March 21, 2013

Dear Margaret,

Over the years I have often been urged by friends and family members to focus on art instead of gravity. Naturally I acknowledge the good intent of this advice; yet, from my perspective it is based on misunderstanding. The advice would coincide with my own sense of priority were it not that what keeps emerging from my study of gravity appears incomparably more beautiful than any human creation. This may not be true of every scientific discovery, but it would certainly be true of this one, were it to be confirmed.

One of the challenges inherent in such thoughts is that the purported beauty does not leap out at the audience with the immediacy of a painting. It is an unfamiliar kind of beauty that takes some study and contemplation to perceive. In a certain sense it is a credibility problem, which becomes weightier still because of a well known fact: Everybody knows how unlikely it is in real life for a slum dog to become a millionaire. Little old me cannot possibly know the answers and the questions that Big Al and his minions have been erroneously overlooking or kicking aside for decades. Big Al is the veritable icon of genius. Who am I to doubt his authority? To see how the authorities may indeed have erred and why the answers and questions I propose should be given serious attention, again, requires considerable study, contemplation, and freedom from a wide range of preconceptions. Happily, the most absolute and unerring authority is ready any time to decide the matter. The thing I want least is to keep Nature waiting.

A recurring theme in the history of physics is the plea for new ideas, especially when—as has been true for the last few decades—the subject is entrenched in a gripping mental quagmire. Conceivably, a slum dog is more likely than a rigorously trained math geek to see the way out. The following comment by the physicist John A. Wheeler, implies the possible truth of this, because he stresses the need for utter simplicity:

> To my mind there must be, at the bottom of it all, not an equation, but an utterly simple idea. And to me that idea, when we finally discover it, will be so compelling, so inevitable, so beautiful, that we will say to one another: How could it have been otherwise? [Interviewed in PBS video, *Creation of the Universe*, 1985.]

With this irony-packed comment in mind, let us consider the problem of *mass*. (Warning: in what follows I intend to hammer on the word *simple*. The other words in Wheeler's remark, *compelling*, *inevitable* and *beautiful* will be left to reside, perhaps, between the lines.)

I suppose you've read or seen some of the recent hoopla about the *Higgs boson*, also known as the *God Particle*, or the *Particle at the End of the Universe*—as the circus masters would have it. Supposedly, this particle is *associated with* a *field* that *gives mass* to other particles. (Each of these italicized words and expressions is a suspect in the flimsy story to follow.) I think an unbiased investigation begins to expose most of the exploits of particle physicists as little more than an inconsequential game of stamp collecting.

The Higgs field supposedly "gives mass" to the quarks and leptons that make up ordinary matter. First of all, note that it is typical of physics these days that its practitioners unapologetically use weasel words like "gives" to camouflage their ignorance. Another classic, often-quoted example is one authored by our same John A. Wheeler. Wheeler pretends to explain gravity by saying that "matter tells spacetime how to curve and spacetime tells matter how to move." The word, *tells* plays the same role as the word *gives*. It is never explained how the orders are carried out or how the transaction takes place. What does matter *do* to make spacetime curve? This is the *crucial* question that gravitational physicists ignore by hiding their heads in mountains of mathematical sand. Exhibiting the same kind of disconnect from physical reality, the idea proposed by particle physicists, of a field that gives mass is clearly not logical unless the alleged giver possesses the mass to give in the first place. Does a Higgs field *have* the mass to *give*? No. If it did then it would be possible to weigh it. But it is not possible to weigh the Higgs field, so a careful detective (if not a street-wise slum dog) suspects a rat in the story. Notwithstanding the world famous data spike that is called a *particle* by the same name, being itself unweighable, the Higgs *field* is really just a mathematical abstraction. Mistaking abstractions for reality is a rampant plague in modern physics, made all the more serious by the growing numbness of its victims.

