

UNBSSI – planting the seeds of space exploration

- Space belongs to no one, and you don't need to enter space to explore it.
- Since 1959, the UN's Basic Space Science Initiative (UNBSSI) has encouraged space science among developing nations through workshops focused on education programmes.
- It also encourages sharing knowledge and access to data from telescopes.
- In doing so, the UNBSSI is planting the seeds of space exploration worldwide.

There are two indisputable yet oft-forgotten facts about space exploration: space belongs to no one, and you don't need to enter space to study its immense wondrousness. For centuries, cultures across the world have stared up at the night sky and wondered what lies among the stars. Exploring space needs a keen eye, an inquiring mind, a basic understanding of any of the space sciences, and access to some of the troves of data pouring in from space every day. Knowing this, one organisation within the

United Nations is quietly and resolutely expanding the frontiers to space exploration by making education, teaching, and research a key part of its focus. In the process, it has bridged the perceptual and infrastructural barriers around reaching out to space and highlighted the benefits of networking and sharing knowledge.

In 1959, the United Nations founded a small expert unit within its Secretariat to service an ad hoc Committee on the Peaceful Uses of Outer Space – the United Nations Office for Outer Space Affairs (UNOOSA). Since then, UNOOSA's scope and size have grown significantly, but its focus has remained on promoting international cooperation in the peaceful use and exploration of space and using space science and technology for sustainable economic and social development. This mission, for want of a better word, is critical if space exploration is not to be considered the reserve of the few. To this end, UNOOSA established the Basic Spaces Science Initiative (UNBSSI). Its focus: encouraging the study and uptake of astronomy, astrophysics, and space science worldwide, particularly in developing nations.

Unlocking the power of astrophysics

Between 1991 and 2004, the UNBSSI held a succession of workshops in conjunction with the European Space Agency (ESA), each addressing astronomy status in a developing region, firstly Asia and the Pacific, then Latin America and the Caribbean, Africa, and Western Asia. One of the critical outcomes of these workshops was the need to

establish small research and education facilities and the collaboration between them; sharing material, knowledge, and access to telescopes was essential for worldwide space exploration. Later workshops saw such facilities developed in, among other locations, Sri Lanka, Honduras, and Jordan. With the rapid advances in computer systems, the focus of the UNBSSI has expanded to include astrophysical data systems, the concept of a virtual observatory, and the development of a World Space Observatory.

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Among the UNBSSI's significant progress are programmes that encourage the study of astrophysics and space science. These include a 'Hands-On Astrophysics' (HOA) teaching curriculum for high school science, maths, and computer science classes in developing countries and a course that introduces astrophysics to university physics students. The HOA curriculum includes teaching aids, software, and other programme material and stands out for several reasons. Firstly, it provides guidance on how students can observe and measure the movement of variable stars, and secondly, through access to the American Association of Variable Star Observers, how they can share their data with professional astronomers. The

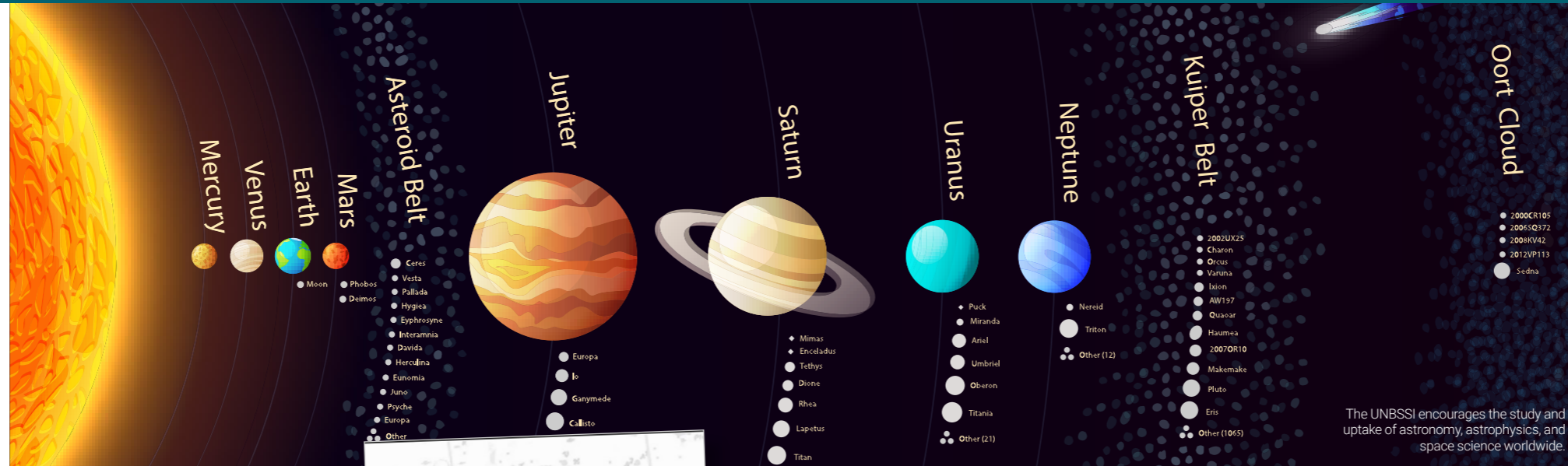
university astrophysics course promoted in developing countries is cleverly structured to stretch the students' imagination, encourage their curiosity, and test their problem-solving capacity.

