JUST WONDERING IF EINSTEIN WENT FAR ENOUGH

or

WHOA, NELLIE, WHOA

I've come up against something that's got me wondering if Einstein might have been wrong on a couple of points. His genius has animated much that has defined the times in which I have lived: atomic bombs, relativity theory, pleas for peace. He reimagined our place in the universe, and we've followed -- amazed -- in his footsteps. His all too evidently certain, surely certain, footsteps.

But I've grown up with the ideas of a relative universe, and I'm wondering, now, if we have gone far enough. Note: I am not proposing what follows lightly. I understand that he's the intellectual giant of our age. His very name is a byword: to describe an averagely competent guy we say, "He's no Einstein, but . . ." I know and understand that -- so it's with some trepidation that I propose that he's wrong on a couple of important points. Because, believe me, I'm no Einstein. But . . .

Bear with me.

We are now realizing that nothing can ever be accurately, precisely measured -- because there's an infinity of something at the end of every scale, and because our tools of measurement and frames of reference are always changing. This is not to say that we can't measure to an extremely useful precision: we obviously do. Our mastery of the useful has given us the industrialized, digital, supercooled present and future. We may not know exactly what is going on at the boundary between one atom and the next, but our theories give us a close enough approximation that we could destroy much of the earth's present biosystem in nuclear holocaust. And we're very good at houses, and cars, and logarithmically miniaturized computer chips. But, in truth, we can't ever get a completely accurate reading.

This has happened to you. To me. We pull out a ruler and want to mark an object that is 3" long. We do it. We mark another, line them up, and they're slightly off. The pencil was too fat; the ruler slipped; the light changed.

The marks may be good enough for us to proceed, since "exact" is not necessary when dealing with pencil lines and rulers; the idea gets across. The fence gets built. But they don't strictly line up if you reduce the scale far enough. If you want a mark exactly 3" from the side of something, you can't use a pencil. The tip is too fat. So you use a pin. -- But, that, at some level, also marks on both sides of 3". You could use a laser, but that also has magnitude, and is on both sides of 3". And so on. We may be able to mark 3" in a way that is good enough for government work, but the point that is exactly 3" from the side of our object is really only a point in our imagination: the "side" is vague, the concept of an inch is vague, and as you get closer and closer to it -- as the pencil becomes a pin becomes an atomic prick of the universal fabric -- there's always something smaller. This is my point that there's an infinity at the end of every scale.

No matter how close you get to an object, you can always take a step that is halfway there, and half of that, and half of that, forever. For all practical purpose you are there, but at some level you are not.

And this is true of all scales, of all measurements: of heat and cold, of velocity, of weight. We can't ever really say, "Yep, I'm right on it", unless we're dealing with crude, rule-of-thumb, day-to-day matters. Because we may be right on it, but we're also on the left of it, the right of it, under it, over it -- and when we really get picky, we can't even accurately define what "it" is.

The problem is made worse by the fact that our instruments of measurement are fallible. The ruler may expand or contract with heat and cold; air pressure at sea level differs from air pressure in Denver, and that change in density must be accounted when deciding at what temperature water will boil, affecting thermometers (or, at least, our use of thermometers). This is the whole issue raised by Heisenberg's principle of uncertainty: just the fact that we observe a phenomenon can affect the phenomenon.

In short, there is a level of uncertainty that is inherent in trying to measure things.

And that has to be true. Because, in fact, the whole idea of "things" is suspect if you take a large enough view.

