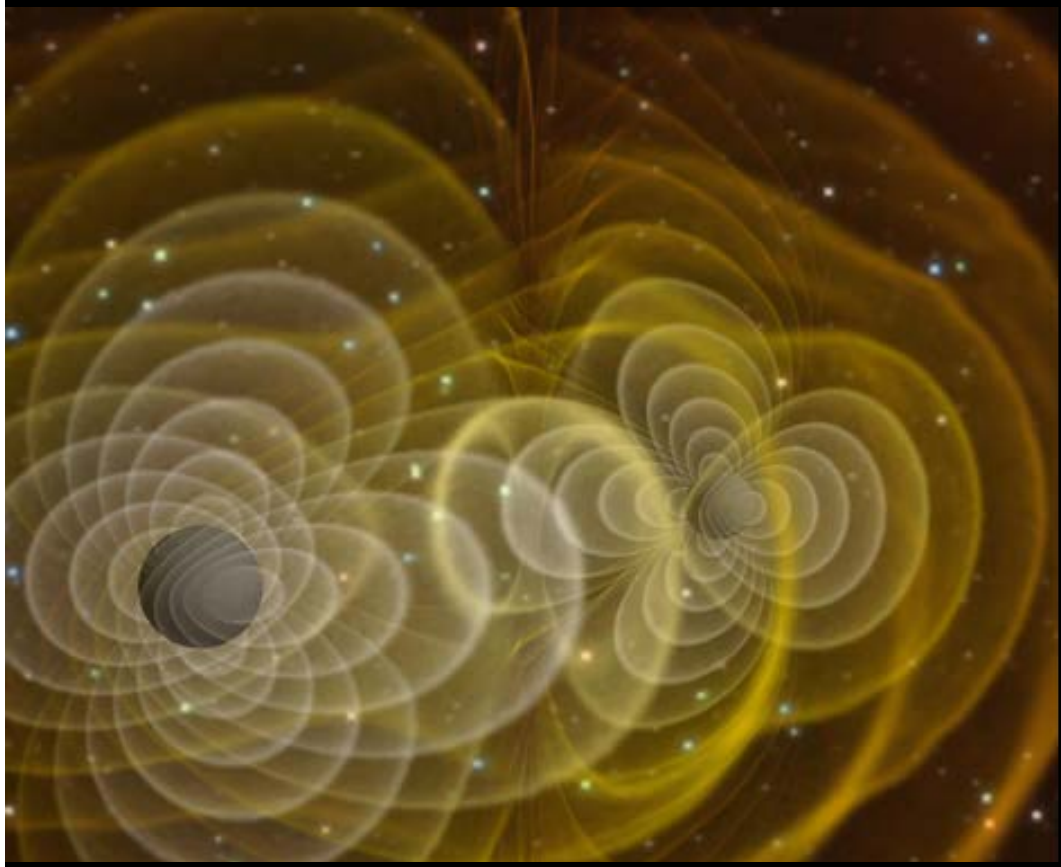
Dirac was famous in physics for being "the strangest man," as Niels Bohr put it—not spiritual like Einstein, or so proud he wouldn't flush the toilet like I. I. Rabi, but silent, with his occasional outbursts pulling at all the bewildering strands of human behavior. At Cambridge a joke had it that a unit called a dirac was a unit of one spoken word per hour. Dirac climbed trees in his three-piece suit. He loved Cher. He disliked poetry but missed out on at least one successful extension of his work, the theory of quantum electrodynamics, on the grounds that the theory had no beauty.

Then Dirac married and ended up with four children, and changed: he learned to tell jokes, he laughed. And slowly his mathematical insights drained away. He had always said his equations existed without language, could not be presented with language. Dirac would not let you say it was hot unless you could cite an exact number, as if he found words to be chronically guilty of untruths. I imagine him sitting at night with a young child, struggling with those questions, the early ones: why does the sun come up and leave? Where has the dead retriever buried under the plum tree gone? Dirac had no love of religion, no softening for a child. He

also had no chalkboard and no equations, only the diracs he must pay out.

Though Dirac slowed down, most of what matters in twentieth-century physics builds on him: he forecast antimatter, fermions, weak force. The principle of conservation of strangeness, where particles like strange quarks resist mixing with other particles that are strange, but at times, going against principle, they do.

In a Dirac-type way here we are, out of our memorable spins: your vodka Christmases and segregated parks, my Budweiser factory with the neon raptor diving. Summer sweeps on and the garden keeps producing these flowers I haven't planted, snapdragons, foxgloves full of the drug fortifying our nephew's heart, white carnations this year (what you wore in your lapel as a boy to signify your mother's death). And though the chickens have done laying for the day, they're still squawking, angry or celebrating or just passing time, down the road.



Five unknown particles that may be lurking in our universe. Photo courtesy of Henze, NASA.

QUANTA

—for Jin

There is an undiscovered particle called the graviton that holds our feet to the earth. There has to be, by the laws of quantum physics, which explain forces with an array of bits: photons for light, gluons for strong interaction, bosons for weak. But in the case of the gravity particle, we cannot find it, or equation our way down the chalkboard to it. Along with the question of the simply expanding versus the expanding-contracting-expanding-forever universe, it's one of physics' mysteries. What is it? How does it work? It has been a law in quantum physics that energy comes in tiny but discrete units that act as both waves and particles, and this holds true of gravity, assigned to a particle arising from the curvature of spacetime. It is also a law of quantum physics that the more you know about the position of a force in one state, the less you can know about it in the other: target a photon in its particle-state, and forget ever pinning down its wave-state.

The supposed graviton particle's a problem, at least in attempts to theorize its presence: it gets into trouble at high energies because of infinities arising in the math, a sign of error. Infinities sound like pleasant things to me, not some kind of Swamp Creatures we want to suppress. But I am hardly a physicist.

"What is the most primitive physical requirement of a quantum theory?" writes physicist Roger Penrose (whose notions of the primitive, I notice, diverge startlingly from my own), "Since we are trying to do physics, we require that a really physical concept of graviton actually does exist."

That means that, as with light, gravitons must be things as well as waves, massless things but things nonetheless. The quantum truth of light's dual life as wave and particle was a breakthrough in physics, largely credited to Paul Dirac. Dirac won a Nobel Prize but his career finally stalled over the infinite, which appeared in too many of his predictions. He refused to accept the theory of renormalization, a theory that eased the infinite from his equations, one accepted and used to expand on Dirac's work by people like Penrose.

Penrose's work revolves around applying Dirac's quantum principles to the mind. Nothing in physics now, he says, can explain consciousness. To unlock its secrets a new physics must be found, a quantum system related to the physics of gravity, one that explains thought and relates it to the universe. Thinking, he believes, occurs in a series of quantum events, so it must have a physical reality to it, a thought-thing that is also a wave like all quantum particles and that, like Heisenberg's uncertain quanta, can be many places at once. Penrose loves the impossible and has created many impossible designs—a triangle that keeps folding in on itself, a staircase that goes up and down at once, very M. C. Escher.

