Julian Barbour

VISITING PHYSICIST

Oxford University

Email Correspondence

January 25–26, 2016

PREFACE

Though never having taken an academic position, Barbour has developed a high profile amongst certain theoretical physicists—especially those whose works stress "philosophical" underpinnings. In the 1990s Barbour co-edited a compendium on *Mach's Principle*. In recent years he has focused his efforts to argue that *time is an illusion* (consistent with views sometimes espoused by Einstein).

I'm not aware of any empirical consequences that would distinguish Barbour's work from others. Experiment is not really his thing. Be that as it may, Barbour's response that Galileo's experiment has been "effectively" done already exhibits the recurrent failure to see that measurements of static *forces* do not allow making conclusions about through-the-center *MOTION*.

I had hoped Barbour would take an interest in Galileo's experiment because of its bearing on the *direction* (and therefore *reality*) of *time's arrow*. If the result of the experiment is that the test object oscillates, then the temporal reversibility of gravity would be supported. A video of the oscillation prediction looks the same whether played forward or backward.

Whereas, a video of the *non*-oscillation prediction is asymmetrical and only makes physical sense in the forward direction. If this prediction were to be supported by an actual experiment, it would unequivocally reveal the unidirectionality of time's arrow: *Time only increases because space and matter also only increase.* By establishing the *interdependence* of the dimensional elements of the world, this result would also indicate a profound *unifying* principle of the physical Universe.

Alas, though Barbour thought my thesis was "well written," he still didn't get it.

Julian.Barbour@physics.ox.ac.uk, 10/14/15 11:36 PM -0800, Galileo's Gravity Experiment **1**

To: Julian.Barbour@physics.ox.ac.uk
From: Richard J Benish <rjbenish@comcast.net>
Subject: Galileo's Gravity Experiment
Attachments: <Galileo's-Belated-Experiment.pdf> <Mr-Natural-Says-LR.pdf>

Dear Professor Barbour,

The attached paper argues that until we do Galileo's experiment, we cannot be certain whether or not an important stone in gravitational physics has been left unturned.

I hope you have some interest in filling this large gap in our empirical knowledge of gravity.

Thank you for your good work.

Sincerely,

Richard Benish

Julian Barbour, 10/15/15 1:36 AM -0700, Re: Galileo's Gravity Experiment **2**

From: Julian Barbour <BarbourJ@physics.ox.ac.uk>
To: Richard J Benish <rjbenish@comcast.net>
Subject: Re: Galileo's Gravity Experiment
Date: Thu, 15 Oct 2015 09:36:19 +0100

> Dear Richard Benish,
>
> I have read your paper, which is well written. My suspicion is that effectively Galileo's experiment has been performed. I think there must have been tests of free fall within mines, from which first deviations from the Newton/Einstein predictions would have shown up. Moreover, atomic clocks are now incredibly sensitive and I am sure some are being used in deep mines. Any effects large enough to be detected in the kind of experiment in space that you propose would also show up.
>
> Best wishes, Julian Barbour.
>
> Julian Barbour
> Emails: julian.barbour@physics.ox.ac.uk or julian@platonia.com
> Website: http://platonia.com

Julian Barbour, 10/15/15 9:04 AM -0700, Re: Galileo's Gravity Experiment **3**

Date: Thu, 15 Oct 2015 08:04:59 -0800
To: <julian.barbour@physics.ox.ac.uk>
From: Richard J Benish <rjbenish@comcast.net>
Subject: Galileo's Gravity Experiment
Attachments: SLENC as Clock Smalley 1975.pdf

> Dear Professor Barbour,
>
> Many thanks for reading my paper and your thoughtful reply.
>
> In response, it should be pointed out that the free fall tests that you refer to all have the character of EXTERIOR solution tests. With respect to the Earth, this is because the distance over which the fall takes place is still extremely small compared to the radius of Earth as a whole. Moreover, the Earth is not uniformly dense. It's density increases toward the center, so that the acceleration of gravity also increases toward the center far below the crust, well into the mantle.

A similar argument applies to clock rates. The GPS and and other "experiments" involving clock rates either involve large distances over the surface or small distances near the surface. The huge region within a massive body where the acceleration decreases and goes to zero at the center has never been probed with regard to either clock rate or gravity-induced radial motion.

Even with the marvelous advances in atomic-clock technology, for laboratory-sized bodies, predicted clock rate differences are still too small to measure.

Therefore, I maintain that Galileo's experiment has never been performed, even "effectively."

