Virginia Trimble

PROFESSOR of PHYSICS & ASTRONOMY

University of California, Irvine • University of Maryland

Email (and hard copy) Correspondence

December 26, 2016 – April 2, 2017

PREFACE

Virginia Trimble is a veteran astronomer who, since the early 1970s, occupied professorships in her home state at the University of California, Irvine and at the University of Maryland. This arrangement was partly motivated by her long-time marriage to Joseph Weber, who reigned at the East Coast institution. The late Weber was well known as the man who launched experimental gravitational wave research with his famous (yet ultimately ill-conceived) aluminum bar antennas.

In 2016 Trimble was one of six co-authors of a paper that proposed sending, essentially, a Small Low-Energy Non-Collider to deep space (beyond 25 AU; i.e., between the orbits of Uranus and Neptune), under the assumption that the device would function as a clock, and thereby enable measuring Newton's constant G:

https://arxiv.org/pdf/1605.02126.pdf

I sent each of these authors a hard copy of my paper (attached and linked) that directly responds to their proposal by pointing out (among other things) that the basic mechanism for their device has never been shown to work. I warned that the apparatus might not function as a clock; that its basic operating mechanism should first be tested with a less expensive, less demanding apparatus on or near Earth:

http://vixra.org/pdf/1612.0341v1.pdf

Trimble was the only one of the six who replied, first, by asking: "Have you also sent it to Michael Feldman, who is the most enthusiastic member of our group?"

At the time I received this reply I was finishing up a brief proposal for measuring G, based on an operating mechanism that has been known for many centuries to function as a clock: I.e., to have a test mass orbit a source mass in *circular* motion instead of *radial* motion through its center. (See attachment.) During this delay in getting back to Trimble, she sent a more emphatic message asking: "Could you please send this to the most enthusiastic (and youngest) member of our collaboration, Michael Feldman."

Of course I let her know then that Feldman had been sent a copy along with my new proposal. Three months later I received a final email of thanks, and an implicit indication that the whole thing had fizzled out. I sent one more email—to which I received no response—addressing the feasibility of a "near space" Small Low-Energy Non-Collider and inquiring about the actual status of her "deep space" proposal.

I still think my proposal (to measure G with *circular* motion) has merit. I suspect that the gravity-induced *radial* motion apparatus proposed by the six co-authors was shelved because of objections such as those spelled out by veteran gravitational experimentalist (and Trimble's colleague, Emeritus Professor at UC Irvine) Riley Newman. This impression is based on my independently initiated correspondence with Newman at about the same time, to which he responded about nine months later. At this later time Newman acknowledged his advisory communication with Trimble about the Feldman, et al proposal. My correspondence with Newman is significant also (though not included here) because it ended up being another example of failure in communication.

The pertinent communication with Newman began with a hard copy of my *Gravitational Clock* paper (sent January 11, 2017)—wherein my objective is clearly stated as being only "to observe the general character of the internal motion, at least as a first approximation," and *not* to measure *G*, nor to precisely measure tiny static forces inside a source mass. Newman nevertheless persisted in misunderstanding my purpose. He got off on long tangents about various technical problems that would pertain only to the stringent needs of the delicate experiments that he mistakenly thought were my main concern. Newman never seemed to get that my interest in measureing *G* is minimal; that my interest in measuring deviations from the inverse-square law are virtually non-existent; that I primarily want only to ascertain whether or not a Small Low-Energy Non-Collider functions even roughly as a clock.

Though Trimble did understand this, she exhibited only the faintest degree of curiosity about fulfilling Galileo's proposal. (Doing Galileo's experiment "would certainly make sense, if…") Whereas if Galileo (or anyone else) deigns to start with a rudimentary device that is not suitable for a precision measurement of Newton's *G*, well then, let's just call the whole thing off. Let's just conclude that, in practice, it *really does not* "make sense" to build the thing for such a humble purpose. No need to roughly test the mechanism at the heart of our scrapped *fancy* experiment by conducting a *grossly simpler* experiment, because our *theories* already tell us that it would work as planned. *Of course* our dream apparatus is a mighty fine clock. *Of course* the test mass would oscillate in the hole. *Of course* we don't need to actually see it to believe it. Duh! *Evidence schmevidence, science schmience*.