Consider four oranges. That seems pretty obvious: they are oranges. There are four of them. But if you inspect them closely, they are not alike. One will be a little larger than the others; one will be juicier; one will be less round; one will be . . . They won't be identical because no two things can be exactly identical unless we imagine them so. It's convenient (wildly convenient -- we couldn't live otherwise) for us to use the word "orange" for the agglomerations of mass and energy that make up our idea of an "orange", but in reality an orange is in a state of flux. It was a bud, then an unripened (green) fruit, then picked and stamped and squished on the back of a truck, and at some point will probably be peeled and eaten, or will degrade into a mound of moldy spores -- the point being that the "orange" is really an agglomeration of matter and energy undergoing constant change. It's not the same orange from day to day: it didn't begin as an orange, it won't end as an orange. Similarly, you aren't the same set of materials you were yesterday: cells have been replaced, skin flaked off, memories made and lost. It's convenient for us to think of ourselves as discrete, lasting entities (I know that's the way I feel), but I know that physically I am changing all the time; emotionally, all the time; mentally, all the time. I am not the same as when I was a child; I'll be older and feebler as time passes; I may or may not agree with everything I am saying in this essay five years from now. It's convenient to think of me as "me", necessary for me to think of me as "me", but we can't really measure what makes "me", because it changes.

So, when we deal with "things", what we're really doing is supplying names to agglomerations of matter and energy which are temporary and changing. That's why nothing can be measured, ultimately, because matter and energy bleed into one another constantly. We interact at the indeterminate borders, but the borders are fuzzy.

Count your four fingers on your right hand. What does it mean that there are four fingers? Should we say five? Count the thumb? And where does the first finger stop being the first finger and become the second? They're connected by that webbing. We think of them as fingers because it's convenient, useful. It allows us to count and work and live, but when we really think about it it's hard to define exactly where one finger ends and the other begins. And they're each different from each other, and slightly different than they were yesterday, and very different than when you were a baby.

And it's not just organic matter that is bleeding into and out of focus. Rocks erode and become salt in the sea, and dry as grains of sand on a seashore, that becomes dust in a cloud over Africa. Take a long enough view and nothing is stable.

Now, I don't want to beat an obviously dead horse. But I'm going to be challenging Einstein, so I'm trying to be clear. On the one hand, it's going to be important if I'm right. On the other, I'm looking forward to understanding why I'm wrong. So, if you would, hang in there. I'm blocking out the steps of my thinking as best I can, even if they seem obvious. Because somewhere someone is missing something.

The mystics tell us, modern science tells us, that we are all one. That the universe is connected. This seems to me to be absolutely supported by the facts. In physics we talk about the conservation of energy and mass. In religion we talk about oneness with a supreme being that is all around us. This is the point that we are never quite the same, that the four oranges came from ashes, are going to ashes, that the gabbro in the high peaks of Turkmenistan will someday be dust on which water droplets crystallize over the Arctic. There is constant interplay -- and that's why we can't measure anything accurately. At some point, given enough time, no object is distinct from another. We are constantly bleeding into and out of one another in a never-ending, highly complicated, incredibly spectacular dance.

Which Einstein encapsulated in his famous equation: $E = mc^2$.

E is energy. m is mass. c is the speed of light. Energy and mass are related. They work with one another. That's what we're seeing when we say that all material and energy is one: the four "oranges" are present agglomerates of energy and mass, that interact with other energy and mass to become riper, less orange, sour, bigger, whatever.

Right. Of course, right.

But here's the thing. It's hard to measure what's happening, exactly, as this goes on. As we've seen above. And this is where I started to realize that Einstein, as right as he is, may be wrong on some points. Critical points.

And here's how I got to that statement.

I began to wonder why E and m are related by the speed of light. That E and m are related seems obvious once you realize that the mystics are right, that we are all part of one constantly interacting thing/process. But why are they related by the speed of light? What has light got to do with it? And why c^2? That seems almost too magical to be believed.

Then it struck me. It isn't c, as a number, that is important. The number changes depending on the units involved. The speed of light can be expressed as 186,282 miles per hour, or, as physicists prefer, 229,792,458 meters per second. It could as well be expressed as some other kind of distance per time interval: 8 bazillion monkey steps per half-week, if we wanted to. What's important about c, then, is that it introduces units of time and distance into the equation: miles and hours, meters and seconds, monkey steps and half-weeks. If you're going to relate E and m, energy and mass, then you will have to do so with time and distance.