I imagine that the physics of gravitons have a corresponding science in the physics of love, another binding force. There's some particle that could be summoned up by an equation, an attachment-ton, a love-ton. Can it, like static electricity, grip, and then wear off? Particles might drift from the bodies of divorcing couples. I wonder, if you had the right lens, if you could see the bits lift away, the way

fluff from the cottonwood trees in April fills the gutters and pales cars, as if invisible hands sheared an endless landscape of sheep above our heads.

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You are my son, my 14-year-old. I would have said you and I were fast together, then you became a teenager, and I don't know anymore. My thinking—my chalkboard—blurs.

"I hate you," you say sometimes, "you're not a real mother." I don't blame you; you face this thing, this primitive physical answer to a charged theoretical need. You find problematic infinities. It's a rule of physics that quantum particles obey a different set of laws than those governing the larger world, different laws in which they can be many places at the same instant, can be both an object and a force. A real mother would be atomic, be everywhere and everything you needed her to be at once. All of us have an instinct for this other law, through the bits that long ago began revolving around one another, on their way to becoming our bodies.

"Surely each graviton carries its own measure of curvature" wrote Penrose, giving gravitons the quality of a face, a turned cheek. Your eyes, leaf-shaped, that flick down on meeting mine. Their curtains drop on so much going on inside, like quiet suburban houses with their inner worlds. Some houses close on physical or verbal violence, though the houses themselves, studded with windows meant to be clear and doors meant to swing open, seem to argue their innocence. But there are secrets we learn: the house down the street where an older boy killed and mutilated a younger one. We went out that night and left you with a babysitter, a tall 20-year-old named Joe, basketball player-y and very nice, and when Joe took you to the park the police stopped you two and questioned him for a long time.

The officers must have been aggressive in their questions; they knew something was up, something involving an older boy and a younger one, and did not know Joe and his niceness. You were very small and remained spooked for a long time, asking: had you yourself been murdered? Had you *committed* murder? Your mouth burned with a new vocabulary, one that, like the theory of relativity, almost everyone's aware of in some sense but almost no one really knows.

If we could find the graviton particle, we could perhaps bend spacetime our way, bring gravity naturally to places like the moon. I imagine this could be true for love gravitons; if we could locate them, we could put them in, or put them back.

Which brings us to you. I want to talk to you like a scientist, to say: *infinities, renormalization, strangeness, weakness of censorship*. You would find me insane. This is in fact one of your weapons: to tell me—accurately—that you have a mad mother.

You don't want to hurt me, or generally don't. You apologize in a fever of penance. You are flickering all over at this age, first one thing, then another.

Dirac's wife, in a rage, screamed at him "What would you do if I left you!" Dirac, who'd once written to her that she made him a human being, paused and answered "Why I would say goodbye, Dear."

An invisibility cloak using optical camouflage by Susumu Tachi. Image courtesy of Z22. Licensed under CC BY-SA 3.0 vis Wikimedia Commons.

THE SCIENCE OF INVISIBILITY

What is surprising? That it is close? That it is here? That it is not at the instigation of some David Copperfield-type magician, not a director like *Avatar*'s James Cameron? Who even cares, but generals and Joint Chiefs and hundreds of other folks in the military whom we lay people will never encounter, but any scientist dabbling in invisibility will, because they will be giving him (odds are still good it will be a *him*) a great deal of money? And they will read his papers and other findings, with great attention to the word "applications."

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There is a coat of invisibility, created in Japan by a team led by Susumu Tachi. The coat works through what's called "retroreflection," reflecting images back, through a surface of tiny beads that function like cats' eyes do when they bounce back light and glow. It only works if you view the coat from the right direction, but if you do, you see a rippling outline of coat and, through it, whatever cars or pedestrians or buildings or scenery happen to be just behind it. Where the coat bunches up it stays opaque, but where it's smooth, you can look through it. Its sleeve might hold a woman outlining her lips, its pocket a man tugging absently at a leash.

The coat is an illusion. It relies on its reflective surface, and trick cameras that project what is behind it onto the front. It is an eerie illusion if done right, because of the ripples of coat without the coat-ness of it: no color, no heft, just enough of its shape to prove that something solid exists, but has been forced to assume the role of window glass, to show what the coat should hide, the woman crying over her lipstick, the man whipping the dog.

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Though terms like "cloak" and "garment," appealing terms that call up *Star Trek* and *Harry Potter*, get thrown around in invisibility science, it's finally the stealth bomber everyone comes back to, saying: "See how far we've come after all." The stealth bomber works by its strange diamond shape, considered so un-aerodynamic it was known as the Hopeless Diamond, until it flew—a manta ray shape so wide and flat it scatters radar.

What would we do if we could be invisible? My 14-year-old son would edge into GameStop or Fred Meyer's and pilfer video games. I know this about him, though I swear he's a good kid; it is his age, when the world promises so much and delivers so little and the reasons for that are not yet at all clear. I would pull the cloak over me and simply sit in the living room. Or I'd creep around and listen in on conversations, a pursuit of mine anyway, though now I use the natural invisibility of a middle-aged woman.

I have no desire to listen in on people I know and hear their secrets; they're welcome to them, their hidden loathings and their lusts and how they really feel about their children, or even about me. It is strangers and their oddness I love, like the woman I overheard tell a friend last week, dripping sympathy, "Of course, that's just too much of you for you to handle." The friend, whose face I could not quite see, who had suddenly been granted too much custody of herself, nodded.

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A version of the Tachi technology exists for the cockpit of a plane, so the pilot would, apart from his or her control panel, see only what surrounds the plane, nothing but the sky and clouds and geese flying with their necks stretched like they're waiting to become foie gras, and whatever else. Pilots would fly like Superman.

True invisibility consists of light refracted so it passes around an object and meets on its far side; since we see light scattered from things and determine color by how the refraction hits the color cones in our eyes, we cannot see what light itself avoids. It sounds impossible but this kind of invisibility has been achieved, though only with items a centimeter or less, like a paper clip. The aim with the research is to extend it, so it could provide cover for a tank. Or a battleship, or soldiers. No one would seem to be there, in the main square or the harbor of the capital city of whatever country we happened to be on the outs with, and then. Bullets spewing from a water fountain. A school of missiles from the still water.

Discussions of invisibility in science circles often touch on ethics—not at all about the military interest in the field, but about the creation of a technology that, once successful, could be copied by individuals and groups all over the globe. Invisibility may turn out to be parallel with the atomic bomb, the search for which began over wartime intelligence that Germany was striving to create such a bomb, though the Trinity test that proved weaponized fission worked occurred after Germany surrendered and mooted the arms race. The bomb haunted its architect J. Robert Oppenheimer, despite his theatrical response to the explosion at Trinity—as the cloud grew fungal and wicked, he quoted the *Bhagavad Gita*,

which he must have memorized for the occasion, saying "Now I am become Death, the destroyer of worlds."

