

Edited by Emma Sanders

Tantalum detector

A new development in detector technology is good news for astronomers. Designed by a team in the space science department of the European Space Agency's Science and Technology Centre, the detector saw first light earlier this spring at the William Herschel Telescope on La Palma.

The detector is based on an array of tantalum superconducting tunnel junctions (tantalum is a metal from the same family as niobium) and it operates at about 0.3 K. The instrument is interesting to astronomers because it allows single photon counting, imaging capability and the possibility to determine the energy of the incoming photon, all at the same time.

The detector has a count rate capability of 1 kHz and time tags the arrival of each photon to an accuracy of 5 μ s using the Global Positioning System as reference.

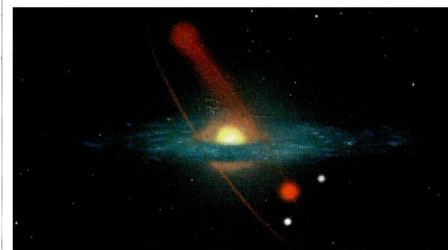
In the past, astronomers used gratings to achieve high-energy resolution. However, this dispersed the light and reduced efficiency. Now they will be able to determine the energy of photons without losing light.

Testing at the William Herschel Telescope was carried out at optical wavelengths, with an array of 6×6 junctions, each with a field of view of 0.6 arcsec. The detector works equally well for radiation up to 1 keV X-rays, where an energy resolution of 5 eV has been obtained.

Superconducting tunnel junction (STJ) devices can also be used for building very sensitive amplifiers (SQUID circuits), and STJ logic circuits have applications in ultrafast signal processors. They only work in zero or fixed, low magnetic fields, however.

The development is the culmination of more than 10 years of R&D in collaboration with European industry.

ESO update



Artist's impression of a star cluster orbiting the Milky Way, losing stars as it goes. (ESO.)

The first 8.2 m telescope of the Very Large Telescope array opens to astronomers on 1 April. It has already made interesting discoveries during its commissioning stage.

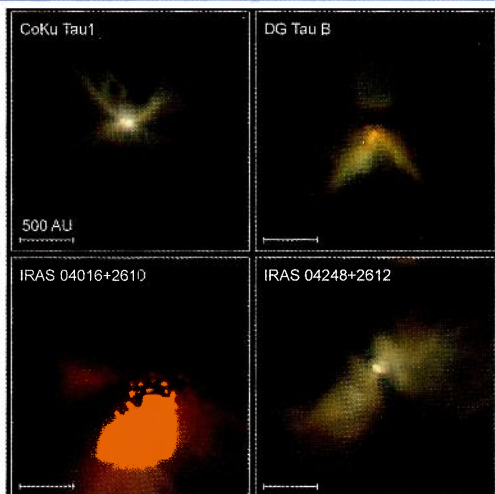
Observations of one of the star clusters orbiting the central region of our galaxy has revealed a surprisingly small number of light-weight stars. This unusual mass distribution is caused by the gravitational attraction of the Milky Way, which pulls stars into its halo – a kind of giant galactic plughole. This is the first time that the effect has been observed, and the results can be used to obtain information about the formation of our galaxy and the amount of dark matter in its halo.

Meanwhile, new equipment has been installed at ESO's other observatory at La Silla. FEROS (Fibre-fed Extended Range Optical Spectrograph) was used to measure the spectra of stars in the outer galaxy.

One star was found to contain an unexpectedly large amount of lithium. This is interesting to cosmologists because lithium is the heaviest element created in measurable quantities after the Big Bang, heavier elements being created by nucleosynthesis in stars.

A star of this age and kind would normally have lost lithium. The excess is a mystery, which astronomers may have to wait for the VLT to solve.

Picture of the month



These young stars are in Taurus constellation, 450 light years away. Taken with the Hubble Space Telescope, the pictures show discs of dust orbiting the central star. The discs will condense to form planets. From the images, astronomers can calculate how much material is in the disc and study the dust's chemical composition to learn about planetary formation. More than a dozen possible extrasolar planets have been discovered, yet none has been directly imaged. The bright star overpowers the planet's reflected light. (Pic: NASA.)

New light is shed on an old problem

For the first time, astronomers have recorded a gamma-ray burst at optical wavelengths. This is no mean feat. Although the bursts are extremely strong (up to 100 billion times as bright as ordinary stars), they occur without warning and last for typically a few seconds. Previous optical detection has been limited to images of the fading burst.

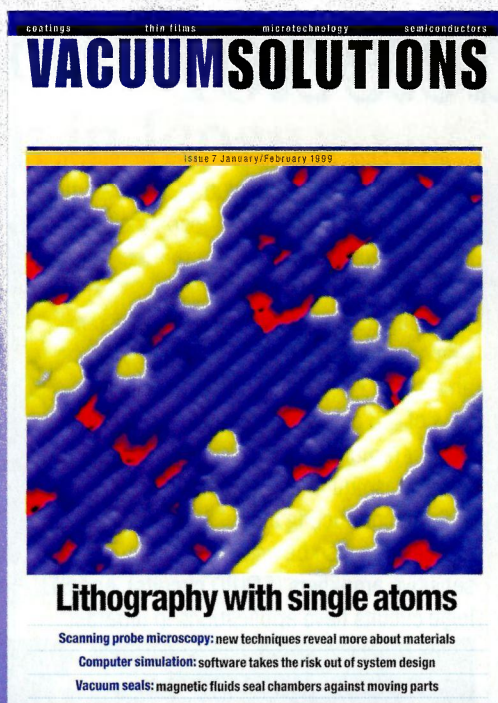
On 23 January, detectors onboard NASA's Compton Gamma Ray Observatory detected the beginnings of an intense burst. Immediately, the co-ordinates were forwarded to ground-based observatories around the world. Just 22 s later, astronomers at a small optical telescope at Los Alamos were on target. Slower off the mark, the mighty 10 m Keck II

telescope at Mauna Kea in Hawaii later pinpointed the fading burst and measured its distance to be around 9 billion light years.

The cause of gamma-ray bursts is a mystery. Candidates include merging black holes and hypernovae – massive exploding stars. The optical observations give astronomers a new insight into the processes at work.

Hear more next month at the Supernovae and Gamma Ray Burst Symposium at the Hubble Space Telescope Science Institute.

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