Bingo.

And it works, of course. Hiroshima and Nagasaki, if nothing else, showed us that you can create an enormous amount of E, from m, when you compact time and distance, and turn one into another.

But my world slowly began to unhinge -- because we're back to measurements, this time of "time".

Now, before I go further, I should deal with a point raised by friends of mine who read an earlier version of this essay. The equation of $E = mc^2$ doesn't just use c, the speed of light, as the constant. It uses c^2, i.e., you start with, say, 186,282 miles per hour as the speed of light. Squaring it, it becomes 34,700,983,524 square miles per square seconds. The relationship of E and m doesn't deal with force (mass moving at a speed in a single direction) then, but with power (mass "exploding" at accelerating speeds in various directions). Certainly. But the insight is the same. c is not in the equation for the number involved; it's in there because it involves units of time and distance. No matter whether you're dealing with "force" or with "power", you have to deal with distance and time, especially time. Either as seconds, seconds per second, or half-weeks calculated by the rotation of Jupiter's sixth moon, multiplied by the number of angels on the head of a pin, time is and has to be involved.

So what has c got to do with E and m? Measurements. It's a ruler. Things moving is how we measure time. A second is how long a clock hand takes to click from here to there. It's defined as the interval required for light to pass from point a to point b on a man-made measure of distance. The "second" doesn't exist independently of us; it's a word and idea we have constructed to seek to regularize the passage of time. And we define it as the interval necessary for a thing to pass from here to there. It could just as well be defined by the speed of a truck if we could keep the speed of the truck constant enough. We'd say: a second is how long a truck going 60 miles per hour takes to get from one end of the house to the other. Or for an ant to cross from one mark to the next, a finger apart.

Einstein used light as the basis for adding time to the E/m relationship because he needed something universal by which to try and measure or predict the rate of change between E and m, and c, he points out, is a constant. So, it's useful -- extremely useful -- as a ruler. When trying to measure the passage of time we can at least assume that light's speed does not vary.

Good enough. Great. But then, why c^2? And how can we ever completely accurately measure it?

And my view of the universe slowly began to unhinge. Because, really, how we are we ever going to be able to say: there, right there, is c, or c^2 anyhow? Our measurement problem comes into play. Forget dealing with units. Just think of c as the number 186,282, or 229,792,458, or whatever. Are we right on c, or a little above or a little below? And if we're close, we know that we can always look closer and find that we are not at c.

It’s impossible to fully measure anything in the physical world. c, the number, is only in our heads. In the physical world, using units, there will be a level of fuzziness. We may be right on, we may be a little over, a little under. Now, we are clearly able to measure c well enough to make use of it, to excel at the use of it, but, it hit me, there will always be an uncertainty as to whether we are traveling at the speed of light. In fact, once we're at the speed of light, we might measure and think that we've exceeded the speed of light, figure that our instruments are off, that weird things happen when you approach the speed of light.

Right.

Because you can exceed the speed of light.

We're back to the problem of measurements. Consider things tiny and small. The Greeks postulated that our universe was made of tiny, tiny building blocks. Atoms. And from the atoms the universe has been constructed in a vast array of edifices -- but that it all goes back to those indivisible, invisible, tiny units. A powerful idea; an idea that dominates everything I was taught about the physical sciences since I was a child. Clearly it's a useful way to describe and work with the chaos in which we swim on a daily basis. It helps us to understand so much of what is otherwise magical and unpredictable.

But it's an idea that is also almost certainly wrong. We hear now that there are subatomic particles: quarks and leptons and muons and bosons. That there are neutrinos and strings and unnamed phenomena that keep interfering with our increasingly uneasy picture of the universe at the quantum level. That what we thought had to be the indivisible building blocks of nature and the universe can in fact be divided. -- And that shouldn't surprise us. If we are willing to consider that space is infinite, why not the dimensions headed the other way? Isn't this, after all, the reason we have trouble measuring things at the limit of the smallness with which we can work -- because there's always something smaller? Universes within each atom?