The scientists at Los Alamos, where much of the Manhattan Project that developed the bomb unfolded, thought the test might set off a fission reaction that couldn't be stopped, and destroy the area completely, or the world for that matter. No one knew, and they speculated on the likelihood of both, and had a statewide evacuation plan in place. In the end, the bomb destroyed just what it was sent to destroy.

Many scientists from the Manhattan Project, reasonable men like Richard Feynman, have all said versions of, *When we heard Germany surrendered, why didn't we stop? I don't know why we didn't stop. Once we realized we could do it, we just wanted to finish.*

They had a version of the adolescent fever, when the fact that something can be had overwhelms.

Feynman was the most chipper and affable of physicists and no casual dismisser of his fellow humans, not arrogant like Oppenheimer and Rabi. Feynman was known as a humanitarian, a fun guy who loved jokes and African drumming, a man who for laughs cracked the top-secret safes at Los Alamos by trying famous mathematical formulas, then left notes inside that convinced physicist Frederic de Hoffman a nuclear spy had stolen the atomic plans. He used aliases for his non-physics pursuits, like painting and writing music, and taught himself to sniff like a bloodhound. Even Feynman, though, faltered when confronted with the bomb. In one interview, he said what happened at Los Alamos when the bomb dropped would make "a tremendously interesting contrast with what was going on at Hiroshima."

"There was a very considerable elation or excitement," he said of hearing the news of the bombing of Japan at Los Alamos, "a lot of parties, people got drunk." He himself, he reported, had gotten very drunk and played the bongo drums while his creation torched a Japanese city.

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It may be illuminating that, in literature, invisibility has been a cursed gift. Like the character Griffin in Wells's *Invisible Man*, those who gain it go from ordinary folk to amoral monsters who feel invincible and become insatiable. They regret the gift, but like those regretters of the bomb, not in time. For Richard Feynman, Hiroshima was a bitter ash before the horror of such a weapon being loosed in the world sunk home. One night when the war was over, he sat in a restaurant having dinner with his mother and he had a vision of a bombed-out Manhattan. A Manhattan destroyed by the project named for it. And then, according to Feynman, everything changed.

"I would see people building a bridge and I would say, 'They don't understand.' I really believed that it was senseless to make anything because it would all be destroyed very soon."

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Invisibility has been a flourishing science for a decade or so. Here may be the problem: that an object of fantasy should be the object of science, and that each step in a scientific process leads mentally only to the next one; it's as if the end too is cloaked in invisibility. Researchers themselves say, *This is so cool!* And then they say, *With so much military money available we'll never run out.* Meaning, here is a field no Great Recession, or state legislators pulling money from research universities, can touch.

The fact of military money comes up often in the literature of this field, along with a fish, a type of flounder that assumes the coloring of whatever it touches so perfectly that a photo of this fish on top of a checkerboard shows a fish you could without any trouble play checkers on, each square exactly as it should be, just a pair of eyes and frilly outline giving the fish away. Whether it's humbling to begin an endeavor outdistanced by a flatfish, or a challenge, or both, I can't say—just that the fish photo is often there in discussions of this science, along with photos of the see-through coat and the stealth bomber and sketches of light-diverting gadgets that might work. Maybe the presence of the fish is the most surprising thing of all, just a little fish (our present technology could vanish it completely from the side, it's so thin) wanting only to be still and stay clear.

In the quantum universe, time runs both forward and backward, and matter doesn't actually exist until it's observed.

—Glenn McDonald

THE FAME QUANTUM

I did all the right things by the famous woman. Meaning, I took no photos, and I only mouthed her name into my husband's ear. I didn't start the gaping and jostling and selfie-stick-poking and autograph-asks I could've by speaking loud. Or by borrowing my husband's smart phone and taking a picture. My teenage son told me I should have. People like that deserve their privacy, I said.

But that's not really what I meant; I meant that a photo of her then would not be a photo of what we mean by *her*—she at the airport slight, pale, dressed down, without makeup. It would be like those photos taken by people who claim to have seen a ghost, where there's only a blur they point to, saying See, it was really there, and you don't believe them.

She and I stood in adjacent lines at Vancouver International, waiting to show our passports and go to the terminal for a plane to LAX. She was just then on the cover of *Glamour*. Moving through the airport escorted by a middle-aged woman in a dark suit with a security lanyard, who had upswept blond hair (dyed) and a British accent.

But as others recognized her we still spoke in whispers, the way you speak of the dead when you're in their presence. Confronted by a corpse, especially of one you knew, you whisper. You begin to approach it and then you stop. It has a positive charge and a negative charge. You want to touch, to renew the old relationship, but your touch will only tell you that you know nothing about her anymore.

In its way the actress's body challenged us. She was as far from being a real and valid human.

The actress wore a navy hat low on her face, a jacket, black jeans, and her outfit, though plain, gave off an etheric air of money. I had to conclude money has a physical presence, not identified yet, like the consciousness particle, or the graviton. It worked its particulate magic in her skin: finer and more poreless than a piece of silk. The actress was 32, but her face looked unlined as a child's. Other than her skin and her slimness, she was merely a pretty woman, one among many in the room. Her husband, not an actor and ordinary looking, had the same skin.

She walked with her eyes forward, looking at nothing: in a large room crammed with people waiting to show their passports, it took skill. She didn't even look at the British-accent woman, who looked at her, murmuring reassurances, "You see it will only be…"; "and then we can go to…" Her expression, in a face we remembered as sensitive, plastic and alive in her film roles, stayed empty. Her eyes only shifted, away, when a face slipped into view. Was she avoiding recognition, or dodging the faces themselves, because they were so jowly, so lined, so raw? Us with crow's feet around the eyes, parentheses lines around the mouth, things that acknowledge we've been walked on, overwritten.

She vanished as we got to the waiting area then reappeared in first class on the plane, wearing huge sunglasses, responding to something her husband said, a hint of grin on her face finally.

A few days later in Laguna Beach I found a $100 bill scrunched up on the sidewalk. It's an expensive place and we got excited: dinner money! But then as I looked at the bill I realized it came close to being real but was subtly wrong. On it Ben Franklin's face had a fat nose, pursed its lips rather than slightly smiling, had sad quizzical eyes. He seemed to wonder how he'd gotten stuck here, in this gray-green oblong, on this particular bill. The paper was shiny. And most damning: where it should have said "United States of America" in block letters next to the face, it read "For Motion Picture Use Only."

Movie money. My bill, I found out later, came from a place called RJR Props and was a relatively new movie hundred. Making fake money is a Hollywood industry. As are many other faux things, like pubic hair wigs, used to give actresses a sense their nudity is less nude. Contrary to urban legend, it's not illegal to film with real currency, and at times directors do, but it's expensive, and requires insurance, and guards. Nearly all filmmakers choose the fake. The trend became to make the bills look more and more realistic, until in 2000 a scene of a casino blowing up in *Rush Hour 2* caused hundreds of thousands of dollars in movie money to drift through Las Vegas, people grabbing, and months of false money being passed off on the Strip. The feds charged the poor prop company with counterfeiting, confiscating their files and their templates, and the company lost millions, in real cash.

