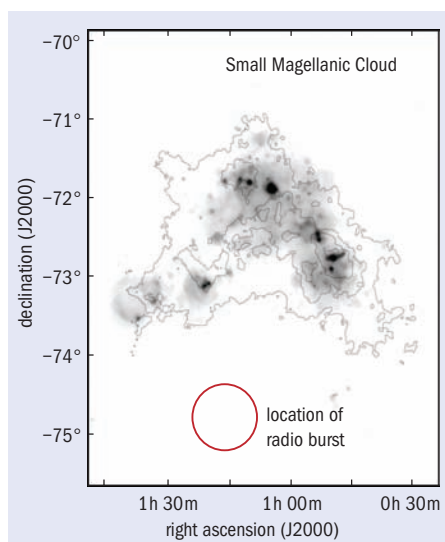


Astronomers detect mysterious phenomenon

Analysis of six-year old archival data of the Parkes radio telescope in Australia has revealed a giant burst of radio waves. Extremely bright, brief and distant, this unique event seems to come from a completely new type of phenomenon. Its detection could open a new field in astrophysics similar to the discovery of gamma-ray bursts in the 1970s.

Pulsar surveys are best suited to detect short radio bursts and to discriminate them from terrestrial interference. The pulsar survey at the 64 m Parkes antenna in New South Wales led to the discovery of a new population of spinning neutron stars – known as rotating radio transients – which emit repeated bursts of radio waves (*CERN Courier* April 2006 p10). Now, astronomer Duncan Lorimer of West Virginia University and colleagues have reported a burst that is 10–100 times brighter than these periodic events emitted in the galaxy. In February, David Narkevic, an undergraduate student at West Virginia, discovered this unique event by chance when he re-analysed observations from a Parkes radio survey of the Small Magellanic Cloud (SMC). The flare was recorded on 24 August 2001 and is located near, but clearly outside, this neighbouring dwarf galaxy.

The observed properties of the radio burst provide additional evidence that the event cannot be of terrestrial origin, nor be associated with our galaxy or the SMC, but probably comes from an object at a



This map of the distribution of both ionized (greyscale) and neutral (contours) hydrogen in the Small Magellanic Cloud shows the location of the radio hyperburst. (Courtesy Lorimer et al., NRAO/AUI/NSF.)

cosmological distance. Astronomers can use the shift of the burst arrival time as a function of radio-wave frequency to estimate the distance to the source. The frequency-dependent refractive index of ionized gas within our galaxy or in intergalactic space induces this time delay. An accurate measurement of this delay allows the team to estimate the projected density of free electrons along the line of sight – the dispersion measure – and hence the distance

to the source. The dispersion measure that Lorimer and colleagues obtain suggests a cosmological distance of more than a thousand million light-years (redshift $z \sim 0.12$) when assuming a realistic contribution from ionized gas in our galaxy and in the source's host galaxy, which is still unidentified.

The observed radio flux of this flare and its derived distance match well that of 3C 273, the brightest quasar in the sky. This makes it an extremely energetic event lasting 5 ms at most, which limits the size of the source to about a tenth of the size of Earth. Although these properties are reminiscent of gamma-ray bursts, there was no such high-energy event detected at the time of the radio burst, and the burst characteristics also differ from expectations for the radio counterpart to gamma-ray bursts.

This exotic event seems to be a new class of phenomenon that could occur several times a day but have so far remained unnoticed. The search for other radio hyperbursts in the complete archive of the Parkes telescope is ongoing. As astronomers detect new events, they will have a better idea of the possible origin. The best candidates to date are merging neutron stars or the last "cry" of a black hole as it evaporates completely through Hawking radiation (*CERN Courier* November 2004 p27).

Further reading

D Lorimer et al. 2007 *Science* (DOI: 10.1126/science.1147532).

Picture of the month



This Hubble Space Telescope image of the gigantic nebula NGC 3603 shows in extraordinary beauty one of the most prominent young star clusters in the Milky Way. It is located in the Carina spiral arm of our galaxy at a distance of about 20 000 light-years. Most of the bright stars in the image are hot, blue stars with intense ultraviolet radiation and violent winds that have formed an enormous cavity in the gas and dust surrounding the cluster. Star clusters such as these are formed by the gravitational collapse of a huge cloud of gas and dust. They offer an opportunity to study the evolution of stars with differing masses, but similar composition and age. (Courtesy NASA/ESA/The Hubble Heritage Team STScI/Aura.)