Now this all sounds like we're a couple of college sophomores smoking weed in our dorm room -- but those sophomores aren't wrong. It's profound. The universe may be -- probably is -- infinitely small too. It expands outward in space, and inward in space. Which is one of the reasons it's so hard to measure a “thing”. Where do we define its end?

The fact is, we just say, there: that's the end. We're close enough. Just cut there and it will work. And if we've planned well enough, it does work. We can ignore the tiny universes within “atoms” because, at least for now, they don't seem to affect our day-to-day existence, but that doesn't mean they aren't there. The infinity of space doesn't affect our day-to-day lives much, but we freely admit that we don't know, maybe can't know, where it ends. But the idea of ultimate building blocks, of “atoms”, seems to me just an effort to fix some “oranges” in space and time: to come up with a name for something that is an agglomeration of matter and energy that is interweaving over the course of time, whose boundaries are defined for convenience sake, as an orange, as an atom, as a classic car with leather seats, but that is really only a snapshot in time of an agglomeration of changing constituents.

And maybe we have to think of the speed of light the same way. And “absolute” zero. <u>Why</u> are there absolutes? It's convenient for us to assume that they are constants, they are limits within which the workings of the universe can be described -- but it seems unlikely. Just as atoms do not mark the lower limit of smallness, I suspect that absolute zero is not the end of the scale for cold (for lack of E), and I suspect that c is not the limit for how fast matter and energy can move.

And, once I assume that they are <u>not</u> limits, much that has been troubling and inexplicable in modern (meaning post-Einstein) physics begins to have an explanation.

So, could Einstein be on the right track, but not quite there?

A couple of last observations need to be laid out before I try to answer myself. First, we know that we are surrounded by a chaotic welter that we can't perceive. Although unbelievably well-adapted to survive on earth, within a range of temperatures, on a watery world, absorbing, interacting with and secreting carbon-based life for a number of revolutions about our sun, we also know that there is a whole range of phenomena that we don't perceive: x-rays and ultraviolet light, for example. Or, very high-pitched whistles (that dogs hear and we don't). We have devised machines to help us extend our senses, but our senses are limited by the fact that we evolved on earth, and in order to survive we apparently didn't need to hear really high-pitched noises. But that doesn't mean they aren't there. They are. Light spectra, sound spectra. We can imagine pressures that are so slight we don't feel them: the air that drifts past a trembling leaf, but we don't feel. Smells that we don't smell, but bloodhounds do. Tastes we don't taste; senses we don't have. In short, there is at least a short range of phenomena happening right here on earth that we don't perceive. It would not be surprising -- in fact, it seems almost certain – that there is a wide range of phenomena happening in the universe that we can't easily perceive or investigate. (Note: This isn't a problem for us. We can live without hearing high-pitched sound, or seeing ultraviolet light. But we would not be accurately describing our universe if we took the position they don't exist. They do.)

So, let's keep in mind that we're perceiving in an (extremely rich) slice of the universe, but we're living in a much larger one.

A second observation: Substances (mass) exist in a range of possible configurations that can seemingly radically change under changing circumstances. Consider water. It is the same substance, but, at sea level, will change from ice, to water, to steam by just adding heat (energy). And it makes these changes at discrete temperatures, almost immediately. (Philip Ball, following Vonnegut, describes this phenomenon as the grand Ah-Whoom, when a fluid suddenly becomes a solid, or a gas becomes a fluid.) The "water" is still composed of the same atomic elements, in the same proportions, two hydrogen atoms for each oxygen, but it has widely different properties on either side of 32° Fahrenheit.

We can change the atomic alignments of substances through chemical reactions. We can condense and expand via pressure. And so on.

In short, substances exist within a range of possible configurations which, given the right input, can be reconfigured quickly and radically. Phase changes happen.