As I smoothed out and studied my movie money, I found more and more giveaways: the institutional building on the back isn't right; the eagle in the Federal Reserve seal looks fake and menacing, like the symbol of a Bond villain. It is intricate as a real bill, an impressive collection of almosts-but-not-quites. It lacks that quantum particle, of money.

Maybe my actress and my bill once appeared together—maybe she clutched it in her small nearly transparent hand. Either way there's no denying the elated feeling both brought us for a second, that rush of a shocking proximity, the hundred dollar bill that promises wealth, the actress at our elbow with her fame. Then the sinking in of what is, the look around you at the real world, that thing that seems in certain cases to be avoidable.

LITTLE THINGS

My mother's dollhouse has become a constant reminder of something—what?—in the time we spend with her, if it could be said to be spent. At 89 she remembers very little. She does not so much talk as chime, like a clock with a surreal burden: "Do we have anything to eat for dinner? Yes, chicken. Do we have anything to eat for dinner? Yes, chicken. For dinner? Yes yes, chicken. Do we have anything. Yes. There's something we have."

This however explains nothing about the dollhouse, which I bought her 30-odd years ago, though she has no idea anymore that that's true. It's a nonce fact from the haze of our family, the kind that only one of us knows, and therefore no one does. She wanted a dollhouse badly though I don't recall how I knew that; she has always been an amazingly taciturn woman. Though my son is 14 and disgusted by all things girly, before we come my mother guards against him by wrapping a bungee-cord all the way round the dollhouse. My mother's décor (Victorian, with teeny candelabra, petit point chairs, a grandfather clock with real brass) reflects a taste as far from her own house as the regal Victoria would be from one of our own lewd and ineptly corrupt politicos, an Anthony Weiner or a Mark Sanford. My parents' house in northern New Jersey screams 1970s: flocked wallpaper, shag carpet made of burnt orange, avocado and brown twists—a sea floating the island of gold floral couch.

Is the dollhouse the home she always wanted, I wonder, and if so, why has she chosen so capriciously not to have it? My father wouldn't really care if she switched to delicate petit point and hardwood floors, though he might find it weird. It may be the alchemy of family, where the dollhouse forms a philosopher's stone and we an intransmutable lead. It may be the good home can only *be* small, small enough for fingers to glue whatever breaks, for survival to be as simple as bungee cord.

Once when my son was a toddler (and my mother had her mind still), he opened the dollhouse doors. My mother caught a glimpse from the kitchen, above the semi-basement room where she keeps her dollhouse. She screamed for him to *stop*, and rushed so fast and so careless she sprawled down the stairs. At the age of 80, she splayed moaning on the floor in front of the double doors of the dollhouse, looking in, presumably, at waxed wood, at a nickel-sized clock face, its minute and hour still glued where the maker chose.

My father began screaming. At me, my brother, my husband, my son. He grabbed my mother by the arms and began dragging her, to where. Who knows?

"Don't *move* her," said my brother. "She could've broken her back."

At which my father dropped my mother and turned on him.

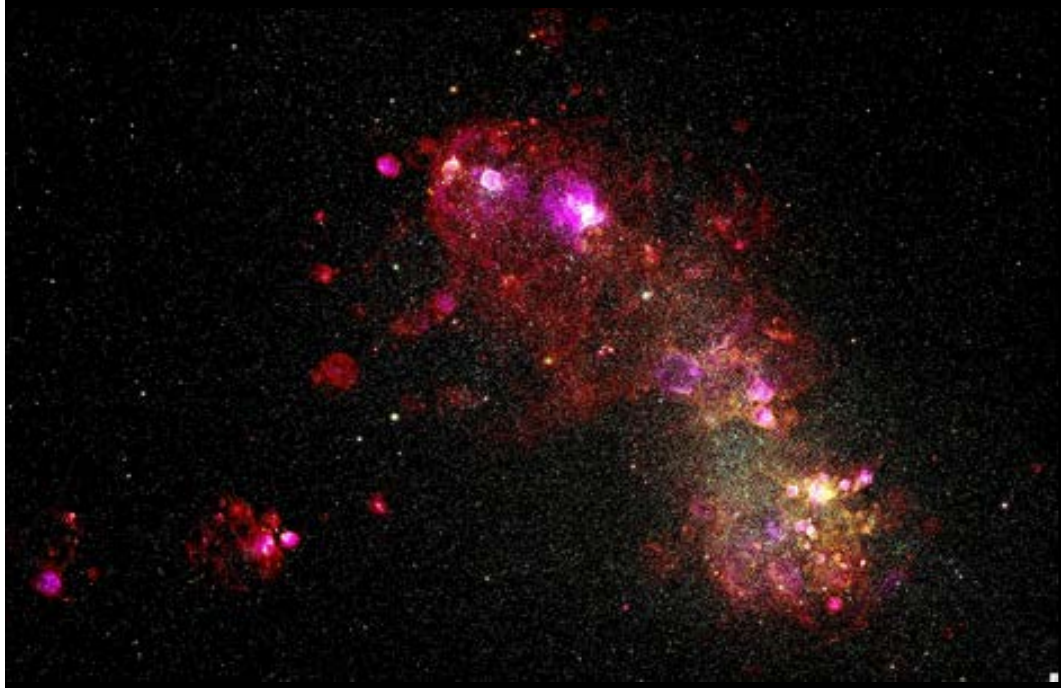
"Don't tell me what to do!"

I recall this in somewhat nonsensical fragments: my brother told my father to stop being a bully, my dad yelled, "I *am* a bully," waving a fist. I'm not sure how this was intended to help my mother, lying on

the floor with her dreams of Victorian respectability, kitchen without food, nursery without children, so close it must have been larger than life. I grabbed my baby and rushed him upstairs, in case things got any worse. My mother, it turned out, had only a few bruises.

It's sad, though my parents love my son, as the saying goes, as much as they can love him, and who am I anyway to point fingers? I have my things. My excellent Swiss Army knife that comes with a teeny flashlight, my cell phone, a few pieces of art I would rather not have Nerf darts hanging from.

It's sad in a larger way, dark and liquid, like hooded eyes, or the sky at a certain hour, or evolution. We know, from chimps and Caledonian crows who scoop insects with formed twigs, from the memory and expectation of cats and dogs, the paintings of orangutans, we share most if not all of what we are. Tool use, thought, beauty. Yet who whips their young from their doodads and facsimiles? Lies in the past, face-in? I have seen my mother in the kitchen miming putting on the kettle, absent water. Homey, concrete, here, empty.



Unexplained lithium in the Milky Way. Photo courtesy of William P. Blair (Johns Hopkins University); data credit: Magellanic Cloud Emission Line Survey, courtesy R. C. Smith (NOAO) and P. Frank Winkler (Middlebury College).