If there were a commandment whose purpose is to guide one to a righteously scientific attitude (and perhaps even a general life-path toward wisdom) it might be this:

Thou shalt not pretend to know things one does not really know.

Violate this commandment at your peril (even if you get away with it temporarily).

December 26, 2016

Professor Virgina Trimble
Department of Physics and Astronomy
University of California, Irvine
Irvine, CA 92697

Dear Prosessor Trimble,

I was very pleased to learn of your recent proposal to measure *G* with a deep space gravitational clock. If the plan moves forward (or even if it doesn't) I hope you see the benefit of building a simpler preliminary apparatus that would demonstrate the same principles, as discussed in the enclosed paper.

Thanks for your good work.

Sincerely,

Richard Benish
4243 E. Amazon Dr.
Eugene, OR
97405

rjbenish@comcast.net
enclosure

Date: Mon, 09 Jan 2017 18:21:06 –0500
To: rjbenish@comcast.net
Subject: Gravitational Clock
From: vtrimble@astro.umd.edu (Virginia Trimble)

Many thanks! Have you also sent it to Michael Feldman, who is the
most enthusiastic member of our group?

Cheers etc

v

Virginia Trimble, 1/10/17 4:57 PM -0700, Gravitational Clock paper **2**

Date: Tue, 10 Jan 2017 18:57:17 –0500
To: rjbenish@comcast.net
Subject: Gravitational Clock paper
From: vtrimble@astro.umd.edu (Virginia Trimble)

> Richard -
>
> Could you please send this to the most enthusiastic (and youngest) member
> of our collaboration, Michael Feldman
>
> mrf@m--y.us
>
> danke schoen
>
> v

To: vtrimble@astro.umd.edu (Virginia Trimble)
From: Richard J Benish <rjbenish@comcast.net>
Subject: Re: Gravitational Clock paper
Attachments: <GravClockOrbit Trimble Jan 11 2017.pdf>

> > Dear Professor Trimble,
> >
> > I am sorry for the delay in responding to your email from yesterday.
> >
> > It was due to being in the process of bringing to presentable form an alternative idea for measuring G. (See attached.) I have it in mind to share this latest development as well as the initial "Gravitational Clock" paper with Professor Riley Newman and others who may be interested. The attached document is a generic version of the presentation that I intend to personalize for each recipient.
> >
> > A hard copy version of the paper that I sent to you a couple weeks ago has already been sent to Michael Feldman, as well as to your other co-authors. Due to your encouragement, I will forthwith send Feldman a pdf version by email.
> >
> > Many thanks for your interest.
> >
> > Sincerely,
> >
> > Richard Benish

Virginia Trimble, 4/1/17 3:44 PM -0700, "gravitational clock" **4**

Date: Sat, 01 Apr 2017 18:44:43 -0400
To: rjbenish@comcast.net
Subject: "gravitational clock"
From: vtrimble@astro.umd.edu (Virginia Trimble)

> > > Richard -
> > >
> > > Did I ever thank you for your preprint? If not, a very belated "thank you!"
> > > A local test of the gravity train would certainly make sense, if you can
> > > figure out a way to do it, in presence of earth g and electromagnetic
> > > effects.
> > >
> > > Best regards,
> > >
> > > Virginia

To: vtrimble@astro.umd.edu (Virginia Trimble)
From: Richard J Benish <rjbenish@comcast.net>
Subject: Re: "gravitational clock"
Attachments:

Dear Professor Trimble,

Your belated thanks is happily accepted and reciprocated. I thank you for giving attention to my paper.

In response to your comment about feasibility, I should recount my interactions with the physics apparatus-builder George Herold (of TeachSpin, in Buffalo, NY). Herold and his work were featured in a July 1 2009 *Physics World* article:

http://www.iop.org/careers/workinglife/articles/page_39058.html

The article gave me the impression that Herold might be interested in building a "gravity train" ("gravitational clock," "Small Low-Energy Non-Collider"). So I sent him an essay similar to the one that I sent you and requested a comment.

This happened before Herold saw the *Physics World* article. In response, he mused as to whether his discussion with the interviewer about just such an experiment was included in the printed interview:

At 10:40 AM -0400 7/2/09, George Herold wrote:

> I have thought about doing exactly what is in your paper.
> (I did mention these ideas to the editor at *Physics World*, and I haven't received my copy of the article yet so maybe it is discussed?)