In addition to my email message I've also sent you a hard copy version of the second attachment (Mr. Natural postcard), upon which I've pointed out that the Small Low-Energy Non-Collider experiment also serves as a test of time-reversal invariance. Of course, I understand that physicists have reasons to expect that a time-reversible result would be found (harmonic oscillation). But it must be admitted that, until the experiment is actually carried out, this is just a guess.

In freshman physics class we learn the "result" of Galileo's experiment and carry on through our careers assuming that we really know it. The truth is that the actual physical experiment represents a rather large (centrally located) stone in the garden of physics under which nobody has yet looked.

I thank you again for your kind response and your curiosity about gravity.

Sincerely,

Richard Benish

PS: I have attached a paper (*NASA Technical Memorandum*) in which Larry Smalley reviews proposals (ca 1975) for doing Earth-orbit versions of Galileo's experiment. None of them ever got beyond the drawing board. A less expensive way of doing it would be in an Earth-based laboratory with a modified Cavendish balance.

Cheers,

RB

October 12, 2015

Dear Dr. Barbour,

TIME-REVERSAL INVARIANCE is among the fundamental principles that would be tested by conducting Galileo's SMALL LOW-ENERGY NON-COLLIDER experiment. It is widely ASSUMED that the test object (time-reversibly) oscillates in the hole. But nobody has ever SEEN this happen. What if it doesn't? Do we understand gravity well enough to be certain that the experiment's result would not reveal the one-way direction of time? Why don't we settle the matter by doing the experiment?

Reasons for the failure of academic physics to even ASK such questions, as well as the positive consequences of finally doing so, are suggested in what follows.

Einstein strongly advocated letting the imagination run wild, toward the extremes of "highest abstraction." [IDEAS & OPINIONS, p. 282] After decades of voluminous work in this direction, our efforts to quantize and unify gravity remain fruitless. The long-sought evidence of gravitational waves remains elusive. And speculations about various invisible extreme conditions of the cosmos are well-characterized by literal and figurative DARKNESS.

Perhaps undervaluing and misinterpreting direct physical experience were among Einstein's gravest errors. Perhaps we have overlooked some crucial clue hiding right under our noses, our real physical noses.

It is commonly believed that weak-field General Relativity has been well-tested on scales from mm to the Solar System. 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 rates of clocks are supposed to decrease to a central MINIMUM. So it is predicted. Humanity has not yet tested this prediction on any scale. The simplest manifestation of spacetime curvature and the motion it is supposed to produce within the most ponderous half of the gravitational Universe (under our noses) thus remains INVITINGLY UNOBSERVED.

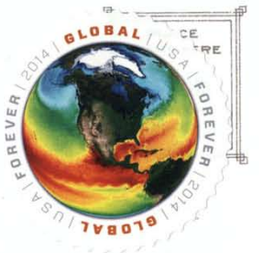
One of the kinematic consequences of the central clock rate minimum (as commonly treated in Newtonian gravity) is the oscillation of a test mass dropped into a hole through the center of a larger massive body. Evidence bearing on the kinematics and (indirectly) clock rate could be gotten by conducting 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. To be truly diligent in our investigation of gravity and the physical world, should we not bring Galileo's proposal to fruition by building and operating humanity's very first SMALL LOW-ENERGY NON-COLLIDER?

Thanks for your good work.

Sincerely,
Richard Benish

Post Card



THIS SIDE FOR THE ADDRESS

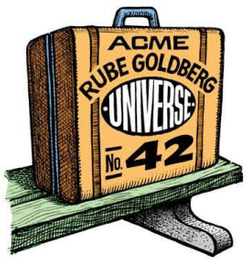
To: Dr. Julian Barbour
College Farm
South Newington, Banbury
Oxon, OX15 4JG
UK

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...

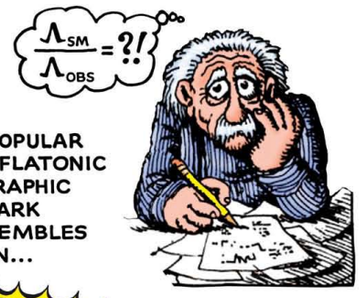
If YOU'RE STILL SCRATCHING YOUR HEAD ABOUT THE DIRECTION OF TIME...



