

Hans J. Haubold and Arak M. Mathai

EXPLORING NEUTRINOS: ENTANGLEMENT, ENTROPY, AND FRACTIONAL CALCULUS

3. 1982 A.M. Mathai Centre for Mathematical and Statistical Sciences

<https://www.growkudos.com/projects/a-m-mathai-centre-for-mathematical-and-statistical-sciences-nurturing-the-love-for-mathematics>



Professor Dr. A.M. Mathai, Department of Mathematics and Statistics, McGill University, Montreal, Canada, and Director of the Centre for Mathematical and Statistical Sciences, Kerala, India.

A.M. Mathai: <https://wol-prod-cdn.literatumonline.com/doi/10.1002/mana.19710480110>

R.W. John: [1978AN....299..225H \(harvard.edu\)](https://www.harvard.edu)

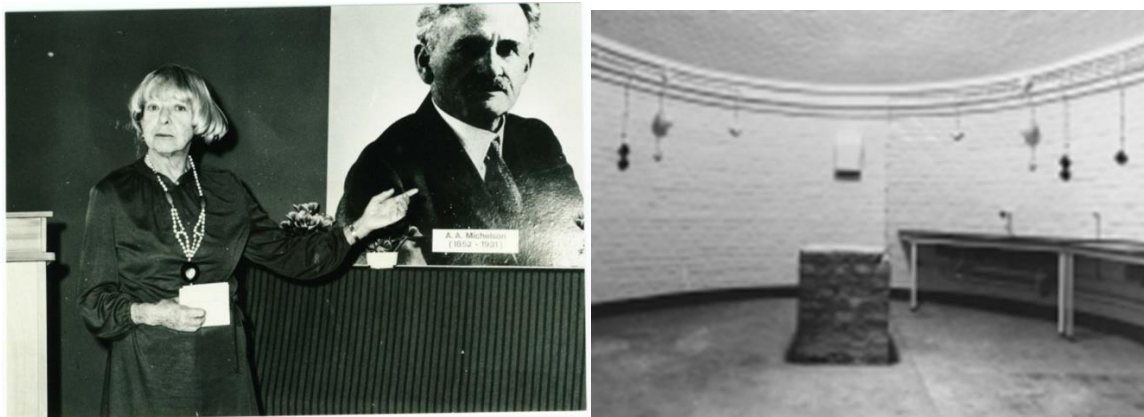
W.A. Fowler (Nobel Prize 1983):

<https://www.nobelprize.org/prizes/physics/1983/fowler/biographical/>



Left: HJH, Haubold junior, A.M. Mathai, in front of the Brandenburg Gate Berlin in 1984. Right: HJH and A.M. Mathai in his office at McGill University Montreal in 1992.

2. 1978 Einstein Centenary 1979 Berlin and Michelson Colloquium 1981 Potsdam



Dorothy Michelson Livingston, youngest daughter of Albert A. Michelson, opening the Michelson Colloquium in Potsdam, Germany, 27-30 April 1981.



1989 Dorothy Michelson Livingston and Goodhue Livingston with BH on the Michelson Livingston premises in Wainscott, New York.

E. Yasui: <https://link.springer.com/article/10.1007/bf00412263>

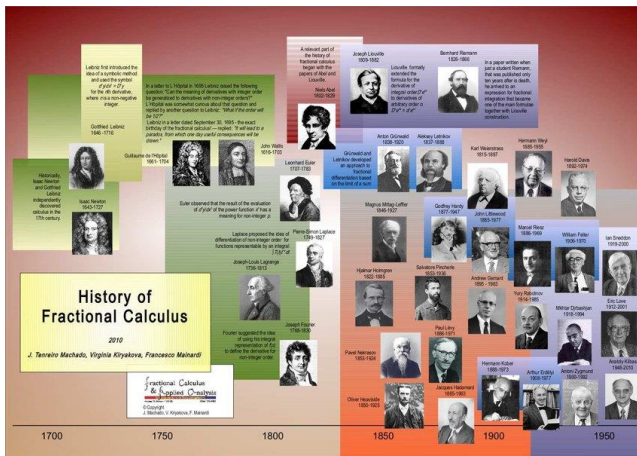
L. Pyenson: <https://pubs.aip.org/aip/acp/article-abstract/179/1/42/747229/Michelson-s-first-ether-drift-experiment-in-Berlin?redirectedFrom=fulltext>