So, recapping, I've come to realize that we can't measure anything perfectly, because the border of any "thing" becomes fuzzy when you get down to atomic levels. "Things" turn out to be interacting with their surroundings constantly. The idea of "absolutes" therefore becomes suspect. Atoms are not the ultimate building blocks we hoped and wanted them to be; they are composed of subatomic "particles" themselves. Thus, we should be suspicious of any experiment which returns perfect data or results. Reality dictates that our observations must always be a little off. (Scientists know this. They take a range of readings when conducting experiments, and wind up using and defining the results generally. The rule being described is there, and useful, but it doesn't describe exactly what is going to happen in each instance. It can't.)

When we couple this observation with the realization that there are phenomena -- all around us -- that we can't perceive with our senses, and that substances exist in a state of potential flux –- that water can become solid, fluid or steam given the proper "inputs" -- that phase transitions are common givens even within the slice of the universe that we can easily perceive –- then, perhaps, we can explain some of the observations in the universe we <u>are</u> seeing, and trying to measure, and understand –- but do not.

For instance, light. Einstein took as a given that matter, that energy, can't travel faster than light. But why do we think this is true? Just as there may be no lower limit to smallness, may be no outer limit to space, there may be no upper limit to velocity. It's true that if some "thing" is traveling faster than the speed of light we won't be able to see it, but I don't think that means that it can't happen. The desire for an accurate method of the measurement of time has led us to posit that the speed of light can't be exceeded, but perhaps the reality is that matter does exceed the speed of light from time to time, or often, or almost constantly.

When I was growing up there was an Air Force base 20 or 30 miles away from which jets were constantly being launched as we sought to exceed the speed of sound. Some very good thinking -- that of course turned out not to be true -- predicted that we couldn't exceed the speed of sound, Mach 1. That insubstantial phenomena such as light could go that fast, but not man and his jets.

It was constant big news as the test pilots and their engineers got closer and closer. Sonic booms rattled our windows seemingly daily as these heroes -- and they were heroes -- sought the limits of the physically possible. And, then, they did it, and it was possible, and amazing. It's now quite common for a jet to fly overhead well before the sound of its passage arrives. You can't look at where you are hearing the jet, you have to look ahead of its apparent passage. (Another example: a bullet will whizz past you well before you hear the crack of the rifle from which it was shot. Thus the soldier's fatalistic expression: "You never hear the one that gets you.")

So, assume that we are wrong about the speed of light. What if, like sound, an object moved faster than the speed of light? Basically, it would pass us <u>before</u> we "saw" it.

We "see" things when light reflects off of their surfaces. The light is partially absorbed, and partially reflected, and the sensors that are our eyes and brains sort out the patterns of absorption and reflection into the images that we see all around us.

Thus an object 100 yards away from us is visible because light bounces off its surface, and reflects towards us (at the speed of light), in a continuous stream, and we "see" it. But what if the object were moving faster than the speed of light, say, towards us? The light would bounce off its surface and arrive after the object had already passed us. The object would be miles behind us by the time that the light reflecting from it at that point, from 100 yards away, reached us.

This creates two results. One, it can mean that there is matter all around us that we can't "see", because it's never there when we "see" it. It's moved on. We have invisibility.

Oh come on, I hear you saying. How can that be true? If so, where are all of the invisible objects in the universe? The answer may be: All around us. "Dark matter" is one of the conundrums facing modern cosmology and astronomy. Theoretically the universe would seem to have to be composed of much more matter than we can presently identify. It's a problem confronting modern science for which no completely satisfying answer has been proposed. I propose: Don't treat the speed of light as an absolute and you have an answer. We don't "see" dark matter because it's moving faster than the speed of light, and we just <u>can't</u> "see" it. Invisible.

Objects moving faster than the speed of light might also explain "black holes". We presently think of them as stars so dense that their gravitational pull acts on the minimal mass of light such that light cannot escape the system. Mind-blowing stuff, but hard to believe, because nothing else seems to have such a property. What if we think of it, instead, as an object -- having mass, exerting gravitational pull -- but moving faster than the speed of light, <u>towards</u> us. The light of its passage, showing where it has been, hasn't reached us yet, although other measurable effects -- traveling faster than the speed of light -- have.

