Carlo Rovelli

PROFESSOR of PHYSICS

Centre de Physique Theorique de Luminy
Aix-Marseille University

Email Correspondence

March 14–15, 2015

PREFACE

For decades Rovelli has been a major proponent of the quest to quantize the gravitational force known as *Loop Quantum Gravity*. He is a well known participant in physics activities such as FQXi-sponsored essay contests and conferences, and Perimeter Institute-sponsored lectures and symposiums. Rovelli is the author of abstruse technical monographs as well as physics books for general audiences.

A figure and snippet of text from the "popular" book, *Reality is Not What it Seems* [Riverhead, 2017] appears below.

Figure 13.1 An intuitive representation of quantum gravity

Exhibit A — In the text surrounding this figure, Rovelli writes: "The world revealed by quantum gravity…is a world that does not exist in space and does not develop in time… Quanta of space mingle with the foam of spacetime, and the structure of things is born from reciprocal information that weaves the correlations among the regions of the world. A world that we know how to describe with a set of equations… I want to go and see it."

To judge the value of any model of gravity that purports to explain its essence or its effects, it is clearly relevant to ask what it says about *accelerometer readings*. How are we to understand *non-zero readings* as indicated by the perpetual flattening of our undersides, and the *zero readings* as indicated by falling bodies? What is the *physical explanation* for these two starkly different circumstances? Like most of Rovelli's colleagues, he never asks such questions.

A hodge-podge of fractalized triangles and flowery incoherent prose about "the structure of things [being] born from reciprocal information" is a *mockery of physics*. It supports the impression that fundamental theoretical physics has become an entertainment industry, much like religion.

Some practitioners do a better job than Rovelli at paying lip service to empiricism and sticking to a more or less coherent story line. A decade or two ago it was fashionable, in vaguely progressive circles, to admit how badly stuck and confused fundamental theoretical physics has become. Anymore, the prevailing schtick is to tell fantastic dreamy stories of the shimmer of the glimmer on the vanes on the feathers of the purple-winged horsies, just over the horizon.

It was *Big Al* himself (leader of the crowded band of *Smartypants Charlatans*) who set the example and gave the green light to dissing "the physical experience of the experimenter" and striving, via mathematics, to reach "up to the regions of highest abstraction." [*Ideas and Opinions*, Crown (1982) p. 282.] Even this iconic god, this maestro sales guy must roll in his grave at the absurdities that now pass for science. What hath *Big Al* wrought? What *Big Al* hath wrought is a throng of Rovelliesque entertainers, trained at and sponsored by Hooba Gooba Headquarters such as Perimeter Institute and similar institutions around the world.

Happily, Rovelli does have a sense of humor, as evidenced by his appreciation for my Mr. Natural postcard, which actually motivated Rovelli to contact me. Having then also looked into some of my other work to find my radical prediction for the result of Galileo's experiment, Rovelli proposed a bet to settle the matter. Sadly, Rovelli's money is not where his mouth is. He backed out after failing miserably to defend his reasons for boldly offering me 100-to-1 odds.

Note that the gist of Rovelli's argument echoes the status quo idea that Galileo's experiment has been "effectively" done. We don't need to really do it because we already know the answer. As I've stated or implied elsewhere, this is just lame, sloppy, inexcusable pseudo-science.

Nothing like a Small Low-Energy Non-Collider has ever been operated by humans—not even close.

carlo rovelli, 3/14/15 8:29 AM -0800, ! **1**

From: carlo rovelli <rovelli@cpt.univ-mrs.fr>
Date: Sat, 14 Mar 2015 17:29:00 +0100
Subject: !
To: rjbenish@comcast.net