A.A. Michelson (Nobel Prize 1907):

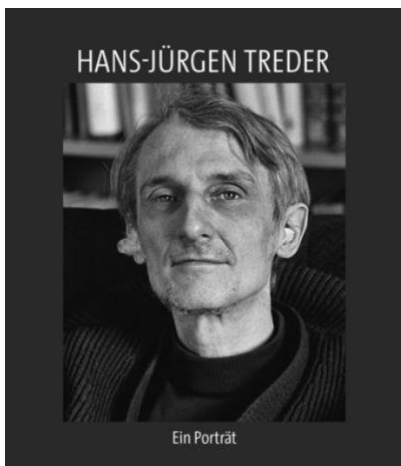
<https://www.nobelprize.org/prizes/physics/1907/michelson/biographical/>

1. 1974 Fractional quantum diffusion and solar neutrino entanglement entropy production

(solar neutrino problem: Solar physics, nuclear physics, neutrino physics) Potsdam, Germany



The timeline of fractional calculus during the period 1695-1970 in J. A. Tenreiro Machado, V. Kiryakova, F. Mainardi, *Fractional Calculus & Applied Analysis*, 13 (2010)447-454.



Professor Dr. Hans-Juergen Treder, former Director of the Astrophysical Observatory Potsdam, Germany, and the Albert Einstein Laboratory for Theoretical Physics, Caputh, Germany.

H.-J. Treder: <https://adsabs.harvard.edu/full/1974an....295..169t>

E. Gerth: <https://articles.adsabs.harvard.edu/pdf/1983AN....304..299H>

R. Davis Jr. (Nobel Prize 2002):

<https://www.nobelprize.org/prizes/physics/2002/davis/facts/>



Astrophysical Observatory Potsdam, Germany.

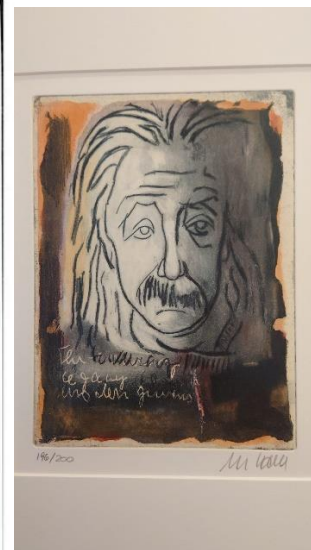
<https://researchfeatures.com/nonadditive-entropies-generalising-boltzmanns-approach-thermodynamics/>

<https://researchfeatures.com/perplexing-solar-investigation-experimenting-neutrinos/>

<https://researchoutreach.org/articles/exploring-neutrinos-entanglement-entropy-fractional-calculus/>

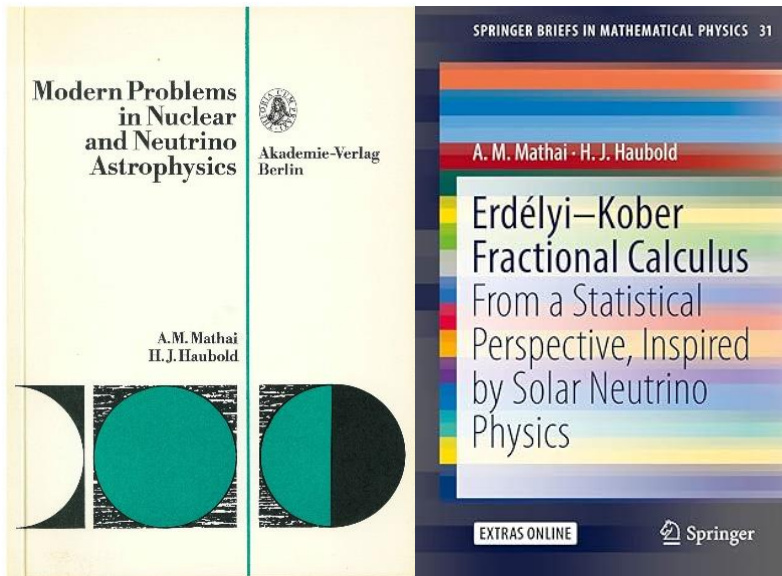


Left: J.-P. Muecket, HJH, V. Mueller, and S. Gottloeber, working group on formation of structure in the Universe, in the working office at the Institute for Astrophysics, Potsdam.