DIS

"Are you the lithium?" a druggist once asked me, loudly. He meant the prescription, shouting carelessly through the store, but he was right: I was cyborg then, part metal. It's why I suppose I felt so tired, unable to exercise without stopping to pant. Lithium blasted straight from the Big Bang, a primeval metal, soft. Along with hydrogen and helium, lithium formed one of the universe's three original elements, present before stars and galaxies began to twist themselves into being. Its ions interfere with other ions floating around in the brain, settling things down, diminishing mania. It has perhaps the weariness of the ancient thing.

My lithium world reeked of metamorphosis: calling my doctor's office over a mysteriously refused prescription to have a nurse snap, "The doctor has expired," my husband pleading absurdity while she insisted, "No, not the prescription, the doctor has expired."

Later, a therapist told me the doctor and his wife (trying to explain how a young psychiatrist could have an expiration date) had committed suicide, leaving two very young children. The doctor and his wife had a disease, a very serious one, perhaps fatal, she explained, which seemed strange, so I poked around and learned the disease was the wife's depression. She took a lethal overdose

and called him, timing the call so he couldn't save her. Guilt-ridden, he killed himself too. No one involved saw the initial explanation as a lie.

My next doctor made me a verapamoid, a calcium antagonist, and I found the doctor mild and pleasant, though the drug never worked.

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Over the last few years I have been, unlyrically enough, asked to speak on panels about people with what was described to me as mental challenge or, in a punctuational gymnastic, (dis)Ability—with the capped "A" and parens supposed to render the split of me from my abilities an offhand thing. One panel had to do with the subject of obsession and one with the book *The Curious Incident of the Dog in the Nighttime* but really, it didn't matter. I came as an empty mouth. A psychologist sat on each of these panels, and, as I'd been invited to display my manic-depression, we formed the bookends of the business. He did (both happened to be men) the *them* talk: I know them, they go off their meds because they think there's nothing wrong with them. Then they get in trouble.

I got very angry and said "Them is *me*."

I wanted to say: believe me, I get it, my "wrongness," if you will. How could I not? As a young wife, I hid under the bed while my husband played back messages on our answering machine. I don't know what calls I expected, just that the blink of the light inspired panic terror. Poison gas and snipers came in and out of my world. I paraded around in sequins and glitter on horribly wrong occasions, my college graduation and most memorably, a grim, upper-crust Scottish Presbyterian wedding in Georgia. At times still I find myself babbling senselessly in front of students, who look embarrassed for me, or stricken, or amused. I can't fault the faulting of my judgment. Nevertheless, the statement, with its certitude about the state of my

cognition and behavior, predictable as a baby wetting its diapers, made me angry.

I suppose I behaved my stereotype on those panels. While I've had a number of surgeries and two years of an ankle problem that turned my walk into something resembling Shaggy's from *Scooby-Doo*, I can't say I know physical (dis)Ability as I do the mind's. And while I prefer the term "neurodiverse" or "divergent," I will hold for now with that silly term, veiling itself, like a nineteenth-century lady, in parentheses. I, as one of this collective, this tumor of *they*s squatting in the social body, have gone off my meds, when the side effects proved awful and in fairness, the drugs didn't work.

I went off lithium, though I never got my pre-lithium body back. Now I've become a sodium, a semi-sodium bound with an acid, coated in pink and handed out as depakote. It seasons that primordial metal still in there. When I went to look up depakote, I found the manufacturer's home page, depakoteer.com, the "er" for Extended Release, only I thought the name meant to characterize users as depakoteers, like mountaineers or Mouseketeers. It seemed admirable on the part of Abbott Pharmaceuticals, a jaunty fellowshipping, a nod to the unknown space Abbott asks us to travel with just the flimsy scrawl of its logo as a map.

No one knows why, or how, depakote works. This drugging might seem strange, risky, but that's true of most psychiatric drugs: the *Physician's Desk Reference* repeats "the mechanism of its actions is unknown" over and over—of gabapentin, for instance, which I also take. Many psychiatric drugs are prescribed off-label, meaning the FDA has only approved them for other disorders, typically epilepsy. Psychiatric testing can be short-term and scant.

Even when more testing exists, as with blockbuster drug fluoxetine (Prozac), which I take a small dose of, it's hard to say what the

tests tell. The FDA reviews drug tests but doesn't, itself, test; drug companies fund almost all drug testing in this country. In the testing of fluoxetine, the FDA considered four studies of the drug in approving it. One showed no difference between the drug and a placebo; three showed something of a difference, with the caveat that most patients, due to the side effects, dropped out. The trial of Prozac started with 5,000 patients and ended with 286.[1] With most anti-depressants and other psychoactive drugs, the results can be paradoxical: depression, anxiety, suicidal thoughts. Negative responses to fluoxetine appear so often the U.K. tries to limit its use in anyone under 18. Manufacturer Eli Lilly has settled hundreds of lawsuits for Prozac-related cases of violence and suicide.

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Given all that, it's hard to explain why I've chosen to go this route—to depakoteer, Prozacoteer. I can say it helps me, makes a difference in my mind, its Rabelaisian views of the world. I'm not sure the change is always a good thing. I used to find the sight of a dead deer or squirrel at the side of the road unbearable: the way legs twist and we learn they really can point in any direction, the look of fur lightly ruffling in the breeze, past use. Not the fact of death but the purely human nature of its cause, outside of time and evolution. I could mourn for days. I'm not sure this mourning isn't the least we owe. But I have no time, and so depakoteer gallantly past them.

I have refused plenty of medications, most notably haldol, a major tranquilizer prescribed by a man with the pinched look of an actor holding it all in for some climactic scene. He appeared (even my husband, trying to put a good face on things then, had to admit) to find me disgusting. The drug, which does what clinicians call "gorking," turned my mind into wet blue Kleenex and tweaked my legs in some compensating shimmy. I didn't take it and earned

[1] Breggin, Peter. *Talking Back to Prozac*. New York: St Martin's Press, 1995.

more drastic diagnoses, like schizophrenia. Noncompliance, I find, becomes like the medieval trial of the witch: if you sink into mindlessness, you're innocent but dead; if you manage to float free, you're guilty and still made dead.

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To bring to the lyric the mind and body that I have, and speak from the lyric soul, I cannot. I'm not sure what of mine can be called mine, body or mind; the lyric, with textbook definition of "the personal emotions and thoughts of a single speaker," wants a warm hand, not mineral. I am not an individual, quite, but a chemo-dual.

That "our bodies of difference," as Stephen Kuusisto writes, "offer crucial ways of knowing" I do believe. I can only give the cellular knowing of my chemical history, with the punctuation of what I suppose I really am, unmixed: hysteria under the bed, glitter. I can talk about 1970s psychiatry, the time I first encountered as a girl patients preyed on sexually, the awful, always visible electroshock machine, used as treatment and threat, its aftermath a gelled amnesia. I do not think, however, that such memoirizing would get to the question.