I got your (great) card. I like your style a lot, and was very happy of receiving it.
But I could bet 100 to 1 that it does not slow down, it oscillates…
c

~~~~~~
carlo rovelli
centre de physique théorique de luminy
aix-marseille university
ph +33 6 14 59 38 85, +39 348 22 51 583
rovelli@cpt.univ-mrs.fr
~~~~~~

carlo rovelli, 3/15/15 3:16 AM -0800, Re: ! **1**

To: carlo rovelli <rovelli@cpt.univ-mrs.fr>
From: Richard J Benish <rjbenish@comcast.net>
Subject: Re: !
Attachments: < Galileo's-Belated-Experiment.pdf > < SGM-CN-and-DE-Sep-6-09.pdf >

> Dear Professor Rovelli,
>
> OK, you're on!
>
> Whatever you can get 100 of, I guess I should be able to get one of them.
>
> But seriously, if gravitational physics were in a healthy state, would the result of an experiment proposed by Galileo be the subject of a WAGER? Should it not already be an empirical FACT?
>
> When do we get started?
>
> Thanks for your interest and your sense of humor. :)
>
> Cheers,
>
> Richard Benish
>
> P S
>
> As you can see from the attached papers, I am willing to bet that accelerometer readings will turn out to be more accurate indicators of our actual state of motion than our visual impressions that falling objects accelerate downward. It does *not* oscillate.
>
> R B

From: carlo rovelli <rovelli@cpt.univ-mrs.fr>
Date: Sun, 15 Mar 2015 12:43:25 +0100
Subject: Re: !
To: Richard J Benish <rjbenish@comcast.net>

> > well, just the name"non-collider"would be a good enough reason for trying the experiment…
> > but:
> >
> > > But seriously, if gravitational physics were in a healthy state, would the result of an
> > > experiment proposed by Galileo be the subject of a WAGER? Should it not already
> > > be an empirical FACT?
> >
> > not really.
> >
> > every slightly redesigned experiment is something new, and, to be infinitely open-minded, one could expect something new to happen. So, EVERYTHING can be subject of a wager. how do you know gravity would just stop tomorrow, for instance?
> >
> > but, except for few interesting cases every experiment is a version of something we have already tried many times. and therefore just a bit of being reasonable, or perhaps just a lot of induction from centuries of observations that Nature likes to be consistent, imply that by far our best bet is that things will keep happening in the way we have observed to do.
> >
> > it is true, as you say that, strictly speaking, the galileo experiment has not be done, but many observations very close are common. a very well known, for instance, is that inside the solar system, or inside a galaxy, the observed observation of an object is always very precisely given by the sum of the forces from all the surrounding bits of matter. if there was ant tiny discrepancies from that, we would have detected it, for instance in the very precise Solar System measurements. For what you expect to happen, there should be a dramatic violation of Newton gravitational law at these scales.
> >
> > Everything is possible, but it is more likely that tomorrow I happily realise I can fly by agitating my arms…
> >
> > c

To: carlo rovelli <rovelli@cpt.univ-mrs.fr>
From: Richard J Benish <rjbenish@comcast.net>
Subject: Re: !
Attachments: <Maximum Force Nov 17 2011.pdf >

> > Dear Professor Rovelli,
> >
> > Did I just see a Rovelli-Bird fly by my window?
> >
> > Ah yes, all sorts of silly things can be imagined as being possible. I'd better not get started with the list from modern academic physics.
> >
> > Your argument that observations from existing experiments are "very close" to verifying Galileo's experiment as well, I have heard many times. Among the reasons that I find it unconvincing are

certain differences between the accepted exterior solutions of gravity and the extrapolated interior solutions.

The idea that gravitational potential continues to decrease from the surface inward corresponds to the GR idea that the rates of clocks continue to decrease to a central minimum. This entails the TEMPORAL coefficient in the corresponding Schwarzschild solutions. Curiously, the SPATIAL coefficient does not follow the same pattern. OUTSIDE matter the spatial coefficient is everywhere the inverse of the temporal coefficient. But INSIDE matter the spatial coefficient diverges, going to unity (flat space) at the center.

In some ways similar to the arguments of Tangherlini (cited in the attached paper; see especially pp. 9-10), my arguments suggest instead that the temporal and spatial coefficients are ALWAYS reciprocals of each other. (They BOTH go to unity at the center.)

In either case, the predictions have not been tested.