This happy coincidence was followed by some correspondence concerning the details about how to build the device and even to a rough estimate as to its monetary cost.

Unfortunately, the dialog was not pursued to fruition. But I was left with the impression that Herold regarded the project as being well within the realm of feasibility. I should add that I would also guess this to be true. It is quite amazing to behold the enormous technological progress and investment that goes into physics experiments of much greater complexity these days.

Notwithstanding the challenges you have mentioned, the only missing thing needed to carry out Galileo's belated gravity experiment, as far as I can tell, is DESIRE. Those with access to the resources have no desire to see it through because they all PRETEND to already "know" the experiment's result. I don't think Galileo would have been very impressed by this attitude, so I will keep trying to generate interest.

How are things coming along with your deep space gravitational clock? Would you really send the thing out there before performing a near-space-proof-of-concept version?

Best regards,

Richard Benish

Deep space experiment could measure the gravitational constant with nearly 1,000 times improvement in accuracy (Update)

17 May 2016, by Lisa Zyga

In the proposed experimental setup, a host spacecraft (right) shines a femtosecond laser pulse onto a retroreflector moving in the tunnel of a sphere (left). The period of the retroreflector's harmonic motion provides information on the value of G. Credit: Feldman et al ©2016 IOP Publishing

(Phys.org)—Scientists have proposed an experiment that could measure the value of Newton's gravitational constant, *G*, from deep space instead of an Earth-based laboratory. The researchers predict that the deep space experiment could estimate *G* with an improvement in precision of nearly three orders of magnitude, since it would avoid the influence of Earth's gravity.

The researchers, Michael Feldman *et al.*, have published a paper on the proposed experiment in a recent issue of *Classical and Quantum Gravity*.

Uncertainty with Big G

Newton's gravitational constant, *G*, determines the strength of the gravitational force between any two objects anywhere in the universe. Over the past century, a dozen or so Earth-based experiments have used torsion balances, atom interferometers, and other tools to measure the value of *G* to be approximately 6.67408×10^{-11}, with an uncertainty of 4.7×10^{-5}.

Although this may sound precise, it is not very precise at all compared to many other physical constants, which have uncertainties that are many orders of magnitude smaller than this. In recent years, the large variations in the measured values of *G* have caused scientists to question if *G* is truly constant at all. (Currently, the overwhelming consensus is that *G* is constant, and that the variations are due to large systematic measurement errors.)

G is currently the least well known of all the fundamental physical constants, which is embarrassing," Feldman told *Phys.org*. "A more precise number, and the possibility that *G* could vary with time, location, or the type of matter involved, could link to improvements in Einstein's general relativity, including quantum gravity."

One of the main reasons that *G* is so difficult to measure accurately is that experiments must account for the influence of Earth's gravity, *g* (sometimes called "little *g*" in contrast to "big *G*"). Little *g* is the acceleration due to gravity specifically on Earth, where it has a constant value of approximately 9.8 m/s^2. Elsewhere in the universe, this value changes, since it depends on the Earth's mass and the distance between the Earth and another object. However, the value of big *G* does not depend on these factors, and so it remains the same everywhere in the universe.

Deep space lab

In the new paper, the researchers suggest that the best way to avoid the effects of Earth's gravity on measurements of *G* is to perform the experiment in deep space, which refers to space outside our solar system.

The scientists propose to launch their apparatus into deep space, likely by "piggybacking" on a major mission. Out there, where the gravity of planets and stars would be negligible, the host spacecraft would release a spherical object that has a 1-cm-wide tunnel through its center. Then (this would likely be the most difficult part), the host spacecraft—which is constantly spinning the whole time—would eject a much smaller oscillating object into the tunnel in the sphere at just the right angle and speed so that the object would move back and forth through the tunnel, without bouncing off the walls.

The host apparatus would continually shine femtosecond laser pulses on the object as it oscillates in the tunnel, and the object (a retroreflector) would reflect these pulses back to the host spacecraft. These pulses would provide data on the period of the object's harmonic motion, which is directly dependent on the value of *G*. The data would then be sent back to Earth via radio communication for interpretation.

If everything goes as expected, the researchers' simulations showed that this experiment could measure *G* with an uncertainty of 6.3×10^{-8}, which is nearly three orders of magnitude more precise than the current best measurement.

