ATTEMPT:

REFUTE THE "PRINCIPLE OF RELATIVITY" IN PHYSICS

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FIRST:

LET'S DEFINE THE "PRINCIPLE OF RELATIVITY"

As far as I know, there are several definitions of the "principle of relativity" in Physics. Among them are the following:

a. The laws of mechanics are not affected by a uniform rectilinear motion of the system of coordinates to which they are referred *(from the Wikipedia and various online dictionaries)*

b. There is no physical way to differentiate between a body moving at a constant speed and an immobile body *(http://muse.tau.ac.il/museum/galileo/principle_relativity.html)*

c. No mechanical experiment can distinguish a state of absolute rest from uniform straight-line motion *(http://www.bluffton.edu/~bergerd/NSC_111/relativity.html)*

d. The laws of physics don't change, even for objects moving in inertial (constant speed) frames of reference. *(http://www.dummies.com/how-to/content/einsteins-special-relativity.html)*

e. The laws of physics are the same in all inertial frames of reference *(http://www.rafimoor.com/english/SRE.htm)*

f. The "principle of relativity" is the requirement that the equations describing the laws of physics have the same form in all admissible frames of reference *(https://www.princeton.edu/~achaney/tmve/wiki100k/docs/Principle_of_relativity.html)*

g. "For all things that participate in it, motion is not detectable: it is like nothing, as if it was not" *(Galileo's own definition, paraphrased from his "Dialogue on the Two Chief World Systems")*

For a start, I think these should suffice, although other definitions can presumably be found.

SECOND:

LET'S OVERTHROW THE MORE EASILY-OVERTHROWABLE DEFINITIONS

Most of these definitions, as we shall show, seem to be rather loose and imprecise, and so it doesn't seem to be too hard to refute them – or more accurately, to render them pointless and useless: in fact, it's my opinion that any moderately intelligent person should be able to do so.

Let us tackle the first definition given above, apparently the most popular one (given its sources, Wikipedia and various online dictionaries): "The laws of mechanics are not affected by a uniform rectilinear motion of the system of coordinates to which they are referred". If they truly are *laws*, then *what* should be able to affect them? Clearly, if *anything* is able to affect things which are claimed to be "laws", then they cannot be laws at all, can they?

If *Star Trek* taught us anything, it's that "ye cannae change the laws of physics". That *is* how scientists regard their various laws and constants, isn't it? Is there *anything* in the laws of mechanics which says that they apply only if certain conditions are present? Is it *ever* claimed in any law of mechanics that it doesn't apply, for instance, under the conditions present on the Moon, or on Jupiter, or in another Galaxy, or on the starship *Enterprise? It is not implicit in the laws of mechanics that they apply everywhere and "everywhen"?* Is there anything in them saying that they apply only under conditions present on Earth; or that they apply only in conditions of a system of coordinates in uniform rectilinear motion? If not, then what is the *point* of even mentioning such a thing? What would be the point of saying, for instance, that "the laws of mechanics are not affected by *the location* of the system of coordinates to which they are referred", or to say that "the laws of mechanics are not affected by a *change in the colour of the sky above the planet containing* the system of coordinates to which they are referred"? Certainly these are *true* statements, but aren't they rather *redundant*, and therefore pointless?

Perhaps you don't agree: perhaps you say, "If we didn't clearly mention that the laws of mechanics are *not* affected by a uniform rectilinear motion of the system of coordinates to which they are referred, people might get the impression they *might* be affected by a uniform rectilinear motion of the system of coordinates to which they are referred, and so make mistakes." But would not that be case even if we were to say "The laws of mechanics are not affected by any *orbital* motion of the system of coordinates to which they are referred"? Would people get the impression that the laws of mechanics, for instance, in a satellite orbiting the Earth, are different from those that apply in a lab on the Earth itself? Indeed, since the lab itself is orbiting the axis of the Earth, due to the Earth's rotation, and in addition it's orbiting the Sun, due to the Earth's revolutions around the Sun, would people think that unless we spelled it out clearly, saying "The laws of mechanics are not affected by any orbital motion of the system of coordinates to which they are referred", that the laws of mechanics on Earth would be different from those on a hypothetical spaceship which is *not* orbiting anything? *Seriously?* You think people *would* think such a thing? Surely you don't think *that!* Indeed, given the fact that the laws of mechanics shouldn't be affected by *anything whatsoever,* wouldn't it become a requirement to spell out *every possible situation* under which the laws of mechanics *don't* change? And would not a list of *all* those possible situations be potentially endless?

Anyway. Let's now consider definition *b:* "There is no physical way to differentiate between a body moving at a constant speed and an immobile body". Here the question begs to be asked, What exactly *is* an "immobile body"? Can an example of one be pointed out? If not – if, that is to say, it is claimed that there *is* no such thing as an "immobile body", as most fans of the "principle of relativity" are generally understood to claim – then would it not be more correct to say "there is no physical way to differentiate between a body moving at a constant speed and an immobile body, but there is no such thing as an immobile body in the first place"? Such a statement would surely raise the question, again, "Why on earth are you mentioning it, then?" Wouldn't it be just like saying "there is no physical way to differentiate between a body moving at a constant speed and a leprechaun, but there is no such thing as a leprechaun anyway"? What would be the *point* of it? Would it not be, again, *pointless?*

The same kind of objection applies to definition *c:* "No mechanical experiment can distinguish a state of absolute rest from uniform straight-line motion". If there *is* no such thing as a state of absolute rest, is this not actually the same as saying, if we spell out all the unspoken claims hidden behind it more completely: "No mechanical experiment can distinguish a state of absolute rest from uniform straight-line motion, but there is no such thing as a state of absolute rest anyway, so forget what I just said, because essentially all I said was that there is no way to distinguish uniform straight-line motion from anything that actually exists"?

And let's also talk about definition *d:* "The laws of physics don't change, even for objects moving in inertial (constant speed) frames of reference". So let's ask once again: would the laws of physics change if the objects were moving in some *other* way? Say, if they were in an accelerating spaceship? Or, to give another example, would the laws of physics change for objects in *circular* motion: such as stones attached to one's hand by a string, being swirled around at an increasing rate? Why, in heaven's name, would the *laws of physics* change for them, or indeed for *any* objects moving in *any* way whatsoever? Why should the *laws of physics* change at all, just because objects move in any particular way? Would they change for objects falling at an increasing rate of acceleration into a large planet, or into a star? Would they change for objects far out in interstellar space, minimally affected by gravity? When exactly *would* the laws of physics change? Would it make any sense to say "The laws of physics don't change, even for scientists who have had a fine dinner at a very good restaurant"? In what way would "moving in inertial (constant speed) frames of reference" be expected to make *any* other kind of difference to the laws of physics, from that which would be expected from "moving in orbital trajectories", or "falling at an increasing rate of acceleration into a very heavy planet", or "having had a fine dinner at a very good restaurant"?