Right: Armin Mueller-Stahl (https://de.wikipedia.org/wiki/Armin_Mueller-Stahl), Color etching The Enduring Legacy of a Modern Genius: Einstein, 2014.

A.M. Mathai: <https://pubs.aip.org/aip/jmp/article-abstract/29/9/2069/228029/Gravitational-instability-in-a-multicomponent?redirectedFrom=fulltext>



Report summarizing research results of the period 1974 to 1988 (Meijer's G-function, left hand) and Report summarizing research results of the period 1988 to 2018 (Fox' H-function, right hand)

4. 1978 Michelson experiment and Hudson River school (history of), New York, USA



Headquarter of the United Nations at East River in New York.



Jerald Peterson (<http://www.jeraldpeterson.com/>), Watercolor view of Queens across the East River from HJH's office 32nd floor United Nations Building New York

<https://researchfeatures.com/dorothy-michelson-livingston-personal-recollection/>

<https://researchfeatures.com/art-science-connecting-motives-research-landscape-painting-19th-century/>

5. 1988 Education in Space Science and Technology, New York. USA

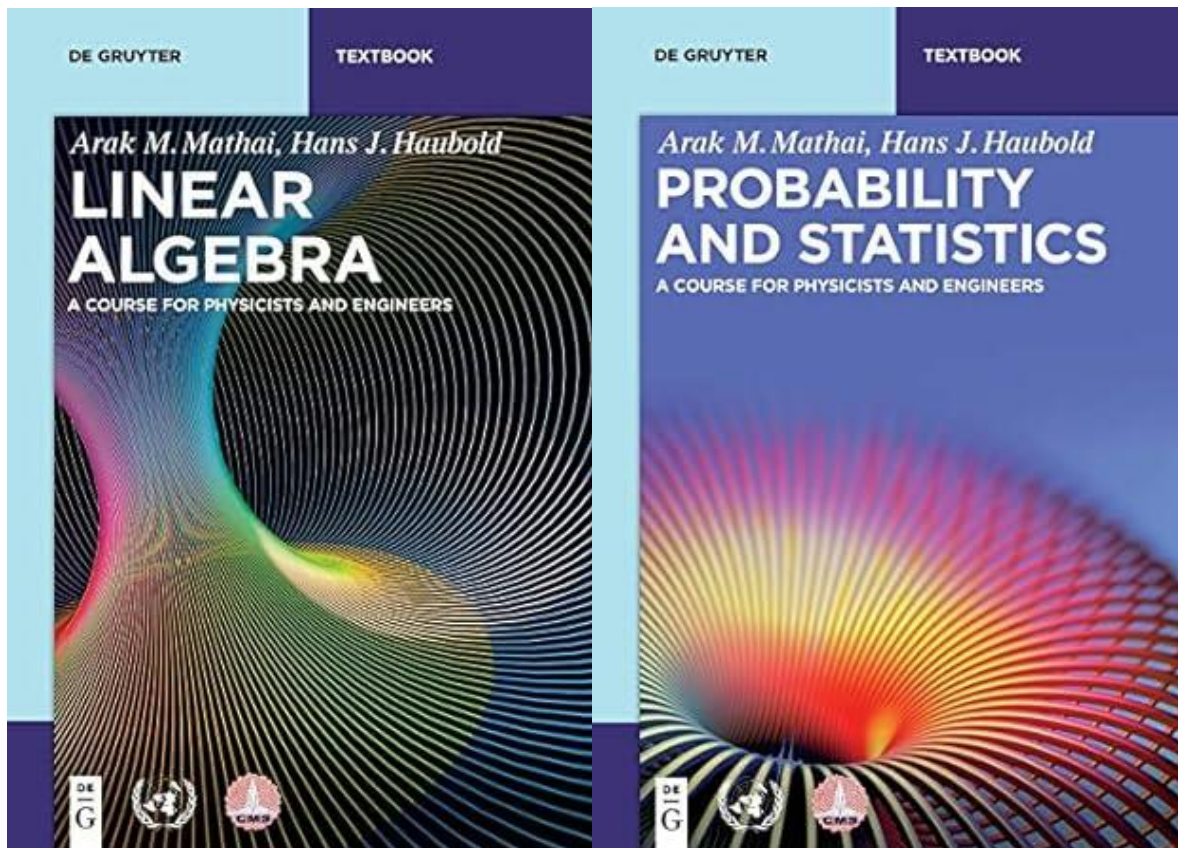
A.M. Mathai Centre for Mathematical and Statistical Sciences and, subsequently,