Next, even if we assume that the ploy of *giving mass* makes a lick of sense, we are not often told that this alleged gift amounts to only a fraction of the total. *Dividing* mass into Higgs-applicable and Higgs-nonapplicable categories results in an immediate loss of simplicity. Why would Nature have a mechanism that "gives" only some mass to a chosen few recipients and have a different mechanism for the rest? It doesn't seem at all natural. The suspicious fact of the matter is made plain by considering the small extent to which the alleged mass-giving mechanism applies to the bulk of our actual weight. The bulk of our actual weight is in the form of protons and neutrons in atomic nuclei (nucleons). Inside nuclei the Higgs-given mass is allegedly only the *rest* mass of quarks. Aside from the intrinsic unobservability of quarks—which further deepens our suspicions—this account amounts to only about 5% of what makes us weigh. Only 5% of the mass of protons and neutrons is due to the proverbial generosity of the Higgs. The other 95% supposedly comes from the *energy* of the quarks and from that which allegedly binds them. This other 95% is supposed to arise by virtue of quarks' relativistic motion within nucleons, and by adding in the energy of the color-field, strong force-mediating *gluons*. Contrary to the impression physicists often try to sell, the resulting conception of mass is chopped up and very complicated.

Beyond this bizarre array of variously behaving microscopic thingons, the cosmological scheme arising from the same kind of fragmented thinking, would have us believe that the rest mass contained in atomic matter is a yet smaller small fraction of the cosmic total. Most of the mass of the Universe is supposedly an elusive kind of *exotic dark matter*, which is not "given" its mass by the Higgs field nor by "ordinary" quarks and gluons, but rather in some even more mysterious way. Altogether, this catalog of fantastical stuff (known as the *Standard Model of Particles* and *Inflationary Cosmology*) built by the world's foremost theoretical physicists, gives the impression of a sloppy, unwieldy contraption that is scarcely worthy of Nature herself. Frankly, it's a preposterous mess.

Perhaps this should be expected, since the whole industry is all about smashing matter to bits. Matter is not being observed in its natural state. Instead, physicists torture it with extremely violent methods. When you blast things to smithereens you end up with a mess. No big surprise. But physicists have invested in this enterprise so heavily that they coddle it like a baby. They have been trained to see it as beautiful. Enigmatic loose ends are sometimes admitted. But the gist of the message sold to the public is one of magnificent triumph. Knowing how impressed people are by big expensive machines and knowing that, as masters of the machines, they are looked up to as gods, physicists have become too corrupted to conceive the need for finding a simpler, more humble and more plausible alternative. Might there be a gentler, yet more effective way to discover the essence of matter? If there is, how do we bring about the needed change in strategy? Would a typical adolescent boy rather play with ordinary objects of everyday experience, or with shiny monumental, hugely powerful, explosion-producing machines? Does a dog knit sweaters or bark at the mailman? Wheeler's initial quote is one of the many instances of lip service being paid to the need for simple new ideas among physicists. Alas, their little boy proclivities and their enormous investment in the monster they have birthed defies the cheap advice, as it tugs them back into the morass.

How shall we transcend this ugly picture of babel? To begin, we must underscore the importance of the persistent, yet routinely overlooked fact that *the physical effects of mass are extremely simple*. That we experience these effects every moment of our lives explains why we tend to be oblivious of them. If the effects are simple then, out of respect for the economy of Nature, should we not expect the Universe to produce them by the simplest possible means? Yes. We would do well to expect that the essence of mass is (as Wheeler anticipated) something simple, not the monstrosity described by the drones at CERN, Stanford, Oxford and MIT.

In class a few days ago, when you referred to magnetism as being positive or negative, I felt compelled to correct your slip-up (it's N or S) because electricity and magnetism are each and together complicated enough without confounding one for the other. We have (+), (–), (N), (S) and probably dozens or hundreds of ways to measure electromagnetism's multifarious effects: voltmeters, ohmmeters, gauss meters, watt meters, amp meters, spectrophotometers, bolometers, oscilloscopes, radios, televisions, etc. etc.

By contrast, raw *mass* has but *two* essential manifestations: *inertia and gravity*. They are measured by essentially *one* instrument, which can be modified so as to appear as two: an accelerometer and a balance. Inertia is a measure of mass by virtue of a body's resistance to change of uniform motion; i.e., a resistance to being *accelerated*. Gravity is a measure of mass by virtue of whatever it is that causes flat tires to be flat only on the bottom. This is the same thing that gives accelerometers attached to massive bodies non-zero readings. Inertia is *resistance to acceleration*; gravity is the *manifestation of acceleration*. The essence of mass is evidently something intimately related to acceleration.