Or – to put it in another way – can *anyone* tell us exactly *when* the laws of nature – or of physics – *do* change? Can *you*, most illustrious and learned reader, tell us that? Not when they *don't* change, but when they *do.* Do they change when there's an alien invasion? When there's a stock market crash? When there's a nuclear holocaust? When the Sun explodes, billions of years in the future? When there's a blue moon? *When*, in heaven's name? If you *can't* tell us when the laws of nature or of physics *do* change, then what's the *point* of saying "they don't change under conditions *'pqr'"?* Why not just say, then, "Ye cannae change the laws of physics"?

In fact, isn't that what is *meant* by the term "laws of physics"? Would it even make *sense* to say "There is a Law of Physics that says *'xyz'*, but *'xyz'* changes to *'abc'* depending on certain conditions"? If a so-called "law of physics" *changes*, then *can* it be called a "law" at all? For suppose there is indeed some statement which *claims* to be a law of physics, which reads *'xyz'* (whatever combination of words *'xyz'* may be). And further suppose that experiments reveal that *'xyz'* does in fact change to *'abc'* under conditions *'pqr'* (again, whatever combinations of words *'abc'* and *'pqr'* may be). Then wouldn't the "law" which merely *claims* to be a "law" of physics be superseded by *another* law – this time a genuine one – which reads: "Under conditions *'pqr'*, *'xyz'* changes to *'abc'"?* (Okay, definition *d* is from a group of websites called "*So-and-so* for Dummies", so let's cut them some slack. But even so, are even dummies going to be *so* dumb as to not be able to think of the requirement that laws of physics simply *can't* change, no matter what – that, in fact, if they do, then they *aren't* laws at all, and *never were in the first place?)*

And the same thing applies to definition *e:* "The laws of physics are the same in all inertial frames of reference". Sure they are: we totally agree. But are they not also the same in all *non-inertial* frames of reference, and indeed in *every* frame of reference that you and I and anyone else can think of? Because if they weren't, they wouldn't *be* "laws of physics" at all, would they? (*Jeez.* This definition is *not* from a website for dummies, but maybe it might as well be!)

And the brainy folks at Princeton University give us definition *f:* "The principle of relativity is the requirement that the equations describing the laws of physics have the same form in all admissible frames of reference." But if the *laws* of physics themselves don't change, and indeed *can't* change, *ever*, then why exactly should the *equations describing them* change *… ever?* It makes me wonder, seriously, what's in the back of the minds of those who write such definitions. Doesn't it make you wonder that too? Or do you think they must have some sort of valid reason for saying so, because they are graduates of Prestigious Princeton, and the only reason it's too hard for *us* to understand it is because we aren't? If they do have any such reason, then why can't we *find* it when do a search for it online?

So personally I'd say, let's ignore *all* definitions of the "principle of relativity" which talk about laws of nature – or of physics or mechanics – *not* changing under certain circumstances. The point is, that although it is completely true, and we totally agree with it, the statement is *pointless*, and *adds nothing to our understanding*, because "laws of nature" (or of physics, or of mechanics) – if they truly *are* laws at all – should *never* change, *ever, under any circumstances!* That's what a "law" *is:* a statement of an *unchanging* principle. A "law" that changes every now and then, or under certain conditions, simply *isn't* a law … and never was. *"Ye cannae change the laws of physics!"*

Would you agree, or not? If not, why not?

Third:

LET'S OVERTHROW THE NOT-SO-EASILY-OVERTHROWABLE DEFINITIONS

Now for definition *g.* "For all things that participate in it, motion is not detectable: it is like nothing, as if it was not". *Now* we are getting somewhere: this is Galileo himself – the Big Cheese himself – talking. More prestigious than even Einstein and Newton. Maybe. Do we even *dare* to attack him? Maybe not. *[Sigh]. [Deep breath].* Okay, let's do it.

Let's translate his words into somewhat more modern English. "If something participates in motion, motion is not detectable by it – it doesn't even exist". Or: "If anything moves, motion can't be detected by it – motion has no existence for anything that moves". *Really?* Taking the declaration as it stands, *exactly as it is spelled out* – not reading into its words anything other than what has been written, *without* "reading between the lines" so to speak – well then, if I walk along a road, just at a saunter, not really moving very quickly, maybe at 3 miles an hour, is he saying that *I can't detect it?* Not just, mind you, that I can't tell my *exact* speed of motion, but I can't even tell *that* I am moving? Surely *that's* not what Galileo meant, because my life experience proves him wrong every day, and so does yours, if that *is* what he meant. Let's give the guy some credit for *not* being a dummy. But then what *did* he mean? Let's try to read between the lines, then.

Some people claim that he meant to say, in effect: "If you are moving in a *closed* compartment and can't look out of it, you can't tell whether you are moving or not." This is based on Galileo's "large ship" thought-experiment: "Close yourself up in a room below decks in a large ship – can you tell whether the ship is at anchor, or whether it's moving in calm waters? Bet you can't!" Essentially, that is what he wrote, though in somewhat more ancient-sounding words, the original being in a kind of Renaissance-period Italian where some words are spelled differently compared to modern Italian: much like in Shakespeare's English when you compare it to modern English. You can look up his entire statement in the original

Italian at <http://pierazzini.unipi.it/giuseppe/fisica_1a/Pillole/Navilio.pdf>, and translated into English at <http://en.wikipedia.org/wiki/Galileo's_ship>.

However, I'm thinking that his claim is disproved by astronauts all the time: because even in a closed space capsule, when the astronauts are weightless, they *can* tell that the capsule is moving, not necessarily by looking out the tiny windows, but by pushing little things like pencils in different directions. Isn't that so? You see, if an astronaut pushes a pencil in the *direction of the orbit of the space capsule,* the pencil will move, not *exactly* in the direction it is pushed, but slightly *away* from the Earth as well, because its orbital speed will become, as a result of the push, slightly greater than that of the capsule; while if it is pushed in the opposite direction it will move, again not in the *exact* direction it is pushed, but *towards* the Earth, because its orbital speed will be slightly *decreased* compared to that of the capsule. Don't you agree? And if the astronaut pushes the pencil in a direction at right angles to the orbital motion of the capsule, then depending on the direction of the push, other, equally weird, things will happen, because the orbit's shape for the pencil is now different from that that for the capsule: if, say, the capsule's orbit was perfectly circular originally, the pencil's orbit would now become slightly elliptical – right? It's true that the astronaut in such a capsule won't be able to tell which *way* the Earth lies, unless he looks out the tiny window; but he *can* tell *that* the capsule *is* moving – that it is orbiting the Earth: can't he? (Besides, if it didn't, wouldn't it fall down to Earth and burn and crash, which – as far as I know – is what happens to satellites when they don't orbit the Earth at orbital speed?)