Six UN-affiliated Regional Centres for Space Science and Technology Education (affiliated to the United Nations)

<https://researchfeatures.com/promoting-global-education-teaching-research-space-science/>

https://www.unoosa.org/pdf/publications/st_space_41E.pdf

- [Africa, Nigeria \(ARCSSTE-E\)](#)
- [Africa, Morocco \(CRASTE-LF\)](#)
- [Latin America & Caribbean, Mexico & Brazil \(CRECTEALC\)](#)
- [Asia/Pacific, India \(CSSTEAP\)](#)
- [West Asia, Jordan \(RCSSTEWA\)](#)
- [Asia/Pacific, China \(RCSSTEAP\)](#)



Linear Algebra and Probability and Statistics for teaching basic courses in the following five areas of space science and technology.

SATELLITE METEOROLOGY AND GLOBAL CLIMATE

https://www.unoosa.org/documents/pdf/psa/reg_centres/curricula/Satellite_Meteorology_and_Global_Climate.pdf

SATELLITE COMMUNICATIONS

https://www.unoosa.org/documents/pdf/psa/reg_centres/curricula/Satellite_Communications.pdf

SPACE AND ATMOSPHERIC SCIENCE

https://www.unoosa.org/documents/pdf/psa/reg_centres/curricula/Space_and_Atmospheric_Science.pdf

REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

https://www.unoosa.org/documents/pdf/psa/reg_centres/curricula/Remote_Sensing_and_GIS.pdf

GLOBAL NAVIGATION SATELLITE SYSTEMS

https://www.unoosa.org/pdf/icg/2013/Ed_GNSS_eBook.pdf



6. 1988 Research in Astronomy, Physics, Mathematics, United Nations New York, USA

Twenty UN/ESA/NASA/JAXA Workshops on Basic Space Science

01_India_a-ac-105-489-e_BSS_1_1991(not available online)

Proceedings: <https://pubs.aip.org/aip/acp/issue/245/1>



S. Chakravarty (India), W. Wamsteker (ESA), and a participant opening the 1991 workshop in India.

02_Columbia and Costa Rica_a-ac-105-530-e_BSS(not available online)

Proceedings: <https://link.springer.com/journal/10509/volumes-and-issues/214-1>

Proceedings: <https://link.springer.com/journal/11038/volumes-and-issues/63-2>

03_Nigeria_a-ac-105-560-add-1-e_BSS(not available online)

Proceedings: <https://pubs.aip.org/aip/acp/issue/320/1>

04_Egypt_a-ac-105-580-e_BSS(not available online)

Proceedings: <https://link.springer.com/journal/10509/volumes-and-issues/228-1>

Proceedings: <https://link.springer.com/journal/11038/volumes-and-issues/70-1>

7. 1993 Research in Astronomy, Physics, Mathematics, United Nations Vienna, Austria



Headquarter of the United Nations at Danube River in Vienna.



View from HJH's office in 25th floor at UN Vienna International Centre across the Danube park and river, 2023.

05_Sri Lanka_A_AC.105_640-EN_BSS

https://www.unoosa.org/oosa/oaadoc/data/documents/1996/aac.105/aac.105640_0.html

UNBSSI, Sri Lanka <https://researchfeatures.com/unbssi-planting-seeds-space-exploration/>



T. Kogure, M. Kitamura, and astronomers from the Philippines in front of the observatory housing a telescope from Japan.

06_Germany_A_AC.105_657-EN_BSS_NEO

https://www.unoosa.org/oosa/oaadoc/data/documents/1996/aac.105/aac.105657_0.html

Proceedings: <https://link.springer.com/journal/10509/volumes-and-issues/258-1>

07_Honduras_A_AC.105_682-EN_BSS **NEO**_2_1998

https://www.unoosa.org/oosa/oosadoc/data/documents/1997/aac.105/aac.105682_0.html

NEO <https://researchfeatures.com/avoiding-armageddon-urgent-search-near-earth-objects/>



HJH meeting D.G. Wentzel (USA) during the IAU meeting in Japan 1997 for getting professional advice for developing astronomy programs in nations around the world.