Try to nudge a bowling ball. What must the ball be *doing* to resist being accelerated? Think about it simply. What must it be *doing*, what physical process could explain this behavior? Notice (to reiterate) that the effect is extremely simple. You push, the ball resists. We can be sure that Nature is not calculating the quark content of the thing, nor concocting some magical fields to "give" the ball some *percentage* of this property while leaving the rest to

some other complicated behavior. By the same token, we can be sure that Nature does not compound the complexity by invoking a wholly separate Department of Gravity which dictates its "mediation" by the "exchange" of miniature, momentum-inverting magic bullets (gravitons) between bodies. Clearly this picture is way too cartoonishly contrived. (Yet, it's the standard wisdom.)

What *simple* thing might the mass of Earth be *doing* to produce the flattening of our undersides (without also flattening our over-sides)? Remember, flat tires are only flat on the bottom. If it were *our* job to produce this effect, we would discover only *one* way to accomplish it: acceleration. We would need to provide a source of propulsion. The effect of flattened undersides can be produced only by acceleration. This is a fact of human experience. Why should it be any different for Nature? Maybe it isn't. Whatever the mass of Earth does to flatten its inhabitants' undersides, notice that it is doing it in *every direction* all around the globe. These facts imply a synthesis: The *resistance* of a body to accelerate in a *linear* direction (inertia) is due to its *manifestation* of acceleration in *every* direction (gravity). Mass is evidently an endless source of propulsion, generating space as it moves continually outward.

Bowling balls are hard to move in *one* direction because they are perpetually generating space in *every* direction. Little accelerometers attached to the bowling ball measure this omindirectional gravitational effect just as a spring balance (i.e., a modified accelerometer) measures the linear inertial effect. The simplicity of these two manifestations of mass imply that the logical explanation of their mechanism will be correspondingly simple *and unified*.

Note that the effects have been historically thought of as being independent of each other. On one hand there is *inertial mass*; on the other hand there is *gravitational mass*. That these two conceptually distinct concepts of mass should conspire to give the same numerical magnitude is, according to standard physics, an unexplained coincidence. If the idea proposed here is correct, the coincidence is no longer unexplained; it is clearly understood as a simple (inevitable? beautiful?) unified mechanism: the generation of space.

By contrast, the so-called *Higgs mechanism* has no known relationship to gravity. Particle physicists freely admit that their particle smashing research totally ignores gravity. They regard gravity as irrelevant and inaccessible with existing technology. The idea that mass can be understood in any meaningful way *independent* of gravity is in itself so dubious that doubts should be maintained toward any theory that purports otherwise. Is it not obvious that Nature would *know better* than to divvy up responsibility for producing the manifestations of mass in so many complex, fragmented ways? By the above simple reasoning we conceive both manifestations as being due to one and the same physical process. What causes little accelerometers on the bowling ball to give non-zero readings is the same thing that makes the ball hard to move. Omnidirectional acceleration of space causes (is the same thing as) resistance to linear acceleration.

Of the many profound consequences of this new conception of mass—if it turns out to be correct—one of the most important should be mentioned here. The new conception of mass sheds a bright light on the otherwise persistent enigma of *time*. Physicists are troubled by the nature of time for many reasons, one of them being its manifest unidirectionality. This is a problem because the established fundamental laws of physics fail to explain it. According to

these laws—which abide by the ancient preconception that matter is composed of *static* chunks of stuff—time may just as well go backward as forward. The standard conception of gravity is a perfect illustration of this.

If a hole is drilled through a body of matter and a test object is dropped inside, the gravity of the larger body is supposed to cause the test object to oscillate back and forth from one end of the hole to the other forever. A video of this motion would attest to the reversibility of time because it would look exactly the same whether played forward or backward.