I'm thinking that the reason astronauts can do this, while Galileo couldn't do it in his "large ship", is because (1) the astronauts are moving a heck of a lot faster than Galileo ever could, and (2) because they have really accurate instruments – instruments of an accuracy 'Leo couldn't have possibly had, or maybe even dreamed of having. Don't you think that's right? But *in principle,* given sufficiently accurate instruments, even Galileo could have done it … couldn't he have? Or else if his "large ship", and the "room" in it, had been *really, really* large – suppose his ship had been several hundreds of miles in size – that is, hundreds of miles in length, width and height. Of course it most likely would have been impossible to build, even with *our* technology, let alone his; but that's kind of irrelevant to the argument, isn't it? But if you dropped a cannonball in a room empty of all air in such a "*R E A L L Y* L A R G E ship", would it not fall, instead of *exactly* vertically, at a slight *angle* to the vertical, because even when the ship is at anchor, the Earth is still rotating around its own axis, and that would give the cannon ball a slight momentum horizontally? Besides, whenever objects fall into a planet, they fall in a *spiral* trajectory, and not *directly* into it in a straight line, mostly because the planet itself is in orbit around its Sun. Am I right? And if the ship were to move in calm waters so that the rate of rotation of the ship around the Earth's axis now changed to something different from the rate of rotation around the Earth's axis of the *dock* where it had been tied up earlier, then the difference from the vertical of the fall of the cannonball would change as well, wouldn't it? And with sufficiently accurate instruments could it not be measured, and the speed of the ship over the water calculated thereby? Let me know what you think! My guess is that you'll agree. (Of course, maybe you won't, but then I'll bet you can't give logical reasons *why* you don't agree!)

Now to get around this, some people claim – or so I understand – that Galileo meant to say, "If you are moving *in a straight line* in a closed compartment but can't look out of it, you can't tell whether you are moving or not." In fact, let's even add to it the words "… certainly not if you are moving at a *constant velocity*". So let's see: are we to understand that Galileo meant to say "If you are moving *in a straight line* in a closed compartment but can't look out of it, you can't tell whether you are moving or not … certainly not if you are moving at a *constant velocity"?*

Hmmm. Okay then. *[Deep thought].* Let's imagine you are in a *special* space capsule, one which is *constrained* to move only in a straight line at a constant velocity – using rockets or some such propulsion method, of course, because if you switched the propulsion off, the capsule would start moving in *curved* trajectories due to the gravitational attraction of the Sun and any nearby planet(s) or asteroid(s) or moon(s). (Wouldn't it?) So let's say you, inside this special capsule, are moving in a *straight line at a* *constant velocity*, passing the Earth. At some point you would reach your closest point to the Earth, right? At that point, can you not, being a clever scientist in the capsule, measure the force of gravity exerted by the Earth, using instruments specially made for the purpose (the kind geologists use to detect tiny differences in the gravitational field of the earth due to underlying oil or gas deposits), and write its strength down in your little notebook? And a little time period *after* that, would not your instruments indicate a slightly *weaker* force of gravity, because you are moving farther and farther away from the Earth? Until of course your capsule approached some *other* planet, or the Sun, in which case your instruments would gradually increase their readings once again – wouldn't they? In other words, any instruments which measure gravitational force would give different readings from time to time, which would tell you *that* you are moving, even if they can't let you *measure your rate of movement* … right?

But – it might be objected – how can you tell whether it is *you* who are moving, and not the planets and stars *around* you that are moving? In other words, can you tell, or can you not tell, whether *you* are stationary?

Well, they would also all be moving *relative to each other*, wouldn't they? So at best, only *one* of them could be stationary, but not all of them! Right? And besides, even if one of them *were* stationary, it could only be so for a single instant in time, for it would immediately thereafter *start* moving, wouldn't it, due to the gravitational forces all around it? So it too could only be stationary for a single *instant* in time, because not only it would start to *move* the next instant, but also start moving in a *curved* trajectory – that is, it would change its *direction* from moment to moment! So it's totally impossible, isn't it, for the planets and stars around you to *all* be stationary for any *period* of time? Just *how* would that be possible?

Also, if we accept the statement that fans of the "principle of relativity" reportedly claim, namely that "there is no such thing as a state of rest", or "there is no such thing as an immobile object", then doesn't the "principle of relativity" imply that you *can't* be stationary, simply because there isn't any such state, and never can be? So then: if we *aren't* stationary, well then must we not be *moving?* Sure, the planets and asteroids and stars around our capsule can *also* be moving, but that by itself doesn't mean *we* wouldn't be moving also, would it. In fact, doesn't the "principle of relativity", when logic is rigorously applied to it, absolutely *demand* that we *must* be moving, simply because according to one of the claims of the "principle of relativity" itself, *nothing* can ever be stationary?

Well, I'm guessing that fans of the "principle of relativity" might now come back at us saying, "No, sorry, we made a mistake: a state of rest or a stationary object *does* exist, it's just that the principle of relativity claims that you will never be able to *tell* whether you are in a state of rest or you are moving inertially in a straight line". Okay. Let's put this into other words that mean the same thing. Would they not be claiming, in other words, that a state of rest *does* exist, ontologically, but no one has been able to find a way of *distinguishing* it from a state of inertial motion in a straight line – in other words, that it's just not *epistemologically* possible? To which we could retort, *"… yet!"* Just because no one has *yet* been able to find a way of distinguishing a state of rest from a state of inertial motion in a straight line, *doesn't* mean it *can't* be done, does it? All it means is that *up till now* no one has found any such way. Am I not right?

Let's pay close attention to something *very important* in the above changed statement, and its meaning with regard to the "principle of relativity": *it claims, does it not, not only that a state of absolute rest exists, that there is also a difference between a state of rest and one of inertial motion in a straight line?* Are fans of the "principle of relativity" *now claiming* that there *is* such a difference, then, only that this difference can't be *detected?* If so, then are they not, then, implicitly destroying the "*principle* of relativity", with the emphasis on the word "principle"? If it is really a *principle,* then should there not be a *proof* that it *is in fact impossible* to distinguish between a state of rest and one of inertial motion in a straight line, both of which actually *do* exist? So where exactly *is* such a proof? Can they show it to us? As far as I know – of course I could be mistaken – its fans either admit that they don't *have* such a proof, or they don't present us with one; but they still claim that it is a *principle.* Well, how can they do so, and still also claim to be rational?

Let's examine their reasoning closely. Aren't they essentially saying: "*I* can't do it, and *you* can't do it; in fact, neither of us can even *think* of a way to do it; and that proves that *nobody* will be able to do it; not now, not *ever". Really?* And what logic course did they take to give them such massive, unshakeable confidence that this is proper, logical reasoning? In fact, it seems to me that the questions now screams out to be asked: *did* they take any logic course at all, *ever*? Or else, it seems to me, they certainly couldn't have *passed* it, even if they did *take* it. For if they had, wouldn't their instructors have clearly told them that this is a maximum-magnitude logical fallacy? Is it not a mistake of the first order to assume that just because no one has *yet* been able to figure out a way to do something – or even to *think* of a way to figure it out – that it's a *proof* that its actually *impossible* to figure out? Do even children get taken in by such reasoning? My guess is, if you ask a child, "Do you think it's ever going to be possible to fly to other galaxies, or do you think that just because we can't do it now, *nobody* will *ever* be able to do it?" that they will say "What have you been smokin', man?" (Or "lady", as the case may be, of course.)