In short, if we remove the artificially imposed limit of c, and imagine a universe where mass does move outside of the limit of our imperfect senses -- like high frequency sound, like ultraviolet light, like who knows how many other phenomena -- if we imagine objects exceeding the speed of light, perhaps by a lot, then we can explain dark matter and black holes.

This is not to say that reducing the speed of light to just one velocity on the scale of all velocities does not allow for strange effects. It does. Time travel, for instance. We think of reality as the concrete material and energy that we perceive right now. The orange is right there: I can reach out, feel it, smell it, see it. It is real. I will continue to believe it is there, and real, as long as I see it, or expect to be able to see it. (Behind the bunch of bananas. In my lunch bag.) In short, it is present (meaning physically palpable) in the present (meaning now). It is real; we see it. But we know that one month from now it will be rotten, if left out in a reasonably temperate environment in which bacteria and decay can work their eroding magic. It will no longer be orange; it will be gray-black and moldy. The time when it was an orange is past. However, the image is not necessarily gone. The light that reflected off the orange when it was that color reflected towards space also. It will have diffracted as the waves of orange light pass through the earth's atmosphere, but, arguably, the light that we see as the orange could be propagating through the vacuum of space -- and be one light-month away. To make it easier, assume that the orange was on the moon's surface, at noon. The light bouncing off the moon would be white, more or less, with a speck of orange in it. If we were to exceed the speed of light, we could catch up to that moonlight, with its speck of orange, and <u>perceive it again</u>. See the orange again. Even though we know at home it is a moldy mess, or, on the moon, a brittle mess, we would see the light reflected from it one month ago, and see the orange as it was one month ago.

An example from the beach suggests itself to me. If you stand in the impact zone, waves will crash around you, rolling up to the beach. Each wave rolls on past, including that big one there, but assume you can swim faster than that wave, the big one, and you leave the impact zone headed for the beach. You could pass the big one, stand in shallower waters, and have it hit you again. The same wave. You could experience the wave again; a wave you originally perceived in the past.

It's only a limited form of time travel, because you can't (in our thinking about the orange) reach out and touch, or smell, or taste, the orange again. The elements that made up the orange and exuded its aroma and made it tangy are still on earth (or the moon). It's only the light reflected one month ago that we are seeing again, but we could see it.

This has the odd effect of making time very relative for an object routinely exceeding the speed of light. If we were on it, we'd be perceiving all sorts of "pasts" and "futures" being presented haphazardly by the light-waves that caught up to us, or that we caught up to.

But maybe not that odd. Because, after all, that's the position we are in here on earth. In effect, we have "beaten" the light of the distant stars here to us on the rim of the Milky Way. It takes years, decades, centuries, millennia, for the light of distant stars to arrive here. The light from Alpha Centauri left there four years ago; from Betelgeuse, 640 years ago. We see, in effect, a universe of differing times, all of them past. A traveler exceeding the speed of light at sufficient velocity could bridge the gaps instantaneously, being here on earth one moment, at Alpha Centauri the next, at Betelgeuse the next. The traveler would be able to know what is happening at each of those spots well before the light encoding the transmission would reach the points on the triangle. The traveler could see Alpha Centauri blow up, be here a second later, and tell us that in four years we would also see it blow up, when the light arrived. He, too, could hang around and reexperience -- "see" -- the explosion again. But even if we just stay put on earth we are seeing a multitude of "pasts", of images of stars from around the galaxy, or from distant galaxies, all of which emitted their light at different times but that we now experience in our "present".