By contrast, if we regard accelerometers as telling the truth about their state of motion, if matter is actually a manifestation of perpetual propulsion, then gravity does not pull the test object into the hole. Instead, the space that initially separated the test mass from the center gets perpetually pushed outwardly past it. Though initially appearing to fall downward, just as in the standard conception, the motion would eventually deviate from the oscillation prediction. Since nothing pulls the object downward, it never passes the center. Therefore a video of the motion played backward can be definitively discerned as being played backward. The reversed video shows the test object ascending to the surface, which is something that (according to the model) never occurs in Nature. The upshot of this is an unequivocal demonstration of the one-way direction of time. It would become transparently understood that time only goes forward, time only increases because space and matter also only increase. The physical process by which this happens is gravity. Time, space and matter are thus seen as continuous, interdependent physical elements whose perpetual outwardness is exhibited in the readings of accelerometers and the flattening of our undersides—every day, all the time.

The idea of gravitational *attraction*, by contrast, fails to provide a sensible understanding of mass: Why are there two kinds: gravitational and inertial? By insisting on the attractive nature of gravity without testing it inside ordinary bodies of matter, we end up with the complicated and mostly irrelevant concoctions of modern particle physics. And we remain utterly lost with regard to the huge problem of time. Here again we see that the problems dissolve if our simple interpretation of accelerometer readings holds true.

In any attempt to understand physical reality, Newton observed that

> Nature does nothing in vain, and more is in vain when less will serve; for Nature is pleased with simplicity, and affects not the pomp of superfluous causes…Therefore to the same natural effects we must, as far as possible, assign the same causes. [*Principia*, Rules of Reasoning in Philosophy, 1686.]

Based on this advice (which is echoed by Wheeler) we expect that *accelerometers giving non-zero readings do so because they are accelerating*. This simple interpretation leads to the prediction that the dropped test object does not pass the center, and that time necessarily unfolds in only one direction. Is the picture emerging here simple enough to possess the beauty of truth? Is it time to ask whether it "could have been otherwise?" Is there any more worthy cause than to seek to find out?

Galileo proposed the holey sphere (Small Low-Energy Non-Collider) experiment nearly 400 years ago. In a world that abided by the ideals that Galileo famously fathered—to insist on empirical evidence in matters of science—this research would be quickly consummated by

conducting the test. It is a physics problem, a conceptually simple, technologically feasible and *obvious* physics problem. In the world as it is, unfortunately, the community of physicists is preoccupied with other things. We are left with the considerably more intractable problem of getting their attention and changing their stuck minds. The authorities' attention needs to be diverted from their expensive toys and monstrous delusions long enough to get them to look for a moment at the huge domain of ordinary matter in its simple undisturbed state, *where they have not yet looked*. Solving this psychological, sociological problem has turned out to be a tall order. In simple terms it has become a *marketing* problem.

Our need is some kind of inexpensive, peaceful, yet effective attention-getting device. The product needs to be re-packaged and distributed as widely as possible so that some oddball simplicity-seeking physicist out there may find it. If I don't keep working at this task, who will? To my knowledge, nobody else yet sees the vast range of applicability or the robust viability of the model. It is too unfamiliar and too contrary to standard wisdom. Presenting the model requires considerable bandwidth devoted to cleaning our mental slates so that the standard wisdom can be exposed for the barren dead end that it is, and to foster receptivity to a whole new way of looking. Evidently, my mission requires finding someone who is both familiar with and suspicious of what has come before as well as capable of adopting a detached, beginner's mind. The search for such a person is surely less likely to succeed by playing in a box of paints than by continuing the serious work of waving my hands, wiggling my lips and scribbling away with equations, graphs and physical ideas. My brushes will just have to wait.

Thank you once again for hearing me out.

Sincerely,

Rick

PS,

Fast-forward to a game of Inverse Kindergarten Jeopardy in the year 2213. Contestant #1 is Frankie Baby the Wilczek, a 21st century Nobel Prize-winning physicist who has been recently revived from cryogenic stasis. Contestant #2 is six-year old Calvin the Whippersnapper. The million-dollar question is: What are the fundamental manifestations of matter? Frankie Baby goes first: "Higgs-field interaction plus quark-gluon plasma plus dark-matter thingies plus spin-2 gravitons, with a holographic side of chromo-supersymmetric Planck-scale stringbranes; basically, believe the ancient Greeks." Calvin's answer: "Accelerated generation of space; basically, believe the accelerometers." Guess who wins.

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