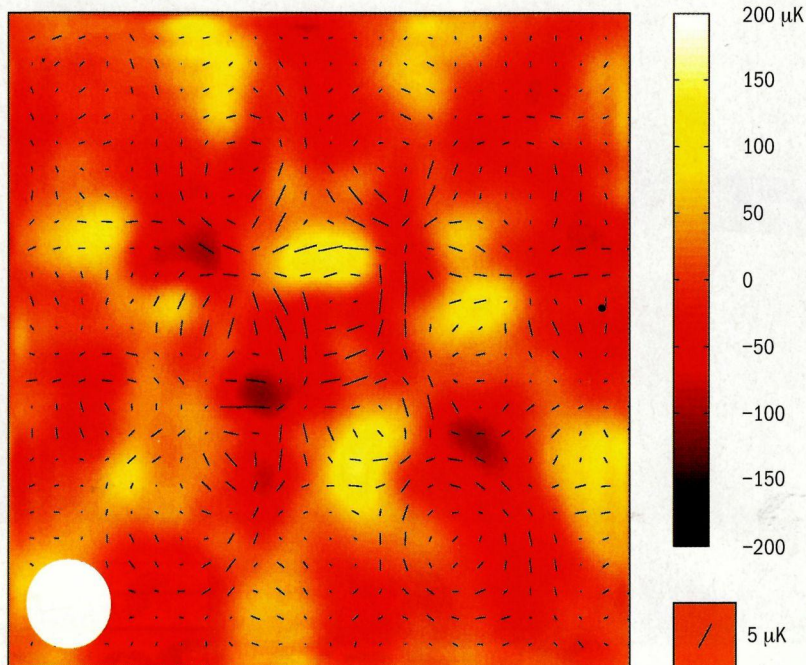


DASI measures CMB polarization



Physics at the extremes: the DASI observing station at the south pole. (DASI.)



This map shows the variations in the temperature and polarization (denoted by black lines) of the CMB. The map is 5 degrees square. (DASI.)

Another big step forward has been made in the study of the early universe. The Degree Angular Scale Interferometer (DASI) has announced the first measurements of the polarization of cosmic microwave background (CMB) radiation. The new results are a strong validation of the theoretical framework for the origin of fluctuations in the CMB, and also lend confidence to the values of the cosmological parameters that have been derived from CMB measurements.

CMB radiation dates from 300 000 years after the Big Bang, when radiation decoupled from matter. Fluctuations in the CMB are evidence for the first clumping of matter particles – the seeds of the galaxies that we see today. The radiation is polarized because atoms moving in the early universe scattered

light differently, depending on whether the light was heading towards or away from them. The faster the speed of the atoms, the more pronounced the polarization. Measuring the polarization of the CMB is a direct measure of the dynamics of the early universe.

This exciting field of study has seen many advances in observing capabilities over recent years, and new discoveries have been coming thick and fast. Just last year, DASI and also the BOOMERANG balloon experiment announced measurements of the angular power spectrum of the CMB (*CERN Courier* July/August 2001 p15). Plotting the observed power as a function of the angular size of emitting regions gives a constraint on cosmological parameters, such as Ω – the ratio of matter in the universe to the critical level

needed to halt its expansion, and also the amount of ordinary matter and dark matter in the universe. The polarization signal is more difficult to detect. For the temperature measurements, 32 different areas of the sky were observed for relatively short time scales. For the polarization measurements, 271 days of observation were needed for just two areas of sky to reach the required signal level.

DASI is a 13-element interferometer located at the south pole. Observers and the telescope must survive freezing antarctic conditions, not without difficulties. However, their endurance has certainly paid off, with some extremely interesting results.

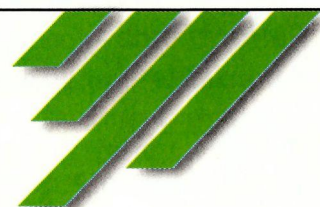
Further reading:

<http://arxiv.org/abs/astro-ph/0209478>.