08_Jordan_A_AC.105_723-EN_BSS

https://www.unoosa.org/oosa/oosadoc/data/documents/1999/aac.105/aac.105723_0.html

Proceedings: <https://link.springer.com/journal/10509/volumes-and-issues/273-1>

09_France_A_AC.105_742-EN_BSS

https://www.unoosa.org/oosa/oosadoc/data/documents/2000/aac.105/aac.105742_0.html

10_Mauritius_A_AC.105_766-EN_BSS

https://www.unoosa.org/oosa/oosadoc/data/documents/2001/aac.105/aac.105766_0.html

Proceedings: <https://link.springer.com/journal/10509/volumes-and-issues/282-1?page=1>



Group photo of the 2001 workshop in Mauritius.

11_Argentina_A_AC.105_784-EN_BSS_WSO_NEO_3_2002

https://www.unoosa.org/oosa/oosadoc/data/documents/2002/aac.105/aac.105784_0.html

WSO/UV, Argentina <https://researchfeatures.com/spektr-uf-unlocking-secrets-uv/>

Proceedings: <https://link.springer.com/journal/10509/volumes-and-issues/290-3>



Willem Wamsteker (ESA)

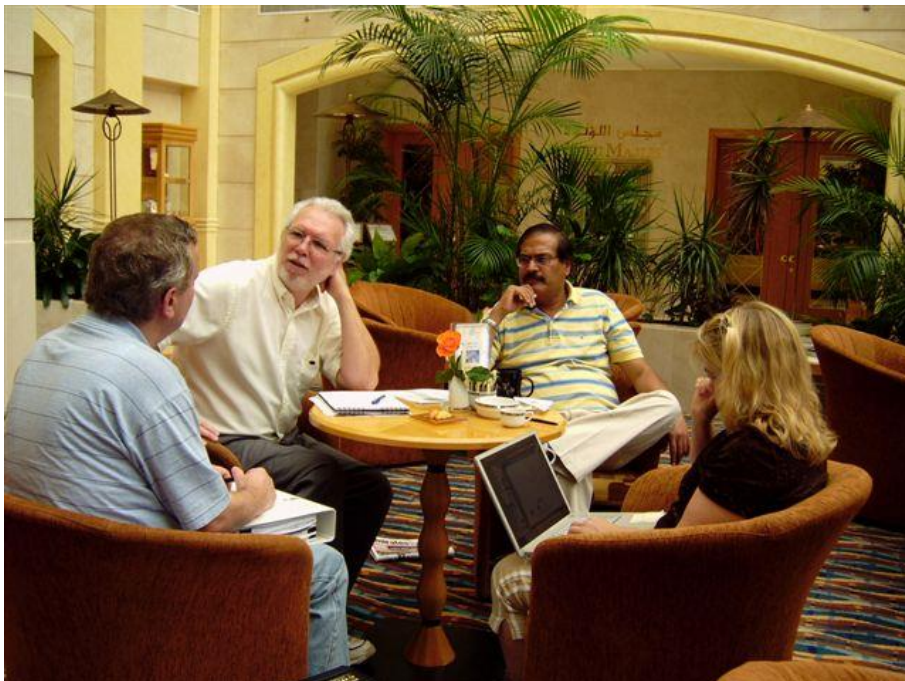


Group photo of the 2002 workshop in Argentina.