Our concept of time, in short, is another one that we would do well to not trust as "absolute". Time dilates and contracts depending on whether you are traveling away from or towards the source of light illuminating the clock supposedly measuring the "time"; and even if two systems are seemingly motionless as to one another, such as Alpha Centauri seems to be to our solar system, it may be that the moments of "present" in both systems cannot be perceived instantaneously -- unless you can exceed the speed of light, in which case you are time traveling. So: we want time to be absolute, so that we have something useful by which to measure the flux of matter and energy, but, perhaps predictably, we find that it is not. Either you can't exceed the speed of light (our condition on earth) in which case your present -- the starry sky -- encodes a multitude of differing pasts, which makes the whole idea of "observation" suspect, or, mind-blowingly, you can exceed the speed of light and be (theoretically) instantly present anywhere in the universe, in which case you are traveling to a spot where the images of your past may eventually arrive.

But skip time travel for a moment. If it's true that matter exceeds the speed of light and thus "disappears", isn't the corollary that there will be light where no matter now exists? (This is the second result of imagining hyper-light speed travel.) If a rock speeds by the earth, faster than the speed of light, it will still reflect light. The rock will just be gone by the time we see the light that reflected from it surface. So, if it's true that "dark" matter is flying about, where is the light that would evidence its passage?

Well, without being too crackpot, I start wondering about the persistent reports of “UFO's”, moving faster than any object possible, seemingly more light than substance, and never, when we look for them, actually there. No doubt there are a number of “observations” that are nothing more than hallucination, wishful thinking, or a bizarre seeking out of notoriety. But there is a class of unidentified phenomena. It may all be swamp gas and headlights, but positing matter that passed this way some time ago (minutes? hours? seconds?), whose images are only now reaching us, may present itself as a useful field of analysis.

Even crazier, what are ghosts? Immaterial forms of light and energy that just can't be explained, but seem to have been perceived from time immemorial. Again, no doubt, most of the paranormal can be explained as psychological maundering, but it doesn't seem impossible to me that if there are hard, particulate pellets belting around our universe, there are gossamer-soft stringlets of silk and time, and that these could be playing in the space between the Newtonian world of absolute measurement, clocks and inclined planes, and the strangely interconnected space-time envisioned by Einstein that I am arguing is even less able to be measured than Einstein hoped.

But, putting aside the occult and the fringe, are there other observations that modern physics countenances that we might classify as matter, unseen, or energy without mass?

Neutrinos.

According to Wikipedia, a neutrino is an elementary particle that usually travels close to the speed of light, is electrically neutral, and able to pass through ordinary matter almost unaffected.

Exactly.

I would say: matter traveling faster than the speed of light, often, and able to pass through matter unaffected because the masses don't occupy the same space for any length of time. The neutrino is in front of my palm and the next instant is on the other side of my hand. It's traveling outside the laws of Newtonian physics because it doesn't stick around long enough to have a physical, measurable effect in the glorious, but limited, spheres of existence in which we live, experience and operate. In fact, it takes highly complicated machinery, devices and processes to even detect their presence -- but they're there.

<u>And</u>, we learn, there's a basic problem. We "know" that there should be 2 or 3 times more neutrinos in existence, made and emitted continually by the sun, than we in fact detect. This is presently explained as undetected changes from one type of neutrino to another, perhaps because the neutrinos pass through the core of the sun. Perhaps. Another way to think about it is that neutrinos -- and who knows what other types of particles -- are routinely exceeding the speed of light. Maybe ½ or ⅔ of all neutrinos are doing so, and thus undetectable as light or other sub-light speed radiation, even though present.

Wild.

One last thought. It seems to me that meteorites and "falling stars" are well-explained by present theories. However, they are, if we characterize them superficially, streaks of light, of often differing frequencies, that appear in the sky, often accompanied by sonic phenomena some of which is not well understood (hisses and whistling), and that the vast majority of time do <u>not</u> impact earth. We say they are bits of particulate matter that burn up when passing into and through earth's atmosphere. Could any of them be -- a lot of them be -- light reflecting off an object that passed by some time ago? Do they have to be within earth's atmosphere? Could they be explained as objects at some further distance?

