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The Isaac Newton Group of Telescopes

The Isaac Newton Group of Telescopes is an establishment of the Particle Physics and Astronomy Research Council (PPARC) of the United Kingdom and the Nederlandse Organisatie Wetenschappelijk Onderzoek (NWO) of the Netherlands

PRESS RELEASE

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A TOTALLY NEW OPTICAL DETECTOR SEES FIRST LIGHT AT THE WHT

A totally new concept in optical detector instrumentation has made its first appearance at the William Herschel Telescope on 2 February 1999. The Superconducting Tunnel Junction Camera (S-CAM), designed and built by members of the Astrophysics Division of the European Space Agency, consists of a photon counting system which provides position and arrival time of each detected photon, along with the photon energy for the first time in history of optical astronomy.

S-CAM is equipped with an array of 6 × 6 small chips of the metal tantalum, cooled with the help of a bath of liquid helium to a temperature within a degree of absolute zero. Incident photons break Cooper pairs responsible for the superconducting state. Since the energy gap between the ground state and excited state is low, each individual photon creates a large number of free electrons, in proportion to the photon energy. Thus by measuring the charge released by each detected photon, these can be sorted in energy

The introduction of the Superconducting Tunnel Junction as an astronomical detector is in many ways the natural next step beyond the semi-conductor CCD detector currently used at telescopes. In the latter silicon-based devices, the band gap between the ground state and the state excited by the absorption of an optical photon is comparable to the photon

energy. As a consequence, only a single electron is extracted from the detector per absorbed photon - irrespective of its energy.

The Crab Pulsar provides an ideal target for verifying the camera's photon counting and timing capabilities. This pulsar is a neutron star spinning about 30 revolutions per second. The pulsar, together with a surrounding nebula, was left behind when a star, about 5000 light years away in the Taurus constellation, exploded as a supernova appearing in 1054 AD.

On 2 February a 240s exposure of the Crab Pulsar was taken using the S-CAM camera. From the data obtained the astronomers made a light curve which clearly showed the characteristic two beams of light which shine out, like a lighthouse, one weak and long and the other bright and short, in each revolution.

The Superconducting Tunnel Junction detectors have applications, not only in astronomy but in the commercial and industrial fields, where fast measurements to capture phenomena in wavelength at very low light levels are required.

The Isaac Newton Group (ING) consists of the 4.2m William Herschel Telescope, the 2.5m Isaac Newton Telescope and the 1m Jacobus Kapteyn Telescope. The ING operates these telescopes on behalf of the Particle Physics and Astronomy Research Council (PPARC) of the United Kingdom and the Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) of the Netherlands. The telescopes are located in the Observatorio del Roque de Los Muchachos on La Palma. This international observatory is operated on behalf of Spain by the Instituto de Astrofísica de Canarias (IAC).

FOR FURTHER INFORMATION:

The STJ Page:
http://astro.estec.esa.nl/SA-general/Research/Stj/STJ_main.html

S-CAM First Light (at ESA Astrophysics Division):
http://astro.estec.esa.nl/Info/scam_first_light.html

S-CAM First Light (at ESA):
http://sci.esa.int/newsitem.cfm?TypeID=1&ContentID=3830&Storytype=4

This press release is also at http://www.ing.iac.es/PR/Press_Releases.html
and mirrored at http://www.ast.cam.ac.uk/ING/PR/Press_Releases.html