It includes a collection of challenges with compact algebraic and numerical solutions that lecturers can easily translate into physics. Importantly, it shows how astrophysics embraces different disciplines within science, including atomic physics, nuclear physics, fluid and plasma physics, solid state physics, organic chemistry, and the more theoretical general relativity and game theory.

In our celestial backyard

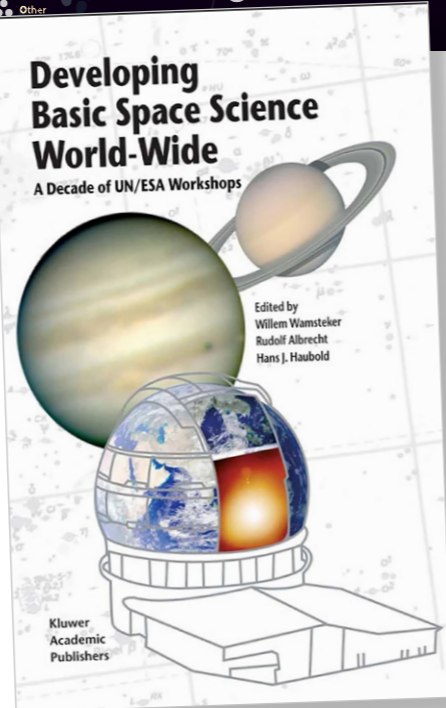
If ever there was a recent event that highlighted the excitement that space science offers the curious and the value of space data, it was on July 14, 2015, when the New Horizons interplanetary space probe flew past Pluto on its path to outer space. In galactic terms, Pluto is somewhat unremarkable; it's not even a 'real' planet, but it is part of our Solar System and, therefore, worthy of investigation. As New Horizons passed Pluto, its seven instruments collected just over 6.45 Gb of data and made more than 400 scientific observations of, amongst other things, its surface, atmosphere, and magnetosphere.

When New Horizons started transmitting data back to Earth, scientists at NASA and Johns Hopkins University Applied Physics Lab were excited but a little in the dark. Because of Pluto's small size and distance from Earth, scientists know little about it, and what images were available didn't promise much. That changed as the data started painting a picture that exceeded their wildest expectations. Far from a lifeless



lump of rock and ice, Pluto emerged to be a geologically active world. Its volatile surface ices continually move, like mammoth glaciers, between towering mountains, down to a vast, frozen nitrogen-ice sea called Sputnik Planitia. Sharing the surface are giant swathes of dark, reddish organic matter.

New Horizons fits into the bigger picture of space exploration and the UNBSSI's mission is by showing how developments in technology and data science allow us a more detailed and accurate examination of space. Scientists are still poring over the data, and if it uncovers splendours on something previously considered unremarkable in our celestial backyard, what unimaginable wonders await us further out?



Developing basic space science world wide, published in 2004, outlines a decade of UN/ESA workshops.

The seeds of space exploration

In keeping with the realisation of the benefits of networking and sharing knowledge to develop basic space science, the UNBSSI is also providing education and research facilities with access to astronomical literature through NASA's Astrophysical Data Systems. While direct access to the telescopes around the world may be limited – there are only so many telescopes, and building them is prohibitively costly – the UNBSSI believes access to the data the telescopes produce shouldn't be. This is why it is working with astrophysics research organisations worldwide with space-borne and ground-based facilities to share access to their databases and archives. It is part of an ongoing project to develop a global virtual observatory.