My sense is that meteorites visibly decelerate as they enter the atmosphere, which I would not expect to be the case for matter moving faster than the speed of light. The insubstantial neutrino doesn't leave a visible trail of light, for instance. Still, the idea may warrant further attention: we've got high velocity "objects" appearing as light in the sky all the time, and only theory says that they are all particulate and traveling at less than light speed.

But turning aside from the fun and strange universe, and from the fun and strange ways to envisage that universe, engendered by matter and/or energy exceeding the speed of light, there's another scale to think about. Energy; temperature. Just as we have tried to posit that atoms are the lowest form of organization of matter, the "building blocks" of nature, and just as we have tried to posit that nothing can exceed the speed of light, we have also tried to posit that there can be no temperature less than "absolute zero". It's a limit on how cold, still and brittle substances can be. It's the other end of the spectrum in $E = mc^2$. In order to be able to measure and describe we have tried to use the word "atom" for the level of matter from which all other matter can be built. We have used the concept of "speed of light" for the scale by which all time can be measured. Similarly, we have tried to use a temperature, "absolute zero", to describe the point at which all energy will have been expunged from an object, from a system, and which therefore "cannot" be exceeded.

I'm back to the questions of measurement. How do we know where absolute zero is? If we use a thermometer in the system, won't it be affected by the cold? Won't the mercury (or the X, or the Y) be affected by the severe environment? Why are we trusting the readings? And even if the readings are accurate, you've got that question of infinites: of why, if I've reached a point I think of as a limit, I can't go a little faster, a little further, a little colder. Why can't I break the sound barrier? We did. Why not the light barrier, the cold barrier, have <u>sub</u>-atomic particles? In short, I'm wondering if we are accurately describing what goes on when you get close to absolute zero. Maybe we're passing it and don't even know.

Consider: there are some weird phase changes taking place as you get close. Materials become highly brittle; they go from solid to something else. (We always see the frozen rose taken out of the container of liquid nitrogen and shattered on the table.) Substances become super-conductors. Devoid of all energy, they suddenly start trying to climb out of their containers; they take on bizarre, unpredictable properties. This may all eventually be explained as phase changes taking place somewhere between absolute zero and 4° Kelvin, I suppose. That's the present explanation. But I am realizing that something else may be going on.

If $E = mc^2$ accurately describes the relationship of matter and energy in the universe, it may explain what happens when you descend past 0°: you have negative energy. Assuming that time is operating at a constant pace, and $E = mc^2$ is correct, this means that you would have to have negative mass. If there is a negative E, and c is positive, then m has to go negative. In short, mass would have to disappear.

Well, when we get close to absolute zero we get <u>some</u> kind of change. Are we, perhaps, in the realm of science fiction? Wormholes? Alternate universes? Assume so: that we take so much energy out of an ingot of matter that it has to <u>leave</u> our universe, so that mass and energy can stay in equilibrium. One way to think about it is that we are at the bleeding edge of a phase change: that the material becomes super-cooled, super-cooled, until some of it is bleeding out of existence (or, at least, of our ability to perceive existence). If the law of conservation of energy and mass is at work on the other side of that universal "wall", wouldn't the alternate universe have to push back some energy (or mass)?

If so, it could explain why the substance is suddenly climbing the walls of the container, becoming anything <u>but</u> solid and brittle.

I'm suggesting, in short, that absolute zero doesn't exist. That there is no end to the spectrum of E; it's just that we can't observe what happens on the other side of 0°, at -1°, because we don't have the equipment or the senses to do so. But this doesn't mean that going to negative 1, 2, or 3° can't or doesn't happen. And, if it does, the effect would be that mass would be lost. But if mass and energy are lost "here", mass and energy would be "gained" there, and that the two systems, the universes connected by the point in time and space where temperatures went negative, might be bleeding into one another, explaining why everything becomes so inexplicable. We're looking at material from the other universe . . .

Couldn't be . . . could it?

Well, Einstein says no, and I'm no Einstein, but . . . hmm.

dc

6/15/11