Primordial nucleosynthesis

Standard Big bang nucleosynthesis presents a pressing cosmological conundrum. There is some evidence suggesting a cosmological origin for ^{6}Li, and the stellar value for primordial ^{7}Li does not agree with primordial Deuterium from QSOs and with Ω_b from WMAP. Although Li observations in low metallicity Galactic halo stars are plagued by possible systematic uncertainties due to modelling of stellar atmospheres and the treatment of convection, it is possible that both discrepancies can be reconciled with physics beyond the standard model during the Quark-Hadron phase. CODEX will provide the first observations of ^{7}Li and ^{6}Li in dwarf stars in galaxies of the Local Group and will make it possible for the first time to measure the interstellar ^{7}Li/^{6}Li ratio in unprocessed material of High-Velocity Clouds. The latter is a direct and robust probe of the yields of the Big Bang Nucleosynthesis yields, providing important insights on whether new physics is playing a role in the early Universe.

In addition to these selected applications, many other science cases have emerged over recent years. Stellar oscillations, the study of the most metal-poor stars in our Galaxy and in its local group companions, the use of cosmochronometers to determine the age of the Universe, the history of the metal enrichment of the Universe … all these cases (and surely many more) will receive a major boost from CODEX on OWL, far beyond what can be now conceived.

References

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Afterglows of Elusive Short Gamma-Ray Bursts

An international team of astronomers[1] has for the first time observed the visible light from a short gamma-ray burst (GRB). Using the 1.5-m Danish telescope at La Silla (Chile), they showed that these short, intense bursts of gamma-ray emission most likely originate from the violent collision of two merging neutron stars. The same team has also used the VLT to constrain the birthplace of the first ever short burst whose position could be pinpointed with high precision. The results were published in the October 6 issue of the journal *Nature*.

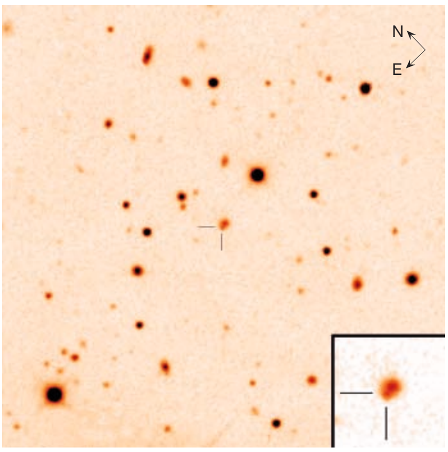
Gamma-ray bursts, the most powerful type of explosion known in the Universe, have been a mystery for three decades. They come in two different types, long and short. Over the past few years, international efforts have convincingly shown that long gamma-ray bursts (longer than about 2 sec) are linked with the explosion of massive stars. It is thought that short-duration GRBs may be due to the merging of two neutron stars; they have evaded optical detection for more than 30 years.

In the night of July 9 to 10, 2005, the NASA HETE-2 satellite detected a burst of only 70-millisecond duration and, based on the detection of X-rays, was able to determine its position in the sky. Thirty-three hours after, Jens Hjorth and his team obtained images of this region of the sky using the Danish 1.5-m telescope at ESO La Silla. The images showed the presence of a fading source, sitting on the edge of a galaxy.

The burst resides 11 000 light years from the centre of a star-forming dwarf galaxy that is about 2 400 million light years away and is quite young – about 400 million years old. From observations conducted until 20 days after the burst, the astronomers ruled out the occurrence of an energetic hypernova as found in most long GRBs. This supports the hypothesis that short GRBs are the consequence of the merging of two very compact stars.

(Based on ESO Press Release 26/05)

[1] Jens Hjorth (Dark Cosmology Centre – DARK, Niels Bohr Institute, University of Copenhagen), Darach Watson (DARK), Johan P. U. Fynbo (DARK), Paul A. Price (Institute for Astronomy, University of Hawaii), Brian L. Jensen (DARK), Uffe G. Joergensen (DARK), Daniel Kubas (ESO), Javier Gorosabel (Instituto de Astrofísica de Andalucía), Pàll Jakobsson (DARK), Jesper Sollerman (DARK and Department of Astronomy, Stockholm University), Kristian Pedersen (DARK), and Chryssa Kouveliotou (NASA/Marshall Space Flight Center). The team is part of the Gamma-Ray Burst Afterglow Collaboration at ESO (GRACE) carrying out gamma-ray burst afterglow studies.



First image in the visible (more precisely, in the so-called *R*-band) of a short gamma-ray burst. The image was taken with the Danish 1.5-m telescope and the DFOSC camera at La Silla on July 11, 2005. It shows the gamma-ray burst to be situated on the edge of a low-redshift galaxy.