I really don't want to be rude, but I have yet to find in the statements of *any* physicist, Einstein included, and running the gamut of *all* Noble Prize winners in physics, and *all* members of scientific societies – including the most prestigious of them all, the Royal Society in London, and the most ancient of them all, the *Accademia dei Lincei* in Rome (of which Galileo himself was one of the first members) – an actual *proof* that just because no one has *yet* been able to *tell* whether something is in a state of rest or moving inertially in a straight line, that it will actually be *impossible to do so, for all time to come.* Is it just me, or do you find this weird too? I always thought that if scientists claim something to be true, they ought to provide a *proof* for the claim … or is that not required these days? Is one allowed, in *science,* to make absolute claims of something being a principle or law *without* proof? Just wondering. I had always thought that if scientists didn't have a proof for any claim of theirs, they had to admit at the very least that the claim was just an assumption or a hypothesis, but clearly not a principle or a law, or even a mere fact. Maybe I'm dumb, but that used to be my opinion. I shall have to revise it, perhaps, given all the above.

[A bit later]. I looked it up, by googling the words "proof in science" (without the quotes), and apparently I was wrong: most people in the know about science nowadays say that science *doesn't* actually deal in proofs at all, even though terms like "scientific proof" and "it's been proved scientifically that … " are bandied about widely. However, they are inapplicable to *real* science, for, as the *Wikipedia* tells us (see <http://en.wikipedia.org/wiki/Scientific_evidence>):

> While the phrase "scientific proof" is often used in the popular media, many scientists have argued that there is really no such thing. For example, Karl Popper once wrote that "In the empirical sciences, which alone can furnish us with information about the world we live in, proofs do not occur, if we mean by 'proof' an argument which establishes once and for ever the truth of a theory," and Satoshi Kanazawa has argued that "Proofs exist only in mathematics and logic, not in science."

What science *actually* does, as I understand it, is employ what's called the "scientific method" to gather *evidence to test ideas about the natural world*. As an article called "Understanding Science – how science *really* works", published online by the University of Berkeley at <http://tinyurl.com/lug52l3>, says:

> […] scientific ideas must not only be testable, but must actually be tested — preferably with many different lines of evidence by many different people. This characteristic is at the heart of all science. Scientists actively *seek evidence to test their ideas* […] Performing such tests is so important to science because in science, *the acceptance or rejection of a scientific idea depends upon the evidence relevant to it* — not upon dogma, popular opinion, or tradition. In science, *ideas that are not supported by evidence are ultimately rejected*. [Emphasis added by me.]

And here's something similar, from <http://tinyurl.com/pz58og2>:

> There is no "proof" in science — that is a property of mathematics. In science, what matters is the balance of evidence, and theories that can explain that evidence. Where possible, scientists make predictions and design experiments to confirm, modify, or contradict their theories, and must modify these theories as new information comes in.

As for what "scientific evidence" is, here's what the *Wikipedia* has to say about it (see again <http://en.wikipedia.org/wiki/Scientific_evidence>):

> Scientific evidence is evidence which serves to either support or counter a scientific theory or hypothesis. Such evidence is expected to be empirical evidence and in accordance with scientific method.

Now coming to the "scientific method", it has been described in many different ways. To begin with, here's one of them:

1. Make observations.
2. Form a testable, unifying hypothesis to explain these observations.
3. Deduce predictions from the hypothesis.
4. Search for confirmations of the predictions;
5. if the predictions are contradicted by empirical observation, go back to step (2).

And here's another description of it:

> The steps of the scientific method are to:

1. Ask a Question
2. Do Background Research
3. Construct a Hypothesis
4. Test Your Hypothesis by Doing an Experiment
5. Analyze Your Data and Draw a Conclusion
6. Communicate Your Results

They both sound very similar, so I guess they could be representative of pretty much all descriptions of the "scientific method".

Well, all this sounds very good, I must admit. But then, thinking about it a bit more, it occurred to me that there is a *huge* hole in the scientific method when applied to the "principle of relativity". I mean, can there ever be *any adequate test* to provide *any* evidence *at all* that something *can't* be done? Remember, the "principle of relativity" claims that you *will never be able to tell* whether you are in a state of rest or you are moving inertially in a straight line – in other words, that it *can't be done*. Not that it *can* be done, but that it *can't, ever, no way, no how*. Right? Well then, *what* test can be devised to provide even a *shred* of actual *evidence* that something *can't* be done? We're not even asking for a *proof* that it can't be done, mind you – because as we saw, scientists tell us that science doesn't deal with proofs anyway – but just *evidence*, nothing more. Simply because something *hasn't* yet been done doesn't amount to evidence that it *can't* be done, does it? In fact, *many* things that scientists at the cutting edge are trying to do at this very moment haven't *yet* been done – because isn't that much of what cutting-edge science tries to do: things which haven't *yet* been done? So then: aren't these cutting-edge scientists trying to do such things because they assume that these things actually *can* be done, and that the mere fact that they *haven't* been done is absolutely *no* evidence that they *can't* be done?

So again I must ask: if there's no proof, *and* there's not a *shred* of evidence *either*, that the "principle of relativity" is true, then what exactly is the justification for calling it a "principle" at all? Can anyone explain that to me? Why should it not be called a "conjecture" or an "assumption" or a "hypothesis" or a "postulate", or some such term which clearly indicates that it's *not* an actual fact – or truth – at all?

Of course I'll be the first to admit that just because there's neither proof nor evidence that the "principle of relativity" is *true*, it doesn't mean it's necessarily *false*; it just means that there's no proof or evidence yet *either way*. Right? So it *could* be true, unless we can somehow prove it *false.* So let's try doing *that* now.

FOURTH:

LET'S PROVE THE PRINCIPLE OF REALTIVITY ACTUALLY FALSE

But first we have to be very clear *what* it is that we are trying to prove false, don't we. In other words, we must have a clear definition of the "principle of relativity". So let us try to find one that *isn't* totally pointless.

The problem is, I for one haven't been able to find one anywhere which isn't either pointless (talking about "laws of physics not changing") or imprecise (talking about "uniform motion" without stating exactly what "uniform motion" actually consists of). If anyone can provide an adequate definition I shall be much obliged! But in the meantime I feel that I must try and express the "principle of relativity" in words of my own, so as to sure that everyone knows what I am speaking about.

Let's get the easily-refuted ones out of the way to begin with. If we enunciate the "principle of relativity" this way:

x: All motion is relative, and it makes no sense to speak of absolute motion or of absolute rest

… then we have a serious problem, don't we: because physicists *know* that *all* motion is *not* relative. Certainly *circular* or *elliptical* motion is not. Everyone knows nowadays that if a satellite stops orbiting the Earth it will fall down to Earth and crash and burn! So orbital motion is *not* relative. Only *straight line motion at a constant speed* is, even according to modern physicists.