As also argued by Tangherlini, it is possible to find a solution that is empirically indistinguishable from Schwarzschild's exterior solution that may nevertheless correspond to INTERIOR solutions that differ markedly from the standard predictions of GR, and even Newton.

I understand your reasoning based on the idea of attractive forces summed over every bit of matter within a given volume. I understand how "self-evident" this reasoning may seem and how radical it is to propose any "dramatic violation of Newton gravitational law at these scales."

The advice of Herman Bondi, if taken to heart, means that, without direct empirical support, we should nevertheless remain unsatisfied with such arguments because a mathematical extrapolation from the outside to the inside is not an acceptable substitute for a physical fact:

> "It is a dangerous habit of the human mind to generalize and to extrapolate without noticing that it is doing so. The physicist should therefore attempt to counter this habit by unceasing vigilance in order to detect any such extrapolation. Most of the great advances in physics have been concerned with showing up the fallacy of such extrapolations, which were supposed to be so self-evident that they were not considered hypotheses. These extrapolations constitute a far greater danger to the progress of physics than so-called speculation."

From this advice (and the arguments above) it follows that existing empirical observations are actually nowhere near sufficient to establish the validity of the interior solutions of Newton and Einstein. However embarrassing it may be to admit, modern gravitational physics suffers from a large and profound gap in empirical data.

I hope you are still interested in following through with your bet, to settle up only after the result of Galileo's experiment is in the record books.

Thank you very much.

Sincerely,

Richard Benish

From: carlo rovelli <rovelli@cpt.univ-mrs.fr>
Date: Sun, 15 Mar 2015 21:49:04 +0100
Subject: Re: !
To: Richard J Benish <rjbenish@comcast.net>

wait: "exterior" and "interior" to a body has nothing to do with "exterior" and "interior" of an event horizon. in the bodies you want to test we are always "outside" the event horizon.
the real question is not what happens inside or outside, but whether there is room for any violation of Newton theory at velocities and potentials << c.

How can a stone know if it is "inside" or "outside" of anything? The gravitational potential is just the linear sum of the potentials of each bit of matter, and the acceleration is its gradient. What could be the *possible* theory that could give your strange prediction and be consistent with all we do with gravity in the Newtonian limit?

c

One of the most commmon misunderstandings in my correspondence with physicists is that they regard my reference to INTERIOR solutions as referring to inside the "event horizon" of a black hole. I'm talking about the reality under our noses, inside the nearest body of ordinary matter. But they misconstrue and seem to insist on thinking the world revolves around their exotic fantasies.

carlo rovelli, 3/15/15 1:31 PM -0800, Re: ! **1**

To: carlo rovelli <rovelli@cpt.univ-mrs.fr>
From: Richard J Benish <rjbenish@comcast.net>
Subject: Re: !
Attachments: < Max Force Annotation.pdf >

Dear Professor Rovelli,

A free stone does not know if it is inside or outside of anything, as you say.

But if an accelerometer is attached to the (ideally massless) stone, it gives either a zero or non-zero reading depending on whether it is falling or not. I understand that the idea of taking accelerometer readings for face value at first sounds absurd because it violates the usual way of calculating motion from a potential.

The paper attached last time (*Maximum Force Derived from Special Relativity, the Equivalence Principle and the Inverse-Square Law*) gives a fairly readable account of the "theory" (better *model*) on which I base the prediction that the test object does not oscillate in the hole. According to the model, gravity is not a force of attraction at all, but rather the process by which matter generates space. The process requires a fourth spatial dimension.

I've attached an Annotation that describes how the paper "almost" got published in the *International Journal of Theoretical Physics*.

I hope you have time to take a look at the paper.

Independent of my radical theoretical ideas, I still maintain that a thorough investigation of gravity should include an empirical test of Galileo's experiment.

Thank you very much.