Perhaps we chemo-duals embody most perfectly the world we live in: what's been bred out of us defines us. Our culture has made cyborgs of many. "These candidates are animatronic," Jon Stewart remarked of the 2008 presidential campaign. "They've had their humanity managed out of them." Foucault writes in *Madness and Civilization* that my kin frighten humanity with a primitive fear, straining in Bedlams on our leashes; perhaps we no longer embody our past but our future, and our straining appears no less awful for the change. Visiting Bedlam lunatics used to be a Sunday jaunt for the Victorian upper classes; now we Bedlam lunatics get invited to sit on panels. Who do we entertain, parsing the pieces of our dis(Ability) for public view?

I have heard a thousand times the cliché that someone behaving disagreeably "must not have taken their meds" that morning, as if we who do take them ebb and flow daily with the sunshine, depending on the cloud cover of these occult, lifelong medications. I'm generally inured to the comment, though one day, at a committee meeting, a woman snipped that about students and I walked back to my office and cried. I'm not sure why. I wanted to snip back about everyone out sick who hadn't finished their bottle of antibiotics, something people also tend not to do. We live in a state of dependence and resistance to pharmaceuticals, from the tantalizing commercials promising dance and canoe trips to the doctors warning us that we must down these, every bland lozenge, or life will be worse than before.

Drugs can make you feel shitty, even when you need them. Men shun their blood thinners because if they take them, they can't get erect. Few argue the foundational right to the hard-on—the Pentagon distributes $50 million worth of Viagra a year. At the ER once, the doctor who'd treated my son for a near-lethal anaphylaxis told me only half his patients ever fill the prescription for the EpiPens that could save them. Politicians prosecute sex crimes and sleep with prostitutes, leave email trails of their illicit behavior. Human beings are foolish and fuck up themselves and their loved ones in any number of ways. My drugged tribe has ballooning weight and the inability to think or feel very much, zits, the shakes; and our noncompliance should not shock in the grand scheme of things. Part of me longs to leave the blur of medication, be like the man who would recognize what is his erect or limp penis and what is himself.

My medication is, though, a social drama. No one wants to face my oddnesses. And psychoactive drugging intrigues. It offers the mind

confronting itself: a small bit of tragedy, with a necessary death and rearrangement at the end.

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They never take their meds. That statement, the dailiness of it—uttered by professionals of me, to me, (as though part of my social ugliness were my ability to own the third-person plural), or by others dismissing the world and its moods as a pharmaceutical complication—haunts me. Why I'm not sure. I think of those panels where I come to wave the fact of my living on medication, the wafer of redemption, and own my faults. Medication serves as the highest synecdoche of what is labeled illness of the mind: taken, it proves a mea culpa of illness; not taken, it also proves a mea culpa of illness

Medication melts us away, into chemistry and metaphor. As does the cause of it. A book I otherwise love describes Bosch's Hell as "the mind of the mad, dark and duplicitous. We are all manic-depressives, with mood swings banging against brass." *No*, I think, reading this. *Madness is not hell, or deceit—it can be that, or its opposite, as with all things human. And no, everyone is not bipolar.*

It's hard to explain how I can believe that depakoteering is the right decision for me to make, though I have no use for the "medical model," the model of mental difference as straight illness, like a neverending flu. Biopsychiatry has taken over the field, pushing aside Freud's dreams and mothers; now we look to genes, neurotransmitters. The mind is not, nor can it ever be in the reaches of metaphor, the body. Thought is not microbe. The "I," skinny holder of self and lyric, hides in the crevasse of the sulcis.

The growing mad pride movement speaks of "mad gifts"; a brilliant student of mine called her bipolar disorder "a gift with a shadow side." Living with this consciousness is not something to be cured of or to have wiped out or to overcome; it needs to be managed (body extracted from bed), and so I'm salt, cyborg, and I go to that with sadness, as you'd authorize, perhaps, an amputation—not of a diseased limb but one that would slow you down, in a rough, jouncing place, a Ship of Fools.

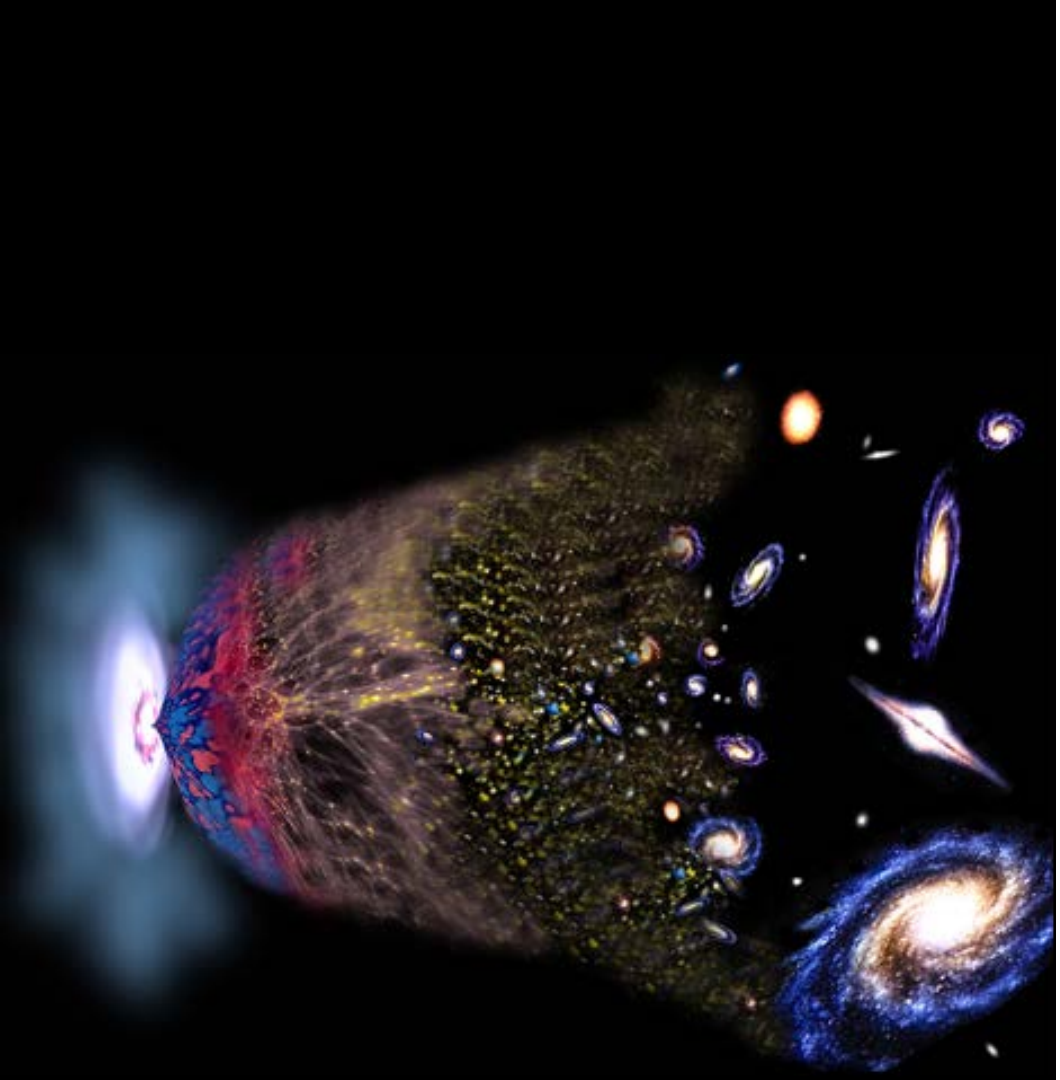
A psychiatrist in Atlanta, Nassir Ghaemi, has urged a change in understanding the depressive side of manic depression as an existential, not a biological, state. Known for its intractability, this form of depression, he writes, actually "springs from the failed hopes of mania." I accept that, though I add that the failed hopes of mania transcend the personal—for love or success or nicer dahlias this year. I find this depression forms my trips to the Underworld, the proper Dis of my disability, where spirits murmur of a world that cannot be wholly beautiful, and creatures so frail, soulful and fleet we would have invented them cannot live their lives without falling under our metals. I come close to writing: How ironic, perhaps awful, that the shadow side of the gift is its capacity for hope.