But even *straight line motion at a constant speed by itself* is not *undetectable*, as we explained using our example of a space capsule constrained to go in a straight line using rockets or some such propulsion method. A scientist inside a lab in such a capsule would be able to tell that the capsule is moving, even if he didn't look out the window. Only *inertial* straight line motion at a constant speed is claimed to be undetectable, and therefore relative.

Of course we can all understand that a kind of motion that is *detectable* can also be *differentiated* from any other kind of motion, so that sort of motion is *not* considered relative, right? For the motion of an object *A* to be considered *relative* to that of an object *B*, it should be impossible to *detect* any difference if one were to consider *A* moving and *B* stationary, instead of considering *B* moving and *A* stationary. Right? So again, only *(1) inertial, (2) straight-line,* and *(3) constant speed* motion is claimed to be undetectable, and therefore relative. We must have *all three* of the above conditions – right?

So here's Galileo's expanded definition, the one we considered above, put into more impersonal language:

h. The "principle of relativity" claims that in physics as it applies to our universe, it is impossible to distinguish whether an object is in a state of rest or moving inertially at a constant speed in a straight line.

But now I have to ask: *can* there be any object in *our* universe which moves (1) inertially (2) at a constant speed and (3) in a straight line? Let me venture to claim that there *can't* be such an object, ever! Not if by the term "inertially" is meant "in compliance with the law of inertia".

The "law of inertia" is, I am given to understand, best stated using Newton's First Law, although apparently Newton wasn't the first person to think of it. Newton wrote, in Latin: "*Corpus omne perseverare in statu suo quiescendi vel movendi uniformiter in directum, nisi quatenus a viribus impressis cogitur statum illum mutare.*" And this can be translated into English as: "Every body perseveres in its state of rest or of uniform motion in a straight line, unless compelled to change that state by a force acting upon it". And the term "uniform motion" is taken usually to mean "motion at a constant speed".

So a body in "inertial movement" would have to be moving *(1) at a constant speed, (2) in a straight line, and (3) without any force acting upon it.* But where *in this entire Universe* can a location be found where there is absolutely *no* force acting upon a body of *any* mass, and in which a body can also *move* — that is, change its location – at a *constant rate in a straight line?* Is there *any* location of any size where gravity does not exist at all? And does not gravity change the straight-line constant-speed motion of *every* body that has *any* mass at all … and given that there simply *isn't* any body that has absolutely no mass at all, doesn't that mean that gravity affects *all* bodies, *without exception*?

It is true that in intergalactic space there are enormous voids where the force of gravity is exceedingly *weak*, but any astronomer will tell you that when it comes to gravity, "exceedingly weak" and "non-existent" are not the same thing – not by a long shot. Gravity, in other words, exists *absolutely everywhere* in our universe, and as such, there is not, and cannot be, any such thing as a body moving *inertially, at constant velocity* and *in a straight line.* Not if the body possesses *any mass whatsoever*, even if it be a mere neutrino, because even neutrinos are affected by gravity! No physicist – to my knowledge anyway – admits that there are *any* particles which are *totally unaffected* by gravity. At least as far as I understand, modern physicists admit that even neutrinos have *some* mass, even though they claim that their mass is really, really tiny compared with the masses of other subatomic particles – what to speak of visible objects. And particles which physicists claim would *actually* be massless if they *were* ever to be stationary, such as the photon, are nevertheless supposed to *acquire* mass due to their movement; and since according to most physicists they can never exist *unless* they are in motion, in their entirely massless state they simply don't exist anywhere in *our* universe. At least this is what most physicists claim, isn't it?

So doesn't all the above imply that even in the most remote corner of the Universe, far from any large source of gravitation, even a single neutrino would not be able to escape being forced into movement in a curved trajectory … because even the tiniest neutrino located far away at the other end of the Universe would exert a gravitational field which would be felt by any neutrino located at *this* end of the Universe? Though I would readily admit that it is entirely possible that the degree of curvature of its trajectory could not be measured by any instruments we could devise at our stage of technology. And even if one of these neutrinos were in a hypothetical state of rest initially, it could not *remain* in that state for more than a single moment in time, because gravity would immediately force it to move … wouldn't it?

So: since there is not, and cannot be, any such thing in *our* universe as an object at rest, or moving inertially in a straight line at a constant speed, then what *point* would there be to saying "The principle of relativity claims that in physics as it applies to our universe, it is impossible to distinguish whether an object is in a state of rest or moving inertially in a straight line at a constant speed"? Would it not, again, be tantamount to saying, if we were to spell out all the *hidden* implications of the statement: "The principle of relativity claims that in physics *as it applies to our Universe*, it is impossible to physically distinguish between two objects that can't actually *exist* in our Universe at all"? Of course it would be one hundred per cent *true*, for it *is* indeed impossible to physically distinguish between two non-existent objects, but what would be *point* of saying it?

But suppose that, in order to surmount this difficulty, we were to imagine that *in a hypothetical "universe"* where gravity does *not* exist, bodies *could* actually move at a constant speed in a straight line. Would the "principle of relativity" survive even in such a *hypothetical* universe? Let's see.

Since we are speaking of a hypothetical "universe" where not *all* the laws of physics as we know them necessarily apply – at all events, certainly not the law of gravitation – well then, we could validly start with imagining the simplest hypothetical universe we can think of: one in which there is only *one* thing in it; and then go on to imagining a hypothetical universe in which *two* things exist, and then *three*, and so on. Is that okay?

Right. So let's imagine a hypothetical universe in which there is only *one* thing. Can we tell whether it is moving or not? Or, more correctly, does it even make any *sense* to speak of it moving? Exactly *what* sense does it make to say it is moving?

Well, we might say, "It could be moving *in the space around it*." Since our hypothetical "universe" is entirely imaginary, we can easily imagine a volume of space that's larger than the imagined object, and imagine the object moving in the space around it. If we also imagine an imaginary Cartesian grid in that space – a set of imaginary, equidistantly-spaced lines all parallel to three axes, each axis being at right angles to the other two … well, you know what a Cartesian grid is, right? – then we could imagine the coordinates of our single imaginary object changing over time, and so we could say that the object moves in the space around it.

But aren't we assuming that *the space itself is stationary*, and that object moves *in* it? In other words, aren't we able to tell that one of the two things – in this case, the space around the single object in our imaginary "universe" – is *absolutely stationary,* while the other thing in our universe, the object, *is in absolute motion?*

The curious thing about it is – and I wonder whether you have noticed it – that in our imaginary universe in which we wanted there to be only *one* thing, we actually ended up with *two* things: one of them being the imaginary object itself, and the other being the imaginary space around it! Admittedly, space isn't an *object*, but it *is* something, not altogether *nothing,* because it possesses at least *one property:* namely, *extension.* If we try to diminish the amount of volume of the imaginary space around the object, we can't get *rid* of it entirely – *not even in our imagination*. We simply *can't* imagine a single object with absolutely *nothing at all* around it, *not even empty space!* Maybe that's a limitation of our imaginations, and maybe an alien life-form, or a hypercomputer-based AI which might exist in the remote future, *could* imagine such a thing; but at all events, *we* can't.