Even though the deep-space experiment wouldn't have to deal with the Earth's gravity, it would still have to contend with other, smaller non-gravitational accelerations that would also affect the retroreflector's motion. These influences include solar radiation pressure, solar tidal effects, cosmic rays, and the momentum from the laser pulses. Some of these effects could be dealt with through careful design—for example, the sphere could be shielded from solar radiation pressure by positioning it in the shadow of the host spacecraft. But the researchers explain that any acceleration greater than 10^{-17} m/s^2 must be modeled and accounted for when interpreting the data.

Why measure G?

The National Science Foundation in the US recently issued a solicitation for new approaches for measuring *G* (Ideas Lab: Measuring "Big G" Challenge). The NSF webpage says that measuring a more precise value of *G* will benefit many fields of physics and metrology, such as understanding the Casimir effect, improving the spring constants that are used to calibrate atomic force microscopy cantilevers, and understanding intermolecular forces in DNA. A precise value of *G* might also be used to test proposed theories that unify gravity with quantum electrodynamics.

More information: Michael R. Feldman *et al.* "Deep space experiment to measure *G*." *Classical and Quantum Gravity*. DOI: 10.1088/0264-9381/33/12/125013
Also at arXiv:1605.02126 [gr-qc]

Tue 4:59:51 PM

Virginia Louise Trimble - Wikipedia

https://en.wikipedia.org/wiki/Virginia_Louise_Trimble

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Virginia Louise Trimble

From Wikipedia, the free encyclopedia

Virginia Louise Trimble (born 1943) is an American astronomer specializing in the structure and evolution of stars and galaxies, and the history of astronomy.[2] She has published more than 600 works in Astrophysics,[3] and dozens of other works in the history of other sciences. She received the NAS Award for Scientific Reviewing in 1986, "for informing and enlightening the astronomical community by her numerous, comprehensive, scholarly, and literate reviews, which have elucidated many complex astrophysical questions," the Klopsteg Memorial Award from the American Association of Physics Teachers in 2001, and the George Van Biesbroeck Prize in 2010, for "many years of dedicated service to the national and international communities of astronomers, including her expert assessments of progress in all fields of astrophysics and her significant roles in supporting organizations, boards, committees and foundations in the cause of astronomy."[4] She is famous for an annual review of astronomy and astrophysics research that was published in the Publications of the Astronomical Society of the Pacific, and often gives summary reviews at astrophysical conferences.[5] In 2018, she was elected a Patron of the American Astronomical Society, for her many years of intellectual, organizational, and financial contributions to the society.[6]

Virginia Louise Trimble

Virginia Trimble at the 75th Anniversary of The Shapley–Curtis Debate in April 1995

Born	November 15, 1943 (age 75)
Nationality	American
Education	UCLA, Caltech, Cambridge
Known for	Annual reviews of Astronomy and Astrophysics Research Studies of telescope productivity
Spouse(s)	Joseph Weber
Awards	NAS Award for Scientific Reviewing Klopsteg Memorial Award George Van Biesbroeck Prize honorary doctorate from the University of Valencia
Scientific career	
Fields	Astrophysics, Cosmology, History of Astronomy, History of Science
Thesis	*Motions and structure of the filamentary envelope of the Crab Nebula* [1]
Doctoral advisor	Guido Münch
Influences	Jesse L. Greenstein, Jan Oort, Richard Feynman, James Gunn, Fred Hoyle, Martin Rees
Website	http://www.faculty.uci.edu/profile.cfm?faculty_id=3060

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4 References
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Life [edit]