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

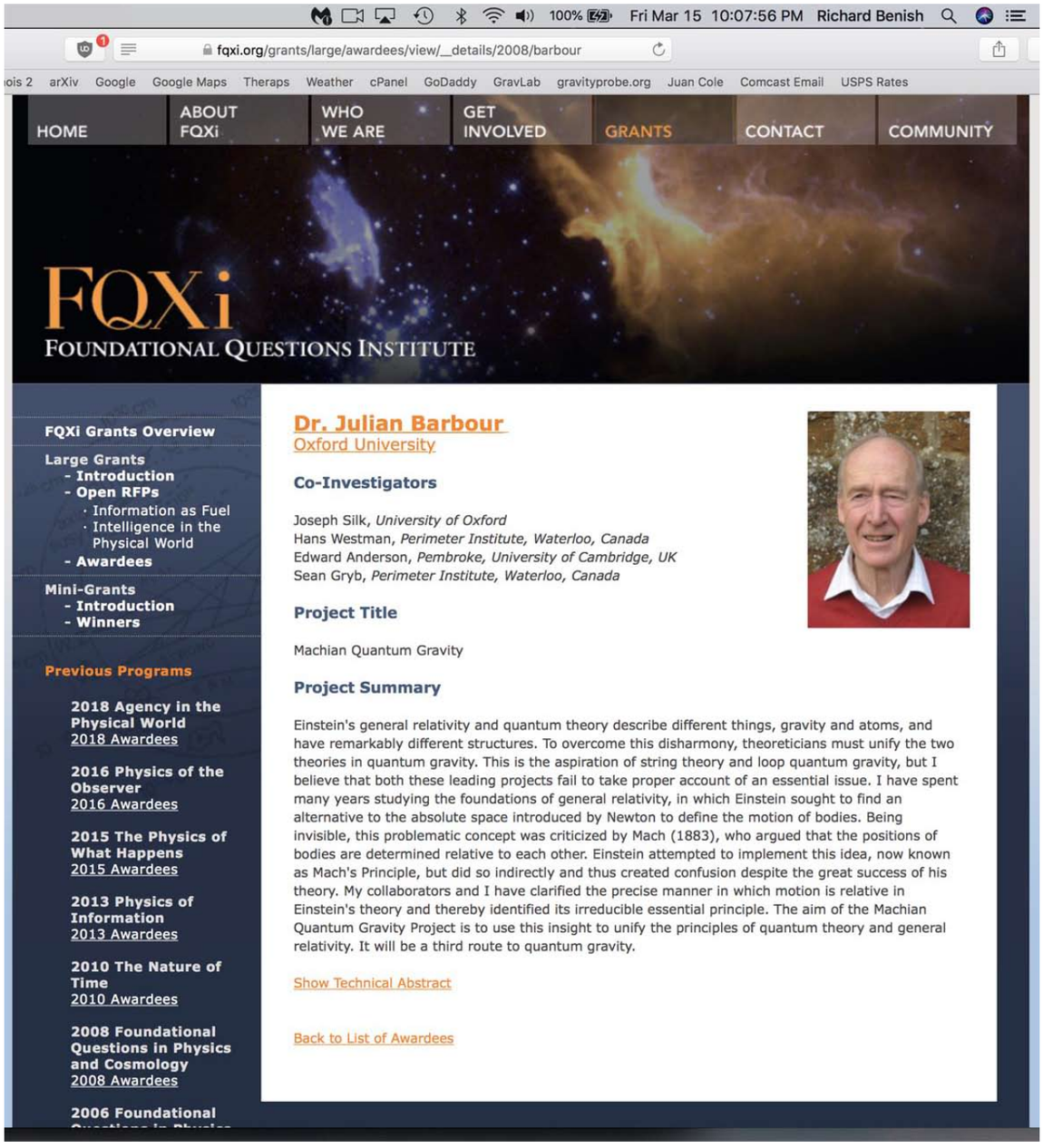
Galileo asked: What happens when a small body of matter falls radially into a larger body without collision? At the opposite extreme of the LHC's high-energy collision experiments, Galileo's experiment requires only a relatively inexpensive Small Low-Energy Non-Collider:

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


100% Fri Mar 15 10:07:56 PM Richard Benish
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Dr. Julian Barbour
Oxford University
Co-Investigators
Joseph Silk, University of Oxford
Hans Westman, Perimeter Institute, Waterloo, Canada
Edward Anderson, Pembroke, University of Cambridge, UK
Sean Gryb, Perimeter Institute, Waterloo, Canada
Project Title
Machian Quantum Gravity
Project Summary
Einstein's general relativity and quantum theory describe different things, gravity and atoms, and have remarkably different structures. To overcome this disharmony, theoreticians must unify the two theories in quantum gravity. This is the aspiration of string theory and loop quantum gravity, but I believe that both these leading projects fail to take proper account of an essential issue. I have spent many years studying the foundations of general relativity, in which Einstein sought to find an alternative to the absolute space introduced by Newton to define the motion of bodies. Being invisible, this problematic concept was criticized by Mach (1883), who argued that the positions of bodies are determined relative to each other. Einstein attempted to implement this idea, now known as Mach's Principle, but did so indirectly and thus created confusion despite the great success of his theory. My collaborators and I have clarified the precise manner in which motion is relative in Einstein's theory and thereby identified its irreducible essential principle. The aim of the Machian Quantum Gravity Project is to use this insight to unify the principles of quantum theory and general relativity. It will be a third route to quantum gravity.
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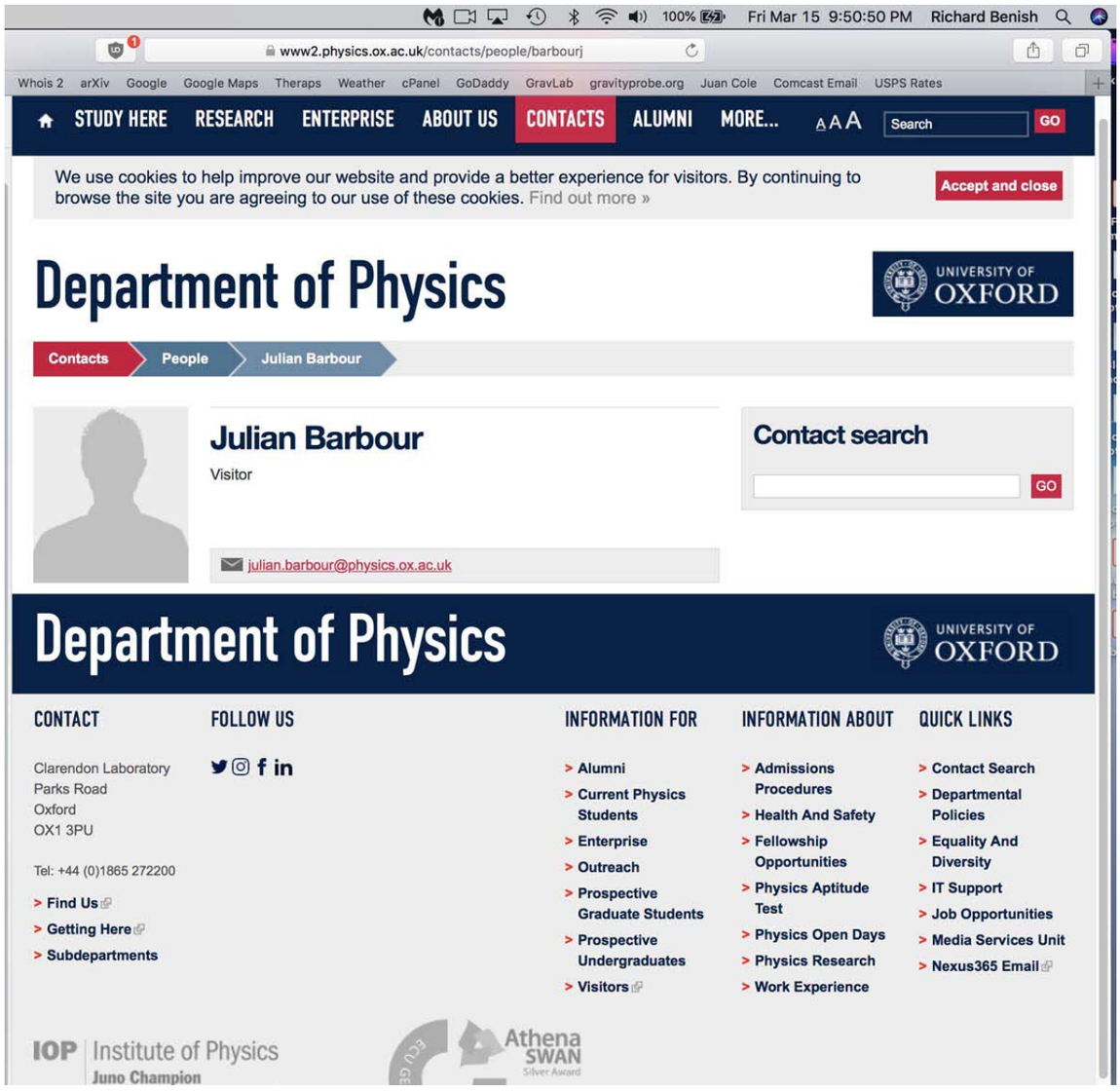
Fri Mar 15 9:50:50 PM Richard Benish
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