Why not say that, and leave it at that? I'm not sure. I worry that our human taste for irony forms its own medication, seasoning all with a palatable bitterness. Yesterday, on a European border, a giant supercollider came online, sending protons careening around and around 17 miles of frozen space to see if the particles would fly apart into the subatomic mash of quarks (quarks, like human societies, have quite a set of cliques: up, down, charm, and top and bottom quarks, the last two also known as Truth and Beauty), muons, leptons, and so on into helium, hydrogen, and lithium, recreating the first seconds of the Big Bang. Scientists used the facility to find the Higgs Boson, the force that holds all matter together. A handful of lawsuits, here in the U.S. and overseas, tried to prevent the supercollider from going online, due to the remote chance it could lead not to the God Particle of the Higgs but to the

Armageddon of unleashed, untameable black holes and strangelets that would convert us all to their substance.

The lawsuits ultimately went nowhere and the collider started. Ideas floated for the opening ceremonies included a joking one of dancers dressed as lithium atoms. Bodies of lithium twisting, doing a pas de swoon round the underground chamber. Silliness, you could say, or a kind of sudden, fierce drive toward the primitive—hunters dancing around the fire dressed as their prey.

The only reason for time is so that everything doesn't happen all at once.



Signals from before the Big Bang—were telltale patterns glimpsed in the afterglow? Accelerating stop and go expansion. Image and caption courtesy of The Daily Galaxy. Photo courtesy of David A. Aguilar (Harvard-Smithsonian Center for Astrophysics).

THE ARROW OF TIME

My mother, a *homo sapiens sapiens*, a member of a top species in evolutionary terms, died four months ago. She was 94 and in her sixth year of Alzheimer's and had, in spite of her weakness, become an impossibly restless body. She rolled. She swung her legs from one side of the hospital bed to the other. She flailed her arms. At the hospital she had to be restrained with a thick belt attached to the bed. This state of things went on, more or less, for five weeks. That belt looked overwhelming on my tiny mother—four foot 10 and maybe 90 pounds at the time.

My mother's confinement enraged her and her body worked like a thing possessed. She reminded me of the souls in the Middle Ages who danced the tarantella to exhaustion because they thought it would cure dangerous spider-bite: she did not seem as if she wanted to move so much as that she had to. My mother, who no longer had a clear understanding of her life, wanted to live. In that drive she wore herself down, and her body seemed on the verge of flying off into its constituent parts—the primal molecules, the fissioning stardust, the restless matter.

⁂

In her anger and her frenzy my mother threw punches at people and scratched them, both nurses and aides, and her family. She told us—my father, my brother and me—how useless we were, sent us away, then pleaded for us to come back again. She turned her nails against herself. When my mother died she had a face scratched by her own hand and a black eye no one in the facility had been able to explain to us. My husband and I worried that some health-care worker she turned on had lost it and hit her back.

⁂

As I say my mother has died, I recognize that, in some form, she has—we have—always existed, and we continue. Not in the sentimental, lives-on-in-our-hearts way. Star matter, asteroid, primal elements, the stuff of us has lived with a tenacity our present self can hardly conceive. Frozen; fissioned; sucked in; spat out. What feels most solid in us (that heaviness around the waistline) may at some point have existed solely as energy. No belt could hold us back. Then the stuff of us attached, grew organs and a brain, pulled together to bring us to this key word, "I."

Evolution is the process by which we have come to be in the state we are—a body with hands and opposable thumbs, a consciousness that narrates ourselves to ourselves—that can designate itself with the personal pronoun. Evolution is the reason I could live this narrative, that of a daughter losing a mother. My mother disassembled before me, something that, until it happens, never seems possible, not with the people who feel foundational to our lives.

⁂

My mother requested cremation. Her ashes now rest in a place my father calls, in his Brooklynese, a "moo-soleum," for "mausoleum."

I made the mistake of Googling "cremation" as we ordered the wooden box for my mother's dust. (And the first time I typed this, I turned "cremation" into "creation.") I had always imagined cremation as the coffin pulleyed into a purifying fire, then the return of the ash pile—rich, heavy, with chunks of bone. Actually I learned the fire largely skeletonizes the body, and what's left goes through a grinder to finish the job. I had come to terms with the death, the woman who'd grown restless as the atoms that made her, even the ash. I wasn't ready for this, for the grinding. When I read this fact I cried as I had not cried before.

⁂

People tell me the woman who railed at me through the last weeks of her life was not my mother, not really. It was her disease talking, they say; she had succumbed to the Alzheimer's, an alien force. *It wasn't her.* As if she'd disassembled already. Though I recognized my mother's anger as herself, pure—she had gone raw and deep, beyond and below her filters. As she lost her fiancee in the Second World War, she had been that person. As she gave up her job and stayed home with us children, she had been that person. As her own mother left her four children again and again, only for my mother's two to cling to her in the kitchen of our apartment, she had been this: restrained. Angry. As poet Rainer Maria Rilke put it of the Chamberlain's death in *The Notebooks of Malte Laurids Brigge,* my mother died her own hard death, one she had carried her whole life long inside her.

⁂

In physics, the question of why life (instead of just matter) exists is a foundational one, a question that's inspired answers ranging from dumb luck to overlapping multiverses housing every conceivable reality. Another answer is the Strong Anthropic Principle, which

holds that in some way the universe needed to make the creature that could observe it—it takes our conscious "I" to see and say "*This, this world, here*." At this point physics becomes philosophy: why would the universe need to preen like this? Some give God as the answer (God needed us to know God) for what's known as the SAP. Others do not, leaving the cosmic motives open.

