John Morack

PROFESSOR of PHYSICS

University of Alaska Fairbanks

Email Correspondence

January 13 – 17, 1996

PREFACE

At the time of our correspondence, Morack was Chairman of the Physics Department at the University of Alaska Fairbanks. My outgoing message was the same as in my correspondence with Marc Davis and Bryce DeWitt.

From these early days of my marketing efforts, we have another variation of the "been done" responses. In this case, Morack expects me to accept, as written in his final response (January 17, 1996) the validity of a kind of conceptual equation:

Various measurements of static gravitational fields
\+ Various unrelated investigations of simple harmonic motion
_____
= Observation of oscillatory motion through the center of a gravitating body.

Insofar as the latter observation is beyond all human experience, the equation may be regarded as a *proposition*, but certainly not as a *fact*. It may in the end be true. But the only way to find out is to *test* it, to *actually, physically do the experiment*. Galileo's experiment has most certainly *not* "been done."

But Morack is in the position of authority. So there.

To: ffjlm@aurora.alaska.edu
From: rjbenish@teleport.com (Richard Benish)
Subject: gravity-induced radial oscillation

Dear Professor Morack,

I have a question concerning a gravity experiment which, to my knowledge, has never been done. It's the one often posed in elementary physics texts: Given a uniformly dense spherical mass with an evacuated hole through a diameter, show that a test object dropped into the hole harmonically oscillates.

This is easy enough to show theoretically, but is there any empirical evidence? I know of examples where the idea has been proposed to used the oscillation as a clock—whose frequency would give a measure of Newton's G (satellite experiment). And I've heard it said that stars can oscillate through the centers of star clusters. But I've never found any data to substantiate it.

This strikes me as curious. So I am asking you, if you can, to please tell me where the predicted oscillation has been physically demonstrated.

If you don't know of any evidence, perhaps this would be a worthwhile experiment to do. (Because it would replace an extrapolation for a concrete fact.) Using an apparatus resembling a Cavendish balance, but having the attracting masses sculpted so as to permit movement of the bobs through the center, I think it would not be too difficult, at least to demonstrate the oscillation as a first approximation.

I thank you very much for any comments or information.

Sincerely,

Richard Benish

Mime-Version: 1.0
Date: Mon, 15 Jan 1996 07:43:46 -1000
To: rjbenish@teleport.com (Richard Benish)
From: ffjlm@aurora.alaska.edu (John Morack)
Subject: Re: gravity-induced radial oscillation

Dear Richard,

The question of how the gravitational field varies inside of an object was raised and solved by Newton. There are numerous experiments to determine how the field varies inside the earth. Indeed the variation of the field has been measured in deep mines, etc and there have been no disagreements with Newton's Law of gravitation that I know about.

The concept of simple harmonic motion comes from the solution of Newton's second law for the case where the force is proportional to the displacement of the object. A simple case is an ordinary spring. There are numerous other examples and they indeed execute simple harmonic motion. The gravitational field inside of a sphere is another case that satisfies this condition and it therefore makes an interesting example which appears in many elementary physics texts.

What could be learned by performing the experiment? Probably not much. The field has been already been measured and simple harmonic motion is well understood. No one doubts that if you could set up the experiment, it would work. Your assummption that it would be a simple experiment to perform I don't think is correct. A simple experiment to measure the gravitational force constant is not trivial. During the search for the non existant "fifth" force a few years ago, there were over twenty experiments performed to look for slight variations in the gravitational field, all using very sophisticated technology, and it took about five years to convince people that Newton's gravitational law was correct. The gravitational force is extremly small compared to Nature's other forces and a laboratory experiment to show the simple harmonic motion of an object passing inside of another would not be trivial. It would be interesting (as any experiment that extends our experience is) but not one that anyone so far has thought important enough to perform.

In Morack's mind, evidently, one such as I, Richard Benish, does not count as "anyone."

There are lots of other experiments that are more important in terms of increasing our understanding of the gravitational field. The principal interest in the gravitational field now is to find a way to quantize it and then test this. This will be necessary in order to unify all four of the known forces and at this point no one knows how it can be done.

I hope this has been helpful.

John Morack

To: ffjlm@aurora.alaska.edu (John Morack)
From: rjbenish@teleport.com (Richard Benish)
Subject: Re: gravity-induced radial oscillation

Dear Professor Morack,

Thank you very much for your thoughtful comments about gravity and the radial oscillation experiment. You are obviously well aware of its theoretical and empirical status.

By way of some "old timer's" advice, I would like to respond especially to your comment: "What could be learned by performing the experiment? Probably not much. No one doubts that if you could set up the experiment, it would work."

First, there is the observation by Herman Bondi:

" 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."

What little we know about gravity is almost entirely based on the observation of phenomena taking place OUTSIDE the gravitating bodies involved. Since the predictions of standard theory (especially general relativity) are so well supported by such exterior observations, the oscillation prediction is surely a reasonable extrapolation; but an extrapolation is still a guess. Knowing what the field strength is and how it varies inside a given body is not necessarily the same thing as knowing how a test object will move through that interior field. Perhaps if we did have a theory which unified the four forces we could justify our confidence in the extrapolation. But we don't; we still do not know how gravity works or what exactly it is. So the reasonable thing, it seems to me, would be to reserve judgement as to the motions it produces INSIDE gravitating bodies until we have witnessed them.

I also admire the attitude of Michael Faraday:

"It is absolutely necessary that we should learn to doubt the conditions we assume, and acknowledge we are uncertain...In the pursuit of physical science, the imagination should be taught to present the subject investigated in all possible and even in impossible views; to search for analogies of likeness and (if I may say so) of opposition—inverse or contrasted analogies; to present the fundamental idea in every form, proportion, and condition; to clothe it with suppositions and probabilities—that all cases may pass in review, and be touched, if needful by the Ithuriel spear of experiment."

If we take the advice of Bondi and Faraday to heart, then, although the experiment under consideration would be difficult, since it is POSSIBLE and since WE DO NOT KNOW the result, we have no choice but to try it. Anyway, that's how I feel.

Thanks again.

Sincerely,

Richard Benish

Mime-Version: 1.0
Date: Wed, 17 Jan 1996 07:42:05 -1000
To: rjbenish@teleport.com (Richard Benish)
From: ffjlm@aurora.alaska.edu (John Morack)
Subject: Re: gravity-induced radial oscillation

Richard,
I think that you missed my point. The experiment has been done. The variation of the gravitational field inside the earth have been measured and simple harmonic motion has been well investigated.
John Morack