12_China_A_AC.105_829-EN_BSS

https://www.unoosa.org/oosa/oaadoc/data/documents/2004/aac.105/aac.105829_0.html

Proceedings: <https://link.springer.com/journal/10509/volumes-and-issues/305-3>



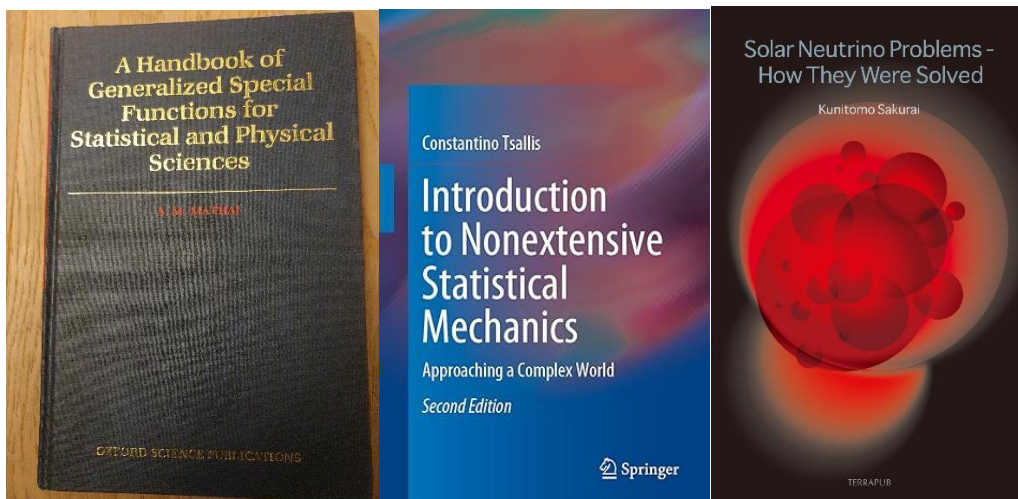
HJH, J. Davila (NASA), N. Gopalswami (NASA), and B. Thompson (NASA) meeting for discussions during the 2004 China workshop.

13_United Arab Emirates_A_AC.105_856-EN_IHY

https://www.unoosa.org/oosa/oaadoc/data/documents/2005/aac.105/aac.105856_0.html



K. Sakurai, HJH, C. Tsallis, and A.M. Mathai discussing the status of the solar neutrino problem during the 2005 workshop in the United Arab Emirates.



Three principal contributors to the workshops from the very beginning in 1991: Mathai (mathematics), Tsallis (physics), Sakurai (astronomy)

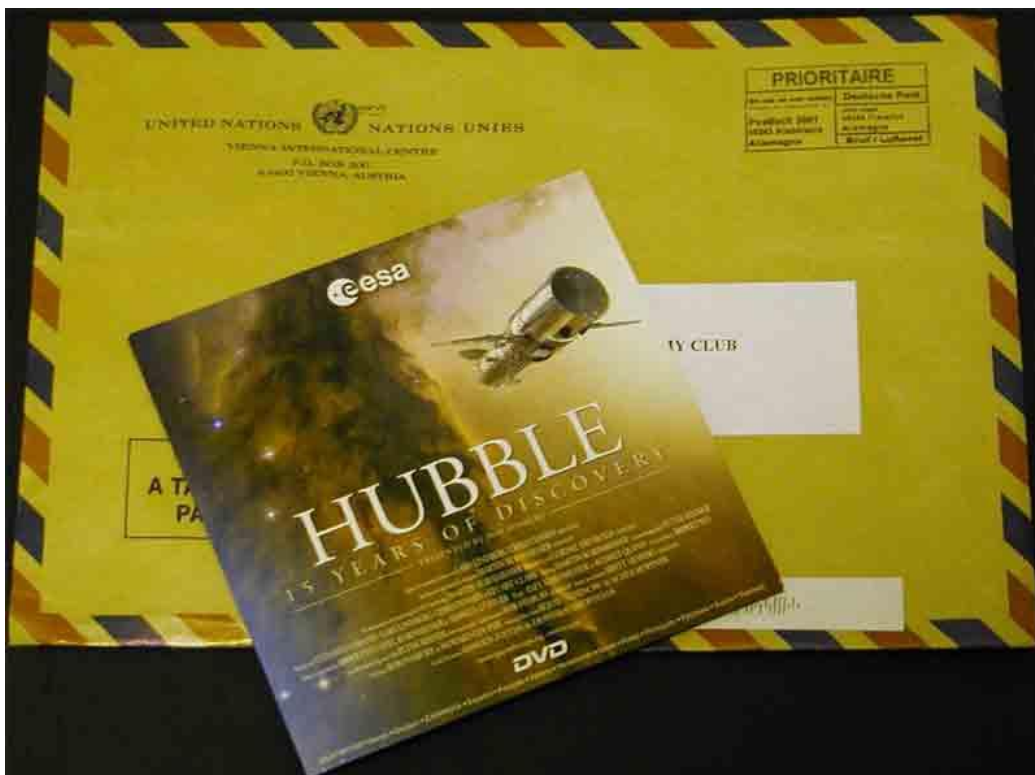
14_India_A_AC.105_882-EN_BSS_IHY

https://www.unoosa.org/oosa/oaadoc/data/documents/2007/aac.105/aac.105882_0.html

Proceedings: <https://typeset.io/journals/bulletin-of-the-astronomical-society-of-india-bawvm3zu/2007>



Group photo of the 2006 workshop in India.