In grief, though, it's not so much the how-did-something-come-from-nothing question that stings, but the return to nothing again. It's the creation versus the cremation: the elaborate making of consciousness only to have it blink out. The stuff of my mother exists—but where is my mother? How does her cosmic moment (her crossword puzzles, the knee-high stockings she wore, her children, her anger) matter, in this universe of restless matter?

A new theory by MIT's Jeremy England has it that a group of atoms driven by an external heat source like the sun will keep restructuring itself in more and more complex ways, as complex life forms dissipate more energy. A rock does a poor job of drawing energy from its environment and releasing it, for example; a human being, with a body that runs at nearly one hundred degrees, who eats, breathes, maybe reproduces, does a better one. It's a fundamental law of physics that energy tends toward maximum dispersal—the second law of thermodynamics or the "arrow of time," the law of increasing entropy. England applies the second law of thermodynamics to evolution. Energy has an innate tendency to spread itself over a greater and greater area and grow inert. It brings about complexity in order to break it down. There is no grand *why* or ontology to this theory: it's just the nature of matter.

⁂

When I read Jeremy England's theory I think of evolution as having a lot in common with art. The same outward-dispersing drive, the same reaching for complexity in order to arrive at what is, at last, both far-reaching and simple. People die. And because of that, we hurt. We inhabit the complications, the particulars, to spread what is most common and indivisible around.

⁂

The priest and paleontologist Teilhard de Chardin wrote in *Hymn of the Universe* that the consecration of the host, and the incarnation itself, "spreads throughout the cosmos"—*the entire realm of matter is slowly but irresistibly affected by this great consecration*. The drive of the incarnation is to sanctify matter, to pass through it and, in doing so, change it, as if consecration too follows the laws of physics. Like art and energy, its drive is outward. Like evolution, if England is correct, it uses complicated forms in order to render them simple: ultimately, we become beings through which a light passes, in the same way the forms rendered by evolution dissipate the energy of their star.

⁂

When my mother finally died my brother said "If there is a God, then he's a motherfucker." I didn't know what to say to that. We were gentle with each other then. *I can't quite see that*, may be what I said. Maybe nothing. In one of her last outbursts my mother recalled being a child, sailing a small boat: after an instant of peace she began screaming "I never appreciated it! No, I never appreciated it!" She shrieked and she wept. This recurred: the quiet memories; the fierce regret. The thought of the life she'd lived, plain and inert as I know it had felt to her, filled her with aching nostalgia. This particularly broke my brother's heart.

⁂

What my mother said about her childhood shattered me, too, but in a different way than it did my brother: it seemed to me she arrived at a knowledge it takes a painful lifetime to achieve. There is joy, or peace, or something it's impossible to name, in all this, in the long and arduous and impossible process of being shaped matter, many energies passing through our bodies. Evolution, art, consecration: we are, as Pere Teilhard put it, *volatilized.* At the end, if we're lucky, we'll see the shining. And we never appreciate it, never, or not enough.

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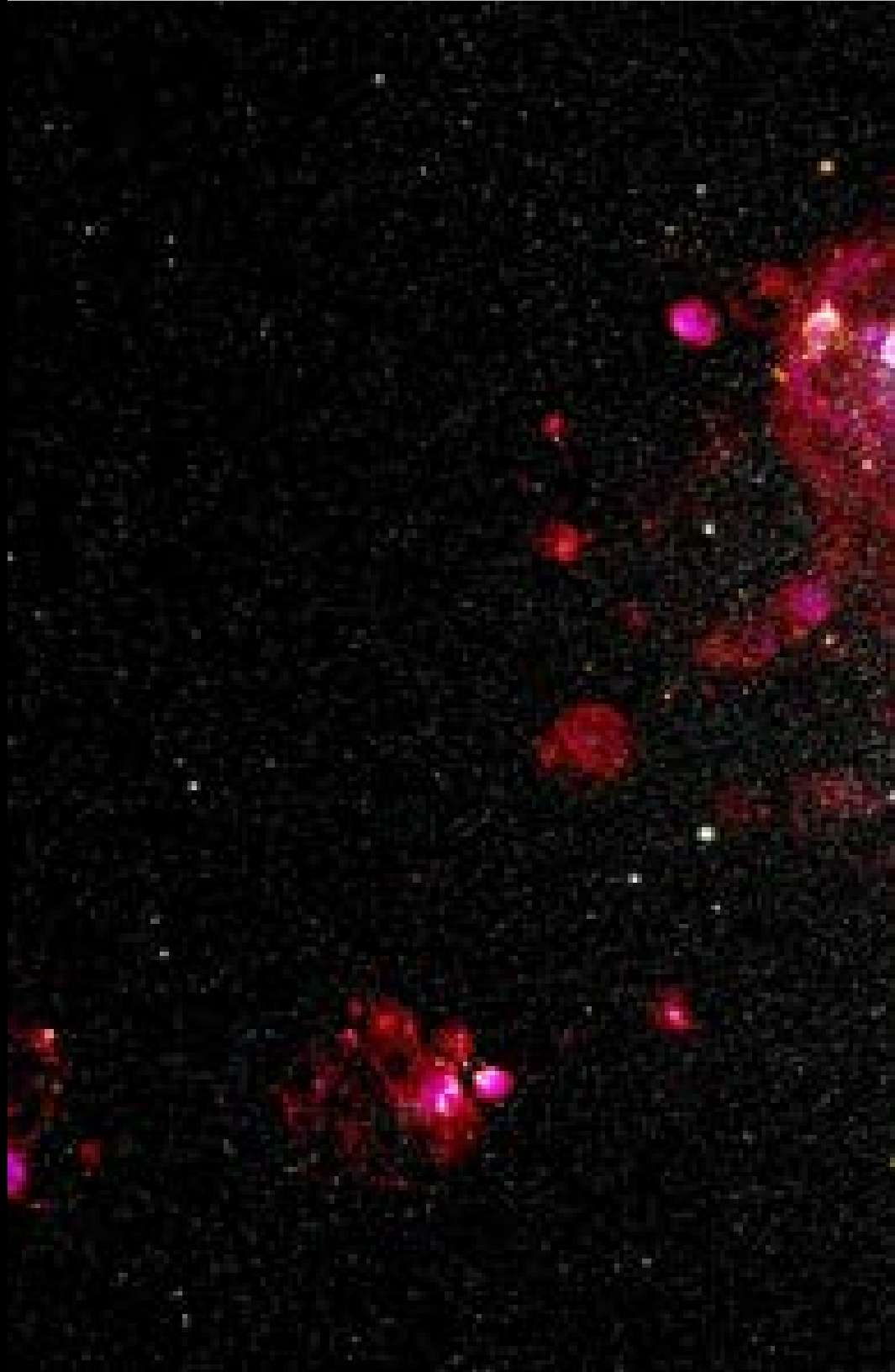

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