Sincerely,

Richard Benish

From: carlo rovelli <rovelli@cpt.univ-mrs.fr>
Date: Sun, 15 Mar 2015 22:35:24 +0100
Subject: Re: !
To: Richard J Benish <rjbenish@comcast.net>

---

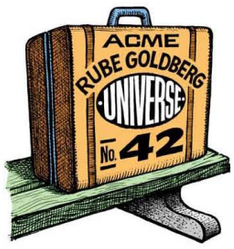
ok… will read… i am far from convinced…
an accelerometer attached to something falling reads nothing at all…
…but i will read…

Mr. Natural SAYS:

If YOU'VE BEEN NERVOUSLY ROOTING FOR "NATURALNESS" TO WIN THE DAY...

If YOU'RE BEFUDDLED BY THE LHC'S FAILURE TO FIND SUSY...

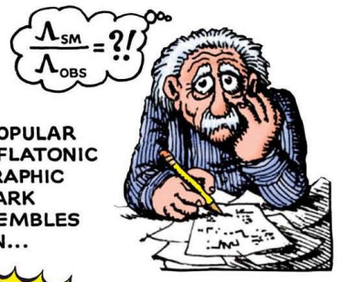
If YOU'RE STILL SCRATCHING YOUR HEAD ABOUT THE DIRECTION OF TIME...



If YOU'RE STRESSED OUT BY THE EMBARRASSING 10^{120} COSMIC VACUUM DISCREPANCY...

OR

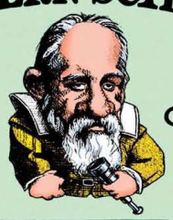
If YOU'VE NOTICED THAT THE POPULAR PLETHORA OF PLANCK-SCALE INFLATONIC SINGULARITY-STRICKEN HOLOGRAPHIC STRING-BRANES INHABITING A DARK MIRAGE OF MULTIVERSES RESEMBLES A HOLLYWOOD FANTASY, THEN...



Lighten Up!

Some fundamental, yet unexplored science has been knocking at the door for centuries. Simply accept the invitation to do an experiment proposed in 1632 by the Father of

MODERN SCIENCE

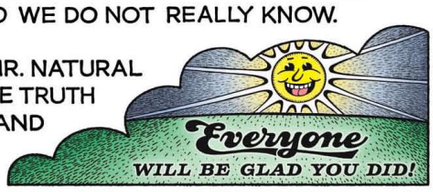
Galileo  Galilei

Galileo asked: What happens when a small body of matter falls radially into a larger body without collision? At the opposite extreme of the LHC's high-energy collision experiments, Galileo's experiment requires only a relatively inexpensive Small Low-Energy Non-Collider:

TWO UNDISTURBED BODIES OF MATTER  SMALL LOW-ENERGY NON-COLLIDER

Mr. Natural UNDERSTANDS WHY YOU MAY THINK YOU ALREADY "KNOW" THE RESULT OF THIS EXPERIMENT. BUT HUMANS HAVE NEVER YET **OBSERVED** GRAVITY-INDUCED RADIAL MOTION THROUGH THE CENTERS OF MASSIVE BODIES. FOR THIS WE HAVE **NO DATA**, SO WE DO NOT REALLY KNOW.

Therefore IT BEHOOVES US TO JOIN MR. NATURAL AND ALL SCIENCE-MINDED SEEKERS OF THE TRUTH TO FULFILL THIS HUMBLE GOAL, TO BUILD AND OPERATE HUMANITY'S VERY FIRST **SMALL LOW-ENERGY NON-COLLIDER.**



GravitationLab.com • rjbenish@comcast.net

1 MARCH 2015

Dear Professor Rovelli,

Einstein strongly advocated letting the imagination run wild, toward the extremes of "highest abstraction." After decades of voluminous work in this direction, our efforts to quantize and unify gravity remain far from the goal. Perhaps Einstein was too quick to dismiss the value of direct physical experience. Perhaps we have overlooked some crucial clue "hiding" right under our noses, our real physical noses. [IDEAS & OPINIONS P. 282]

It is commonly believed that General Relativity has been well-tested on scales from mm to AU. True as this may be for the Schwarzschild EXTERIOR solution, it is not at all true for the INTERIOR solution.