<https://astromart.com/reviews/accessories/software/show/hubble-15-years-of-discovery-dvd>

15_Japan_A_AC.105_902-EN_BSS_IHY_4_2007

https://www.unoosa.org/oosa/oaadoc/data/documents/2007/aac.105/aac.105902_0.html

IHY2007, Japan <https://researchfeatures.com/international-heliophysical-year-2007-building-foundation-broader-growth-science/>

Proceedings: <https://link.springer.com/book/10.1007/978-3-642-03325-4>

Proceedings: <https://link.springer.com/journal/11038/volumes-and-issues/104-1>



Group photo of participants of the 2007 workshop in Japan.

16_Bulgaria_A_AC.105_919-EN_BSS_IHY

https://www.unoosa.org/oosa/oaadoc/data/documents/2008/aac.105/aac.105919_0.html



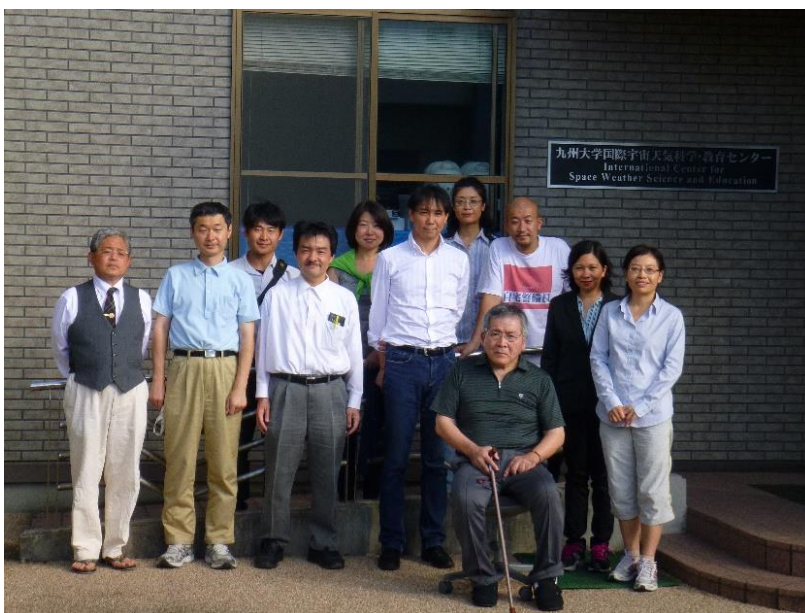
Group photo of the 2008 workshop in Bulgaria.

17_Republic of Korea_A_AC.105_964-EN_BSS_IHY

https://www.unoosa.org/oosa/oaadoc/data/documents/2010/aac.105/aac.105964_0.html



Group photo of the 2009 workshop in the Republic of Korea.



K. Yumoto with his professional colleagues in front of the Space Weather Institute Japan.

18_Egypt_A_AC.105_994-EN_ISWI_5_2010

https://www.unoosa.org/oosa/oaadoc/data/documents/2011/aac.105/aac.105994_0.html

19_Nigeria_A_AC.105_1018-EN_ISWI

https://www.unoosa.org/oosa/oosadoc/data/documents/2012/aac.105/aac.1051018_0.html



UN/Nigeria Workshop on ISWI -- Group Photo on Day 1 (17 Oct. 2011).
Location: Main entrance of the Reiz Continental Hotel, Abuja, Nigeria.

20_Ecuador_A_AC.105_1030-EN_ISWI_5_2012

https://www.unoosa.org/oosa/oosadoc/data/documents/2012/aac.105/aac.1051030_0.html

ISWI, Ecuador <https://researchfeatures.com/remarkable-legacy-international-space-weather-initiative/>

Proceedings: SUN and GEOSPHERE Vol.9, No.1 – 2014