Besides, for something to move, shouldn't the space *within* it moves be *bigger* than itself? How can a cube having measurements, say, of exactly 1 metre by 1 metre by 1 metre move at all inside a space whose dimensions are, say, 0.5 metre by 0.5 metre by 0.5 metre? In fact, even if the space were exactly 1 metre by 1 metre by 1 metre in size, wouldn't that very fact render an object whose measurements are *also* 1 metre by 1 metre by 1 metre, totally *immobile* inside it?

So, as far as I can see, we can't even *imagine* a hypothetical universe with only *one* thing in it: we *have* to imagine a space around it which is at least a *smidgen* larger than the object itself. This, I'm guessing, has something to do with the limitations of the way our minds imagine things. For example, we can't imagine a square circle either, because the moment we imagine a square, we notice clearly that it isn't a circle, and vice versa. And this doesn't apply just to our visual imagination. For instance, we can't imagine a day that's both a Tuesday *and* a Thursday, can we? Or a middle-C note (in music) that's *also* a high-C. Not the two notes *combined*, mind you, but one kind of note that *is* another kind. All that sort of thing seems to be beyond the capabilities of even our *imagination.*

In that case, I suggest that we start by trying to imagine a hypothetical universe with *two* things in it! Let's imagine a universe like the one above, in which we have *two* things: namely, one being an *object* possessing mass, and the other being the *space* around the object. Now: can we not *legitimately* say that it is the object that must be moving, and the space around it must be at absolute rest? I suggest we can, because we certainly can't say the opposite: we can't say, in other words, that the object is at rest and the space moves around it. Because remember what we *mean* when we say something "moves": we mean that its *coordinates change!* If we were to say the space moves, then aren't we implying by that sentence, that its *coordinates change?* And if so, then aren't we saying that the change in its coordinates must be determined by its movement in an even *larger* space, *within* which it moves? Or to put it alternatively, aren't we implying the existence of yet a *third* thing, namely, *another* space which *is* stationary, and *within* which *our* space changes its coordinates? If we don't mean that, then what possible *meaning* can we ascribe to the notion that our "space moves"?

What I guess I am trying to say is, if we imagine a hypothetical universe with only *two* things in it (because we *can't* imagine a hypothetical universe with just *one* thing in it, and absolutely *nothing* else, not *even* empty space around it), they we must admit that one of these – namely the empty space around the object – must be absolutely stationary; and so if the object moves, well, it can move in an *absolute* and not merely *relative* sense. (Of course the object can also *not* move, which is to say, it can be *stationary*, in an absolute sense too.) Am I mistaken? If so, how?

But suppose that we get around it by imagining a hypothetical universe, again without gravity, with *two* objects in it, the two surrounded by a space. *Now* can we speak of straight line inertial motion being relative, or not? Well, since we now have *three* things in this hypothetical universe, namely the two objects and the space surrounding it, doesn't the same argument we made above apply again? Mustn't the space be considered *absolutely* stationary, and the objects, if they are moving at all, be considered to be moving *absolutely?* Because if that were not the case, then wouldn't we be implying the existence of a *fourth* thing in such a universe, namely *another* space which *is* stationary, *within* which the original space moves?

And wouldn't the same argument apply again and again, at least in *essence*, regardless of how many things there are in our hypothetical universe? Even if we added a gazillion things to our imaginary "universe", would we not end up with *one* of them being a *stationary* space in the *absolute* sense? And if one of the gazillion objects were stationary relative to that space – that is, if its coordinates in that space were *not* to change over time – it would also be *absolutely stationary*, wouldn't it?

Now up till now we have imagined all our hypothetical universes *without gravity*, but shall we consider what would happen if we *introduced* gravity into our hypothetical universes? Well, the moment we introduce two or more objects possessing *mass* into our hypothetical universe, would not gravity make its mysterious appearance? In other words, wouldn't our hypothetical universe revert to being exactly like our own, in which inertial motion in a straight line at constant velocity *cannot* exist? So, wouldn't the argument we presented earlier, about the "principle of relativity" being pointless, apply to our *hypothetical* universes too? At least if the "principle of relativity" were enunciated using *all* the unsaid things which are glossed over, almost cheatingly, in the majority of definitions of the "principle of relativity"?

Okay, admittedly we have up till now only demonstrated that the "principle of relativity" can't *apply* to our Universe, and therefore it can't be *true* in our Universe (regardless of whether or not it is true in some other "universe"), because an inapplicable statement certainly can't be *true* in any situation in which it *is* inapplicable, though of course it can't be *false* in that situation either; but we haven't yet come up with a *contradiction*, which might be the only way we could actually prove the "principle of relativity" *false.* So let's see if we can come up with one, then! (Of course we have to admit that it can't be proved *false* in *our* Universe, because as we said above, it simply can't *apply* to our Universe, and a statement that can't apply to a particular situation can't possibly be *false* in that situation – though of course, as we said, it can't be *true* either.)

But let's imagine a *hypothetical* "universe" in which there is no gravity (thus permitting inertial motion in a straight line at constant velocity), but in which all the *other* laws of physics remain the same as they are in *our* Universe. Let's suppose that in this hypothetical "universe" there are a number of objects moving inertially in straight lines at constant velocities relative to one another. Let's call the objects *A, B, C, D, … etc*. Suppose object *A* moves at a constant velocity $v_{(AB)}$ relative to *B*, at a constant velocity $v_{(AC)}$ relative to object *C*, at a constant velocity $v_{(AD)}$ relative to object *D*, *etc., etc.* For making things simple, let's initially consider only objects *A* and *B* – we can consider the other objects later on. Under the "principle of relativity", it would be just as correct to say that *A* moves at velocity $v_{(AB)}$ relative to *B*, as to say that *B* moves with velocity $v_{(AB)}$ relative to *A*: right? Now let's suppose that one of the objects – let's call it object *X* – collides with object *A* and thereby exerts a force on it, so as to change $v_{(AB)}$ – namely, *A*'s velocity relative to *B* – to another constant straight-line inertial velocity $u_{(AB)}$, which is *different* from velocity $v_{(AB)}$. So now it is correct to say, isn't it, that the constant straight-line inertial velocity of object *A* relative to object *B* has changed from $v_{(AB)}$ to $u_{(AB)}$ *because* of the *force* applied by object *X* to object *A*? Would you admit that? And, due to the "principle of relativity", it is *equally* correct to say, alternatively, that the constant straight-line inertial velocity of object *B* has changed relative to object *A* from $v_{(AB)}$ to $u_{(AB)}$ because of the force applied by object *X* to object *A*. Would you admit that too?

If you admit all that, then pay close attention to what you would have just admitted. You would have admitted, would you not have, that the constant straight-line inertial velocity of object *B* relative to object *A* has changed *without any force being applied to object B?* And so, in fact, has the constant straight-line inertial velocity of object *C* relative to object *A* changed without any force applied to object *C*, and the constant straight-line inertial velocity of object *D* relative to object *A* changed without any force applied to object *D*, and so on down the line! In fact, the constant straight-line inertial velocities of the vast *majority* of objects in our hypothetical "universe" relative to object *A* have changed due to the force exerted by object *X* on object *A*, without *any* force being applied to objects *B, C, D* and so on.