The most physically significant feature of the interior field of a uniformly dense sphere is that the rate of a clock at its center is supposed to be a MINIMUM. Humanity has not yet tested this prediction on any scale. The most ponderous half of the gravitational Universe (under our noses) thus remains to be empirically explored.

One of the kinematic consequences of the central clock rate minimum (as commonly treated in Newtonian gravity) is the oscillation of a test mass in a hole through the center of a larger massive body. Evidence bearing on the kinematics and (indirectly) clock rate could be gotten by conducting Galileo's experiment, as described on the front of this card. It could be done in an Earth-based laboratory (with a modified Cavendish balance) or in an orbiting satellite.

I would therefore urge you to please help to generate interest in performing this experiment that Galileo proposed so long ago. If we are truly diligent in our investigation of gravity and the physical world, why don't we bring Galileo's proposal to fruition by building and operating humanity's very first SMALL LOW-ENERGY NON-COLLIDER?

Thank you very much.

Sincerely, Richard Benish

Post Card

THIS SIDE FOR THE ADDRESS

To: Professor Carlo Rovelli
CENTRE de PHYSIQUE THEORIQUE de LUMINY
CASE 907, LUMINY, F-13288
Marseille, FRANCE
EU

RECENT FORUM POSTS

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Anonymous: "Again, thanks Steve, it is in your wheelhouse. So if you and others wish to..." *in* Thermo-Demonics

Steve Dufourny: "Considering primordial informations.The supermassive BHs are fascinating,we..." *in* Information as Fuel — A...

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FQXI ARTICLE April 24, 2019

The Spacetime Revolutionary

Carlo Rovelli describes how black holes may transition to "white holes," according to loop quantum gravity—a radical rewrite of fundamental physics.

by Colin Stuart

FQXi Awardees: Carlo Rovelli

December 13, 2016

You might call Carlo Rovelli a reluctant physicist. "I wasn't one of those kids who was enamoured with science at an early age," he says. "I only decided to study physics after the exclusion of everything else."

Rovelli, now at the Centre for Theoretical Physics, in Luminy, Marseille, France, certainly didn't think it would become his career—or that he might one day be known for co-founding a radical new theory to explain the origins of spacetime, loop quantum gravity. He is now investigating whether evidence for this model could be found in the form of "white holes," formed as black holes turn themselves inside out, spewing, rather than swallowing, matter.

Carlo Rovelli
CTP Luminy, Marseille

Rovelli recounts that he only went to university in order to delay enrolling in Italy's compulsory military service. So he freely concedes that he was far from a model student. Attending university in the Seventies he was swept up in political activism, a legacy from the halcyon days of the late Sixties. "I was more into trying to change the world than studying," he admits. But Rovelli soon realised he wasn't getting vary far with his political revolution. It was only then that he started studying relativity—Einstein's ideas on gravity that involve weaving space and time together into a four-dimensional fabric—and quantum mechanics—the theory governing the world of the very small—in more detail. He describes what came next as a flash. "It was incredibly beautiful," Rovelli says. "I fell in love with it."

One Brief Lesson on Physics-Writing

Carlo Rovelli discusses his international bestseller, "Seven Brief Lessons on Physics," with Colin Stuart.

