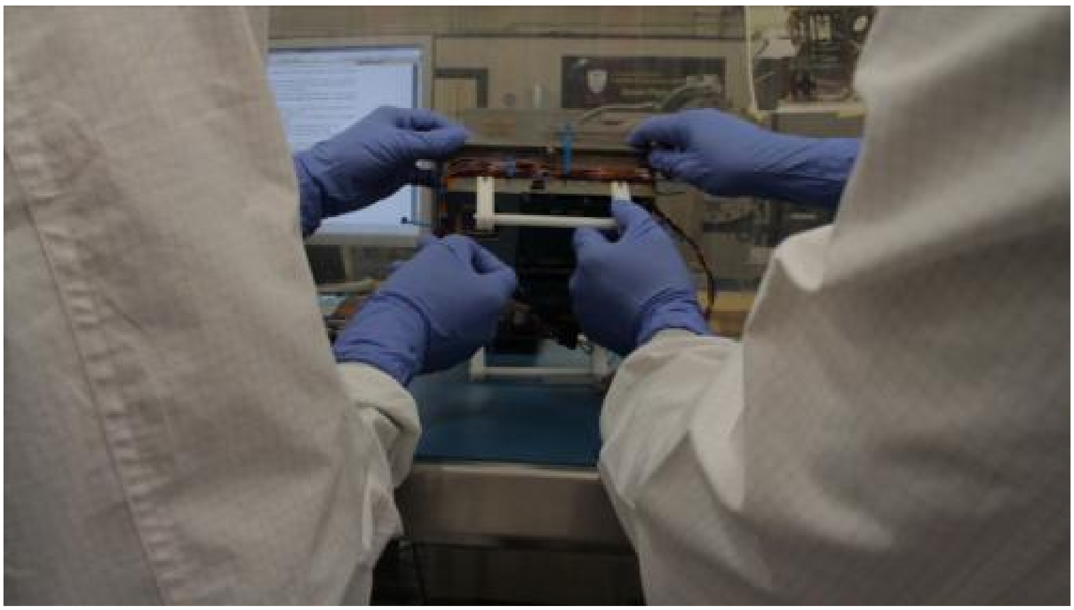
PHYS.ORG

World's smallest space telescope

February 22 2013



This shows the assembly of one of the first two satellites in the BRITE constellation at the Space Flight Laboratory of the University of Toronto Institute for Aerospace Studies. Credit: Johannes Hirn, University of Toronto

The smallest astronomical satellite ever built will launch shortly after 07:20 a.m. EST on Monday, 25 February 2013 as part of a mission to prove that even a very small telescope can push the boundaries of astronomy.

The satellite was designed and assembled at the Space Flight Laboratory (SFL) of the University of Toronto Institute for Aerospace Studies (UTIAS). It will be launched from the Satish Dhawan Space Centre in

Sriharikota, India, along with its twin, also designed in Canada, but assembled in Austria. Each nano-satellite in the BRIght Target Explorer (BRITE) mission is a cube 20 centimetres per side, and weighing less than 7 kilograms. The BRITE satellites are part of the new wave of nano-satellites that can be designed, assembled and deployed fast and relatively cheaply.

"SFL has demonstrated that nano-satellites can be developed quickly, by a small team and at a cost that is within reach of many universities, small companies and other organizations," says Cordell Grant, Manager of Satellite Systems for the Space Flight Laboratory at UTIAS. "A nano-satellite can take anywhere from six months to a few years to develop and test, but we typically aim for two years or less."

Up to now, such nano-satellites had been used only to monitor the earth and experiment with new technologies. "Researchers, scientists and companies worldwide, who have great ideas for space-borne experiments, but do not have the means to fund a large spacecraft, can now see their ideas realized," said Grant. "BRITE has the potential to open an entirely new market for low-cost high-performance satellites."

BRITE is the first nano-satellite mission intended for astronomy, and the first-ever astronomy constellation —more than one satellite working toward a common objective— of any size. The previous world-record holder for small astronomy satellites was the MOST satellite, designed and assembled in part by SFL at UTIAS. Launched in 2003 and still operating, MOST was the first entirely Canadian satellite for astronomy, weighing in at 53 kilograms. Compared to the 11 metric tons of the Hubble Space Telescope, MOST was aptly called a micro-satellite.

"BRITE is expected to demonstrate that nano-satellites are now capable of performance that was once thought impossible for such small spacecraft," says Grant. But only small telescopes can fit within a 20 centimetre cube. Therefore, BRITE is not intended to take pretty pictures, but will simply observe stars and record changes in their brightness over time. Such changes could be caused by spots on the star, a planet or other star orbiting the star, or by oscillations and reverberations within the star itself —the analogue of earthquakes on stars. The study of these so-called "starquakes" is called asteroseismology.

To perform precise measurements of the brightness of stars, the telescopes need to be above the atmosphere. Otherwise, scintillation —the atmospheric effect that causes stars to twinkle— overwhelms the relatively small brightness variations of the stars themselves. By avoiding this, a very small telescope in space can produce more accurate data than a much larger telescope on the ground. Also, unlike telescopes on Earth which are useless during the day, in bad weather or when the stars set below the horizon, telescopes in space can potentially observe stars all the time.

As their name suggests, the BRITE satellites will focus on the brightest stars in the sky including those that make up prominent constellations like Orion the Hunter. These stars are the same ones visible to the naked eye, even from city centres. Because very large telescopes mostly observe very faint objects, the brightest stars are also some of the most poorly studied stars.

It turns out that the brightest stars are also the largest. Big bright stars lead short and violent lives and deaths (supernovas) and in the process seed the universe with heavy elements without which life on Earth would be impossible. To better understand these stars is to better understand how life arose on our planet.

Because big objects oscillate and quake slower than smaller ones, the BRITE satellites do not have to keep their eyes constantly on any given star, but can observe from time to time to see if anything has changed —as children do in the game Mr. Wolf, where they only take a peek at their playmates once in a while, but are still able to tell if any of them has changed position.

Hence, the BRITE satellites can monitor their target stars whatever orbit they are placed on, and do not require a dedicated rocket to place them in a specific orbit. By piggy-backing on any available rocket, the BRITE satellites can thus be launched for relatively little money: the first two BRITE satellites will be sent to space on the Polar Satellite Launch Vehicle (PSLV) C20.

To gather more observations and to increase the lifetime of the mission, scientists will be launching three such pairs of satellites —one Austrian pair, one Polish pair and one Canadian pair supported by the Canadian Space Agency— so that within a few years BRITE will become a constellation of six satellites. Each twin in a pair watches the sky in a different colour (red or blue), providing another exciting layer of data to the scientists.

More information: LIVE COVERAGE OF THE LAUNCH:

webcast.gov.in/live/
www.ndtv.com/video/live/channel/ndtv24x7
ibnlive.in.com/livetv/

Provided by University of Toronto