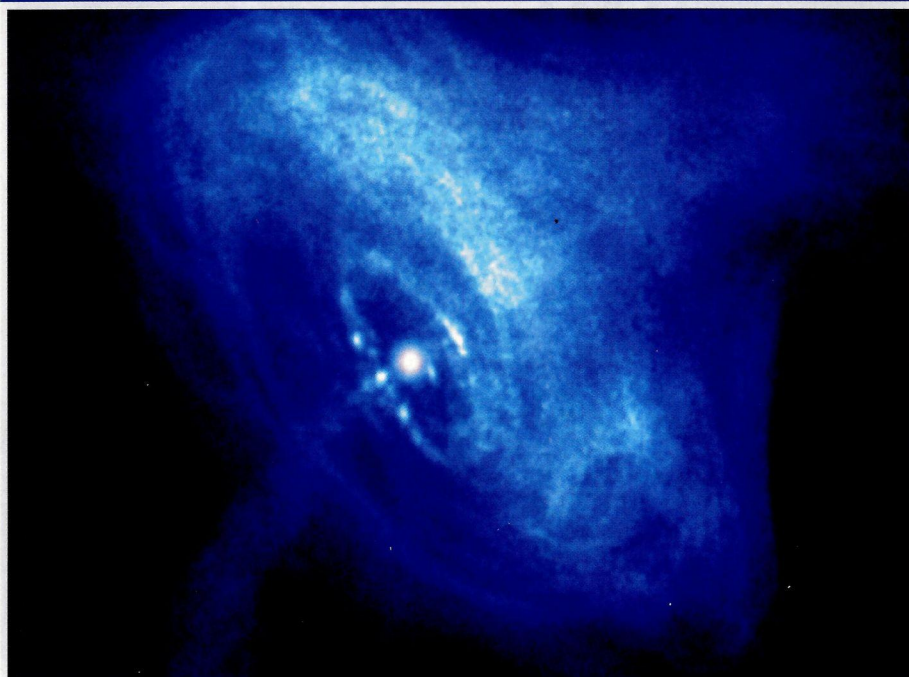


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Picture of the month

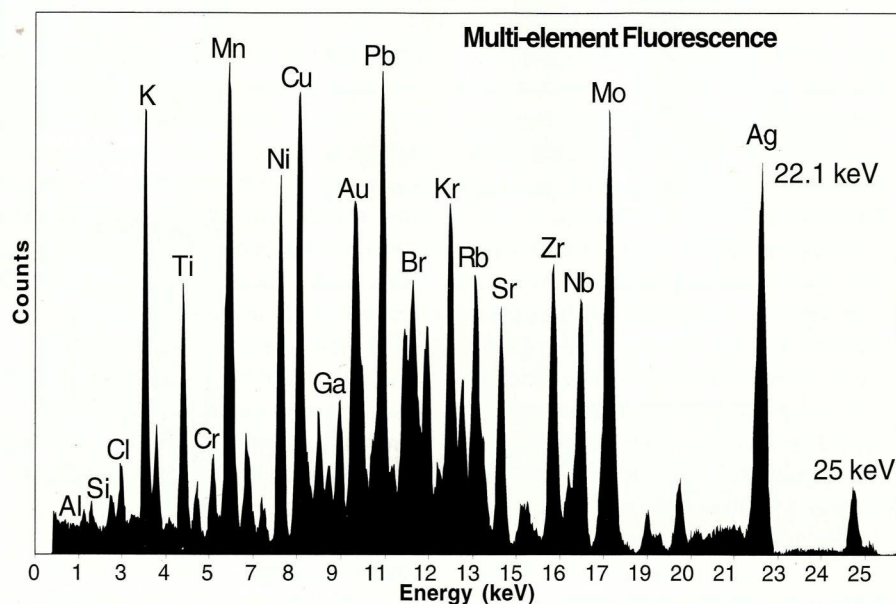


This image shows the X-ray emission from the inner region of the Crab nebula. The disk of material is orbiting the central pulsar, a rapidly rotating neutron star seen as a white dot near the centre of the image. The Chandra X-ray observatory imaged the Crab over a period of several months, and the results have been made into a short film where material can be seen moving outwards from the pulsar at half the speed of light (see <http://chandra.harvard.edu>).

Thanks to Chandra, and also the XMM-Newton X-ray satellite, X-ray observations now have comparable resolution to those at optical and radio wavelengths, providing a wonderful tool for astronomers who are trying to piece together the different processes at work in some of the most energetic regions of the universe. (NASA.)

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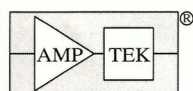
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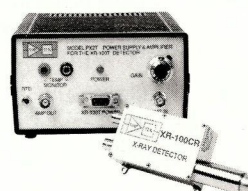
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