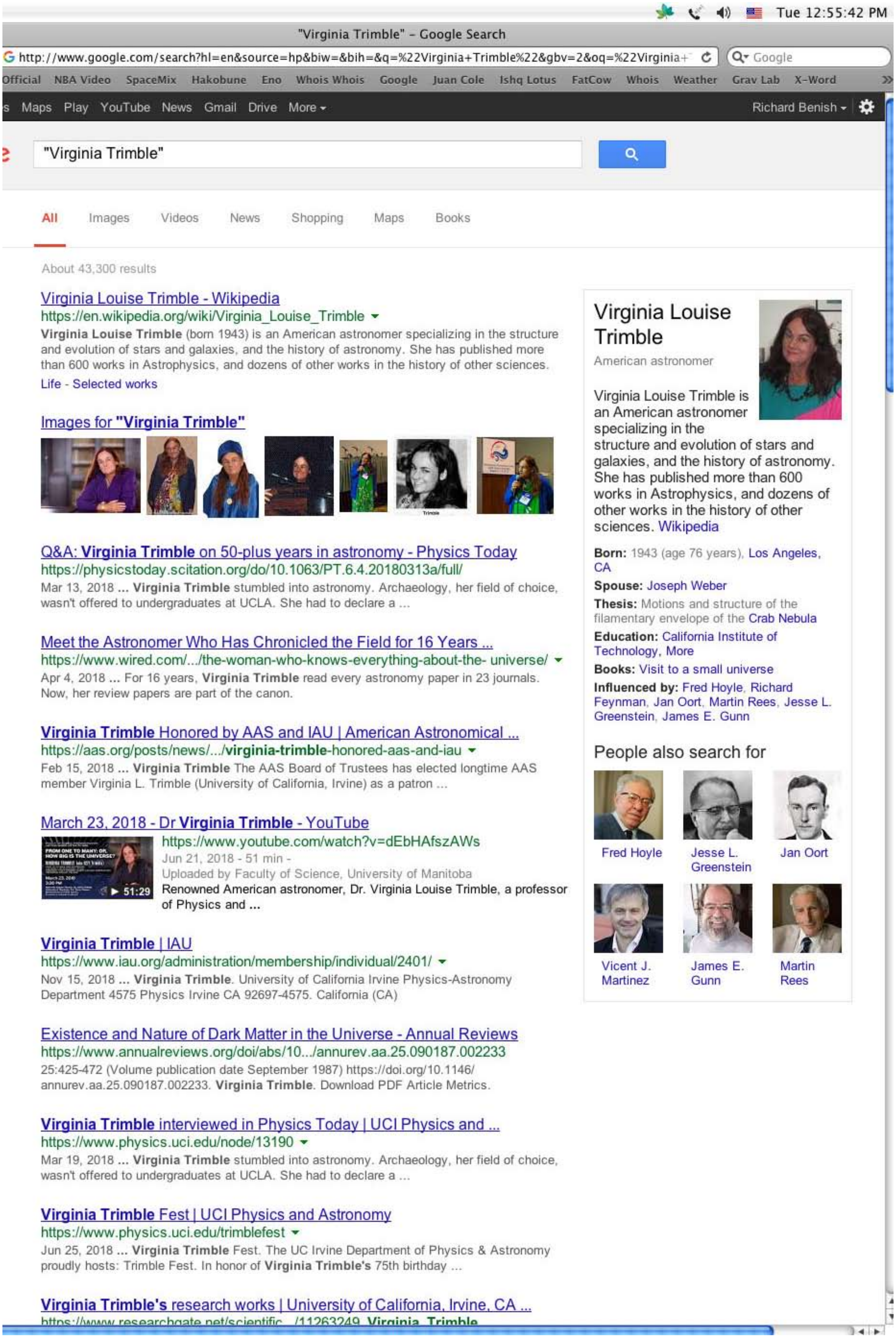
Trimble "grew up the only child of a chemist father and a mother with a flair for language, within easy driving distance of both UCLA and Caltech."[7] While attending UCLA in 1962, she was the subject of a *Life* article titled "Behind a Lovely Face, a 180 I.Q."[8] The following year, she was selected to promote The Twilight Zone television show as "Miss Twilight Zone" in a national publicity tour. [9] She received her B.A. from UCLA in 1964 and her Ph.D from the California Institute of Technology in 1968. At the time, the California Institute of Technology did not admit women students "except under exceptional circumstances,"[10] and she was only the second woman allowed access to the Palomar Observatory.[11] Following a year of teaching at Smith College and two years postdoctoral work at the Institute of Theoretical Astronomy in Cambridge, Trimble joined the faculty of the University of California, Irvine in 1971, where she is now Professor of astronomy. In 1972, she met and 11 days later married University of Maryland, College Park Professor Joseph Weber, a pioneer in gravitational wave physics. From then until his death in 2000, she spent half of each academic year as a visiting professor at the University of Maryland.[12] She was vice president of the International Astronomical Union's Executive Committee from 1994-2000,[13] and vice president of the American Astronomical Society from 1997-2000.[14]