Now although we have hypothesised that in this alternative "universe" *gravity* doesn't exist, we did say, didn't we, that all *other* laws of physics that apply in our Universe also apply in our hypothetical "universe". Right? So the law (as I live and breathe, of the great Newton himself, quoted earlier in Latin and with an English translation) which says, essentially, that an object's inertial and constant velocity in a straight line can't be changed unless a force is applied to *that very object,* has been violated, hasn't it? Does this not amount to a contradiction? Does this not overthrow the logical validity of the "principle of relativity", *even in a hypothetical "universe"* in which inertial straight line constant-velocity motion *can* exist?

Now let's see if we can find a contradiction in the "principle of relativity" in *our* Universe. To do that, shall we ask ourselves, "What exactly *is* our Universe?" Well, isn't our Universe, broadly speaking, a collection of a finite number of objects possessing mass? Of course the number of objects in the Universe is ginormous, but it isn't *infinite*. Right? (We shall consider, and try to render invalid, claims of an *infinite* Universe later on.) Now *any* finite collection of objects possessing mass must also posses a *centre* of mass, right? Even if the objects in the collection are in constant movement. For instance, a drop of water or oil, or a helium balloon, has a centre of mass: right? As I understand it, if a drop of water falls from a bottle to the ground, its centre of mass *also* falls from the bottle to the ground. In other words, its centre of mass is caused to move by the force of the Earth's gravity acting upon it, and of the force of its gravity acting upon the Earth (remember, gravity is reciprocal, and it's not just the Earth attracting the drop of water – the drop of water also attracts the Earth). Isn't that so? But the movement of the water's own molecules doesn't have any effect on the movement of the *centre of mass of the drop*, do they. The centre of mass of an object is totally unaffected by the movements of its *own* particles, due to Newton's third law, "Action and reaction are equal and opposite". When two objects hit each other in empty space and go off in different directions as a result, their centre of mass is not disturbed in the slightest, because whatever momentum one loses the other gains, and vice versa. And the same applies when three, four, five or any other number of objects collide.

If, for example, a bomb were to go off in space, the motion of the centre of mass of the bomb wouldn't be affected by the explosion, would it. I understand that due to Newton's third law, if the bomb were in orbit around the Moon, for example, before going off, the centre of mass of the products of the explosion would also remain in orbit around the Moon, until of course some of these products hit the Moon because of their being reduced in orbital speed, after which the centre of mass of the bomb would be affected by the forces exerted by the surface of the Moon on the products of the explosion that hit it. Isn't that your understanding too? But until some of the products of an explosion hit something else, the centre of mass of the explosion and the centre of mass of the bomb before the explosion remain the same.

Now it makes sense to me to say that the Universe also has a centre of mass. But if that is indeed the case, then how can the centre of mass of the entire Universe be in motion? What possible force could make it move? Even if the Universe did start with a "Big Bang", like a bomb, wouldn't the centre of mass of the Universe remain exactly where it always was: namely, wherever it was that the Big Bang started, due to the operation of Newton's third law? The "Bang" itself couldn't have made it move, could it have? Just as the explosion of the bomb around the Moon couldn't affect *its* centre of mass. Am I not right? And even if there was in fact no "Big Bang", the universe would still be left with a centre of mass, which would be unaffected by the individual motions of the all the objects in it. So doesn't it make sense to say that the centre of mass of the Universe couldn't be in motion – that it must, in fact, be absolutely stationary?

To put it another way: What could possibly *be* the state of motion of the entire Universe, *considered as a whole?* Not of the individual *parts* of it, but the *whole* shebang. How could it be possibly be in motion at all? Even if we *accept* the principle that all motion must be relative, well then relative to *what* could the *entire* Universe be in motion? Clearly, nothing whatsoever! Especially if we define the word "Universe" to mean "Absolutely *everything* that exists in many manner whatsoever". (And isn't that the only realistic definition of the word "Universe"?) If we define "Universe" to mean "Everything that exists in many manner whatsoever", then clearly there can't *be* anything relative to which the Universe *as a whole* moves, can there be? Because if there were any such thing it would have to be *outside* the Universe, but by the above definition, *nothing* can be outside the Universe! And if there can be nothing outside the Universe relative to which it moves, must the Universe not be at absolute rest?

Fans of the "principle of relativity" might retort saying, "No, the Universe as a whole cannot be at absolute rest either, because there is nothing relative to which it can be at absolute rest, any more than there is something relative to which it can be in motion." So then it must be *neither* in motion *nor* at rest, mustn't it? Or in other words, would it not be like saying "The Universe can neither be in motion nor *not* be in motion"? But what *meaning* can there be to such an assertion? Surely one must admit that a physical thing is *either* in motion or it's *not* in motion, but not *neither* the one *nor* the other*.* Would it not be, to claim any such thing, similar to claiming "The Universe can neither *posses* mass nor *not* possess mass"? Or like claiming "The Universe can neither *be composed of* individual objects nor *not* composed of individual objects"? Or like claiming "The Universe can neither *exhibit* a gravitational field nor *not* exhibit a gravitational field"? Wouldn't it be rather *meaningless* to make any such claims? Wouldn't they, in fact, render all of physics altogether *meaningless?* (And I don't think even fans of the "principle of relativity" would argue that the Universe is *not* a physical thing … ? Heck, even Jupiter is a giant ball of gas; in other words, composed of gazillions of tiny particles; but that doesn't mean it *isn't a physical object*, does it.)

I have also heard it claimed once in a while that our Universe *is*, admittedly, finite, but that it has *no centre*, and therefore no centre of mass either, because it is "curved" around itself, like the surface of a beach ball. Even though that makes no sense to me – because I think it's rather clear that our Universe is *three* dimensional and not *superficial* like the surface of a beach ball, and I just can't see how a *three*-dimensional space can be "curved" – I am willing to accept it as a starting hypothesis. But even if I do so, how does it invalidate my argument? Surely even a beach ball *has* a centre of *mass*, and just because its centre of mass is not anywhere on its *surface*, and indeed it's surface doesn't have a centre itself, it doesn't mean *it hasn't got a centre of mass!* If our Universe is indeed curved around itself and the centre of mass of our Universe isn't on it's surface, whether that "surface" is two- *or* three-dimensional, that by itself doesn't mean it *doesn't* have one, does it. It just means that its centre of mass is somewhere *else*, and *not* on its surface. (I wonder if I should add, *"…duh!"?)* In fact, can anyone *demonstrate* that our Universe has no centre of mass? I doubt it very much, but I am all ears if anyone wants to have a go at it.

And besides, what about considering the Universe *as a whole*, like I said earlier? Even if we were to admit that it doesn't have a centre of mass – again I find that hard to believe, because I have never seen anything that doesn't have a centre of mass, and can't even think of one, but even if I were to accept such a thing with all the absurdities implied by it, which I would be doing without any evidence to back it up, just for the sake of argument – even then, if we consider the Universe as a *whole* it *must* be at rest, mustn't it, by the argument given above: that there would be nothing *else* relative to which it can be in motion, and it makes no sense to say that it's *neither* in motion *nor* not in motion!