A growing area of focus for the UNBSSI is space weather because it brings events in space closer to home and therefore adds a

layer of interest and relevance for scholars and students. Space weather refers to the variations in the space environment between the Sun and Earth that impact systems and technologies on the ground and orbiting our planet. An example is coronal mass ejections from the Sun, which generate significant solar wind that can

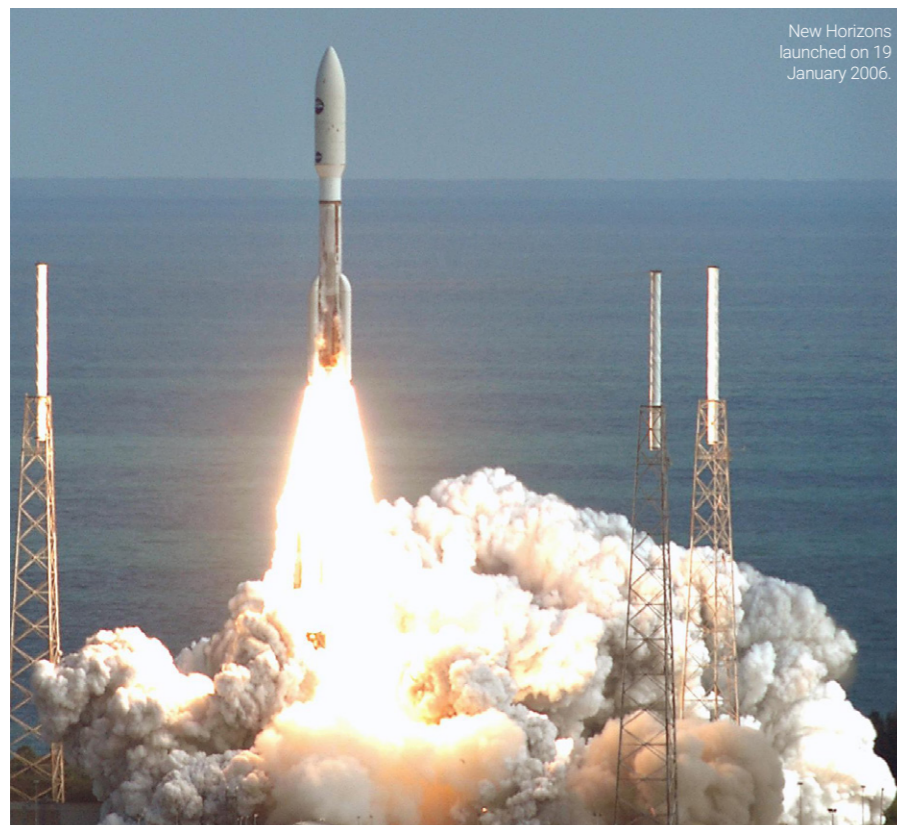
trigger geomagnetic storms around the Earth, disrupting global communication systems and power transmission. Space weather also broadens the scope of the science involved in studying space, bringing in research in seismology, aeronomy – the science of the Earth's upper atmosphere – and heliophysics – the physics of the Sun. The UNBSSI will therefore be actively contributing to the education and outreach

programme component in a UNOOSA workshop in Vienna in June 2023 focusing on space weather.

The UNBSSI's mission is expanding, and the growing realisation that events in space can impact us directly on Earth adds a sense of imperativeness to that mission.

The nobility of the UNBSSI's cause is matched only by its scope. The enormity of space is immeasurable and unconquerable, and only through cooperation and an open mind can we even scratch the surface of what it holds. Importantly, whatever that is, it belongs to no one. Therefore, the UNBSSI's efforts to plant the seeds of space exploration in the minds of everyone worldwide should be supported and celebrated.

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New Horizons launched on 19 January 2006.



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The United Nations Basic Space Science Initiative (UNBSSI) is a long-term effort to develop astronomy and space science through regional and international cooperation, particularly in developing nations.

Funding

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- 193 Member States of the United Nations

Collaborators

- Willem Wamsteker (ESA)
- Arak M. Mathai (Canada)
- Masatoshi Kitamura (Japan)
- Don Wentzel (USA)
- International Astronomical Union (IAU)
- Committee on Space Research (COSPAR)

Further reading

Kitamura, M, et al, (2006) *The United Nations Basic Space Science Initiative: The TRIPOD concept, Proceedings of the International Astronomical Union, 2(SPS5), 277–284.*

Haubold, HJ, Wamsteker, W, (2004) *Developing basic space science world wide: progress report, Advances in Space Research, 34(10), 2178–2181.*

Wamsteker, W, Albrecht, R, Haubold, HJ, (2004) *Developing Basic Space Science World-Wide: A Decade of UN/ESA Workshops*, Kluwer Academic Publishers.

United Nations General Assembly (1996) *Report on the fifth United Nations / European Space Agency workshop on basic space science: from small telescopes to space missions, hosted by the author C. Clarke Centre for Modern Technologies on behalf of the Government of Sri Lanka.* STSC 33rd session.



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