Honors [edit]

- The main-belt asteroid 9271 Trimble, discovered by astronomers Eleanor Helin and Schelte Bus in 1978, was named in her honor.[2] The official naming citation was published by the Minor Planet Center on 31 January 2018 (M.P.C. 108696).[15]

Selected works [edit]

- Trimble, Virginia (1992). *Visit to Small Universe*. Masters of Modern Physics. Springer Science & Business Media.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Virginia Louise Trimble (born 1943) is an American astronomer specializing in the structure and evolution of stars and galaxies, and the history of astronomy. She has published more than 600 works in Astrophysics, and dozens of other works in the history of other sciences.
Life - Selected works

Images for **"Virginia Trimble"**

[Q&A: **Virginia Trimble** on 50-plus years in astronomy - Physics Today]
https://physicstoday.scitation.org/do/10.1063/PT.6.4.20180313a/full/
Mar 13, 2018 ... **Virginia Trimble** stumbled into astronomy. Archaeology, her field of choice, wasn't offered to undergraduates at UCLA. She had to declare a ...

[Meet the Astronomer Who Has Chronicled the Field for 16 Years ...]
https://www.wired.com/.../the-woman-who-knows-everything-about-the- universe/ ▾
Apr 4, 2018 ... For 16 years, **Virginia Trimble** read every astronomy paper in 23 journals. Now, her review papers are part of the canon.

[**Virginia Trimble** Honored by AAS and IAU | American Astronomical ...]
https://aas.org/posts/news/.../**virginia-trimble**-honored-aas-and-iau ▾
Feb 15, 2018 ... **Virginia Trimble** The AAS Board of Trustees has elected longtime AAS member Virginia L. Trimble (University of California, Irvine) as a patron ...

[March 23, 2018 - Dr **Virginia Trimble** - YouTube]
https://www.youtube.com/watch?v=dEbHAfszAWs
Jun 21, 2018 - 51 min -
Uploaded by Faculty of Science, University of Manitoba
Renowned American astronomer, Dr. Virginia Louise Trimble, a professor of Physics and ...
51:29

[**Virginia Trimble** | IAU]
https://www.iau.org/administration/membership/individual/2401/ ▾
Nov 15, 2018 ... **Virginia Trimble**. University of California Irvine Physics-Astronomy Department 4575 Physics Irvine CA 92697-4575. California (CA)

[Existence and Nature of Dark Matter in the Universe - Annual Reviews]
https://www.annualreviews.org/doi/abs/10.../annurev.aa.25.090187.002233
25:425-472 (Volume publication date September 1987) https://doi.org/10.1146/annurev.aa.25.090187.002233. **Virginia Trimble**. Download PDF Article Metrics.

[**Virginia Trimble** interviewed in Physics Today | UCI Physics and ...]
https://www.physics.uci.edu/node/13190 ▾
Mar 19, 2018 ... **Virginia Trimble** stumbled into astronomy. Archaeology, her field of choice, wasn't offered to undergraduates at UCLA. She had to declare a ...

[**Virginia Trimble** Fest | UCI Physics and Astronomy]
https://www.physics.uci.edu/trimblefest ▾
Jun 25, 2018 ... **Virginia Trimble** Fest. The UC Irvine Department of Physics & Astronomy proudly hosts: Trimble Fest. In honor of **Virginia Trimble's** 75th birthday ...

[**Virginia Trimble's** research works | University of California, Irvine, CA ...]
https://www.researchgate.net/scientific.../11263249_Virginia_Trimble

Virginia Louise Trimble
American astronomer

Virginia Louise Trimble is an American astronomer specializing in the structure and evolution of stars and galaxies, and the history of astronomy. She has published more than 600 works in Astrophysics, and dozens of other works in the history of other sciences. Wikipedia

Born: 1943 (age 76 years), Los Angeles, CA
Spouse: Joseph Weber
Thesis: Motions and structure of the filamentary envelope of the Crab Nebula
Education: California Institute of Technology, More
Books: Visit to a small universe
Influenced by: Fred Hoyle, Richard Feynman, Jan Oort, Martin Rees, Jesse L. Greenstein, James E. Gunn

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