But what about an *infinite* Universe? What if our Universe were in fact infinite, and so wouldn't *have* a centre of mass? Well, it seems to me that there are serious mathematical problems with such a concept. For we could ask ourselves: "How many objects would there be in a truly *infinite* universe"? And if we were to answer, "An infinite number, obviously", then wouldn't we be contradicting ourselves, at least implicitly? Surely *every* number, no matter how large, must be *finite* and not *infinite.* When we write down a number, we start with the digit in the largest "tens" column, and then the one in the next-largest "tens" column, and so on, but until we have come to the last digit in the "ones" column, the number hasn't actually been written down, has it? It would never be possible to write down any truly infinite number, even using some sort of shorthand, such as "ten-to-the-power-of-x" or "x-factorial", because even such numbers, despite being gigantonormous in the extreme, aren't really *infinite,* but just very, *very* large. Of course one might argue that it could be written as "∞", but that's hardly any better than writing it down as "an infinite number", is it. That's just saying "it's an infinite number" without demonstrating that there *is* in fact such a number. I'm guessing, anyway, that an infinite number simply can't exist, and I would challenge anyone who says it can to *demonstrate* that it can. If they can't do so, then wouldn't I be justified in saying that there is simply *no* demonstration that an infinite number *can* exist? And if so, could I not correctly deduce from that there is no demonstration that an infinite *universe* – which would have to contain an infinite number of objects, or at least be an infinite number of light-years across – can exist, either? Whereas there *is* a demonstration that a *finite* number can exist – indeed, we deal with finite numbers every day, especially when going shopping – and so there *is* a demonstration that a *finite* Universe *can* exist.

So does it make sense to speak of the Universe being infinite? I submit to you that it doesn't, because if it were indeed infinite, we would perforce have to admit the *existence of a number that doesn't exist,* and that amounts to a contradiction.

Besides, there are other arguments against an infinite number also – for example, the one given by George Gamow (who apparently attributed it to the mathematician David Hilbert, but, as far as I know, only as a joke). Gamow called it "Hilbert's Hotel", and this is how the argument goes:

Let us assume a hypothetical hotel with infinitely many rooms, *all* of which are occupied – that is to say, every room contains a guest. One might be tempted to think that the hotel would *not* be able to accommodate any newly arriving guests, as would be the case with a finite number of rooms. But no!

Suppose a new guest arrives and wishes to be accommodated in the hotel. Because the hotel has *infinitely* many rooms, we can move the guest occupying room No. 1 to room No. 2, the guest occupying room No. 2 to room No. 3 and so on, and accommodate the newcomer in room No. 1. By repeating this procedure, it is possible to make room for any *finite* number of new guests. (Or so Gamow claims.)

It would also be possible, according to Gamow, to accommodate a (countably) *infinite* number of new guests, if such a number of guests even existed: just move the guest occupying room No. 1 to room No. 2, the guest occupying room No. 2 to room No. 4 … and generally speaking, the guest occupying room No. n to room No. $2n$ – and all the odd-numbered rooms would be free for the presumably infinite number of new guests.

This of course, results in the hotel being always able to accommodate guests, *even though all the rooms were full when the guests arrived.* The sign outside the hotel could read: "No Vacancy (Guests Welcome)" … which is absurd, and indeed self-contradictory, isn't it? Doesn't it amount to a *reductio ad absurdum* – that is to say, an argument which proves that our initial assumption *can't* have been true?

So all this leaves us with only a *finite* Universe being possible, doesn't it? Which means that our argument about the "principle of relativity" not being valid when it's applied to the entire Universe still stands!

FIFTH:

LET'S DRAW OUR CONCLUSIONS

Well, shall we see what conclusions we can draw from all the above?

In the first place, it seems to me clear that all definitions of the "principle of relativity" which speak of the laws of nature – or of physics, or of mechanics – *not* changing under certain conditions are pointless, because although they are completely true, they aren't in any way helpful to our understanding of the Universe. All that needs to be said is "The laws of nature never change, period – because if they do, they aren't really laws at all." So such definitions are in no way *relevantly* connected with the "principle of relativity". They are vacuous, empty of any serious meaning, and totally unnecessary.

In the second place, there seems to be no *proof*, or even mere *evidence*, that has *ever* been presented by *anyone* – including the most prestigious of physicists – that just because no one has *yet* been able to tell whether something is in a state of rest or moving inertially in a straight line, that it will actually be *impossible to do so, for all time to come.* Of course *this by itself* doesn't render the "principle of relativity" *false*, but it certainly doesn't render it *true* either. And if there's no proof or even evidence that it's *true,* it seems to me inappropriate to call it a "principle". At best it can be called a "postulate", or an "assumption", or a "hypothesis" – at least in my opinion. But it isn't a *principle*, if by "principle" we mean anything like "A rule or law concerning the functioning of natural phenomena" or "A general scientific theorem or law that has numerous special applications across a wide field". (The former definition is from the Free Online Dictionary and the latter from the Oxford online dictionary.)

In the third place, all those definitions of the "principle of relativity" which leave something out – especially the requirement for *inertial*, *constant-speed*, and *straight-line* motion – seem to me to be pretty much all unduly deceptive, because when we express the "principle of relativity" with *all* the unsaid assumptions clearly spelled out, we realise that it simply can't apply to *our* Universe, due to the presence of *gravity* in it – which renders it impossible for *any* object in *our* Universe to *be* in inertial, constant-speed *and* straight-line motion.

In the fourth place, the "principle of relativity" doesn't even apply to a hypothetical "universe" in which gravity *doesn't* exist; because the moment we try to imagine such a "universe", it turns out that no matter how many objects there are in it, there will have to be at least one imaginary space in that same "universe" that is absolutely *immobile*. So that if any of the multitude of objects in such a "universe" is stationary relative to that space, it too would be absolutely stationary! And besides, in a hypothetical "universe" in which gravity doesn't exist, but all the other laws of physics are the same as in ours, the "principle of relativity" seems to imply that the velocity of an object can be changed *without any force applied to it* – which contradicts Newton's First Law.

And in the fifth place, it seems to me that *our* entire Universe *as a whole* must be stationary in an absolute sense, which is to say, *not* be in motion at all: because even if, for the sake of argument, we *accept* the "principle of relativity" and *admit* that all motion *must* be relative, well then if we define "Universe" to mean "Absolutely *everything* that exists in *any* manner whatsoever", then there can *be* nothing relative to which the Universe as a whole *can* be in motion! So isn't the "principle of relativity" self-contradictory, if we take into consideration the *entire* Universe? Doesn't it render *itself* invalid, then?

So finally – given all five of the above conclusions – hasn't the "principle of relativity" been soundly refuted? *You* tell me!

Cheers mate. Email me if you want at <ardeshir@mac.com> .