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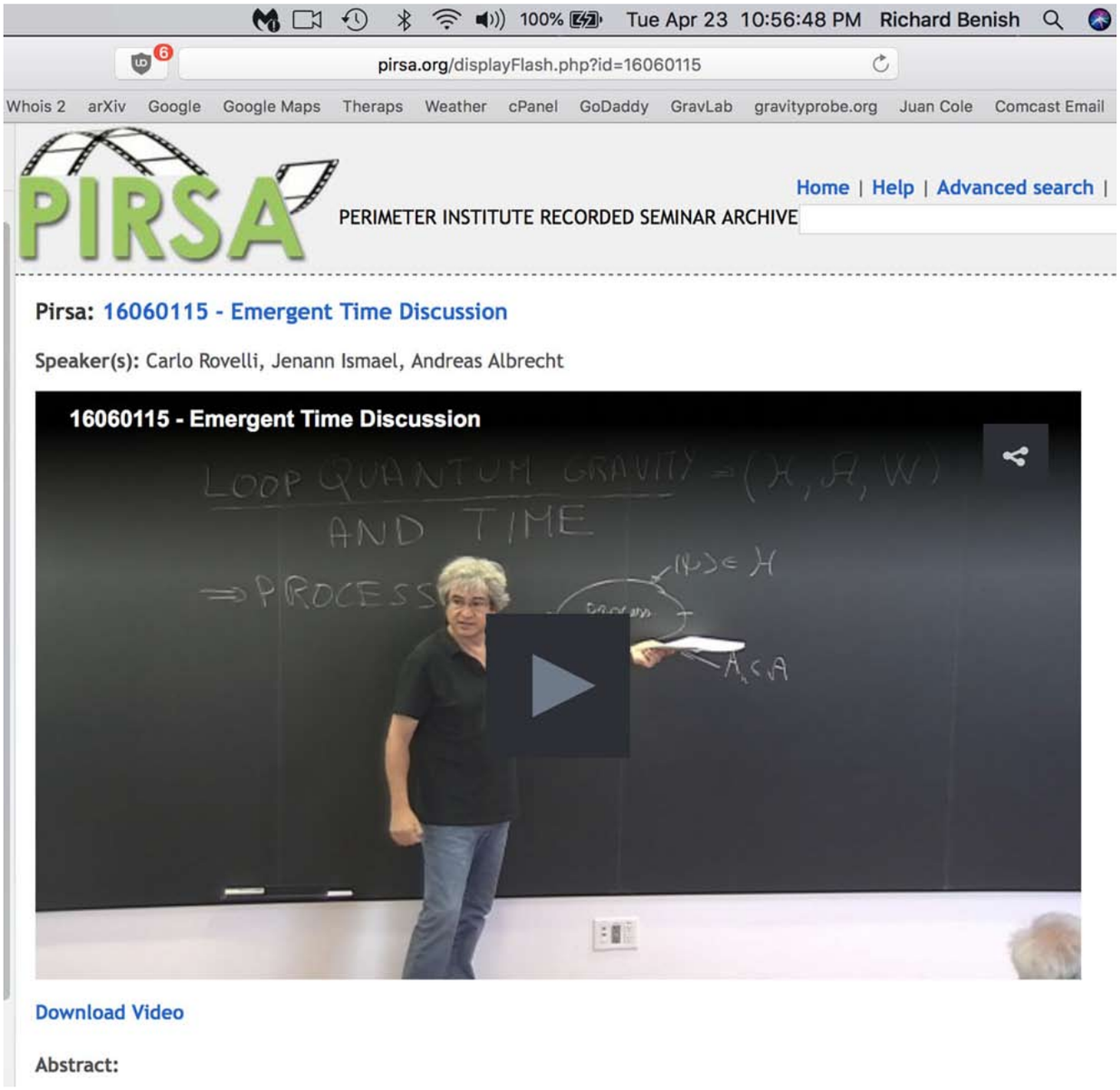
Immersing himself in physics, Rovelli's studying habits changed. During a wander around the library at the University of Bologna he stumbled across a review article on quantum gravity—the quest to unite Einstein's theory of gravity and quantum mechanics—by British physicist and FQXi member Christopher Isham. It would change everything. Rovelli was captivated by how the subject required us to completely change our views about space and time. "I thought wow, this is better than LSD. I want to do this!" he says. He then realised that physicists might be able to change the world even more than political revolutions do. "I think that Copernicus and Dirac and Einstein changed the world quite a lot," Rovelli says. "I wanted to be part of this common adventure."

Rovelli then went on to do a PhD, at the University of Padua, Italy, but unusually for a doctoral student he didn't publish any papers, instead choosing to focus on mastering the different approaches to quantum gravity. Doctorate complete, he set out on his own,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