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# Cosmic archaeology: Astrophysicists use new spectrographs to look far back into the history of the universe

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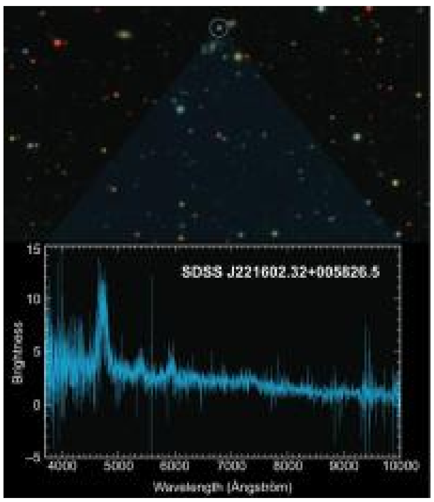


Focussing on the cosmic power station: the image shows the light spectrum of a quasar - a young galaxy whose centre is a supermassive black hole. The bluish-looking quasar is shown within a circle at the top of the photo; the BOSS spectrum at the bottom of the image. The astronomers use the BOSS spectrum to derive the redshift of the object and hence its distance. BOSS will collect millions of such spectra and chart the geometry of the universe. Image: D. Hogg / V. Bhardwaj / N. Ross

(PhysOrg.com) -- The distant past of the universe is moving closer. Astronomers are using special spectrographs to investigate galaxies in the depths of the universe as part of the Sloan Digital Sky Survey III. The instruments are very sensitive to infrared light and can even detect very distant galaxies whose light is shifted towards the long-wavelength, red region of the spectrum as a result of the cosmic expansion. The astrophysicists hope that the Baryon Oscillation Spectroscopic Survey (BOSS) will record the spectra of 1.4 million galaxies and 160,000 quasars by 2014.

The scientists have good reason to be delighted. On the night of September 14-15, 2009 the new spectrographs on the 2.5-metre telescope at Apache Point in the US state of New Mexico provided the first data from galaxies and quasars. "The light spectra look remarkably good," says Guinevere Kauffmann from the Max Planck Institute for Astrophysics in Garching near Munich. Her research group has been involved in the Sloan Digital Sky Survey (SDSS) for more than seven years. "With these instruments we are looking back to a time when galaxies and their black holes were much more active than they are today."

The full name - Baryon Oscillation Spectroscopic Survey - reveals what is so special about the project, as the BOSS spectrographs use a peculiar feature of the early universe: baryon oscillations. These were caused by the interaction of gravity and radiation pressure. Like sound waves travelling through air, they compress matter. Immediately after the birth of the universe they were moving with half the speed of light, but froze, so to speak, when the universe cooled down a few hundred thousand years later.

"These frozen waves can be seen in the distribution of the galaxies today," said Daniel Eisenstein from the University of Arizona. "By studying the baryon oscillations we can draw inferences about the nature of dark energy." This mysterious matter is driving the universe apart and accounts for more than 70 per cent of its energy density. BOSS is intended to literally shed light on this darkness: "We expect the best ever data obtained on the large-scale structure of the universe," adds principal investigator David Schlegel from the Lawrence Berkeley National Laboratory.

The project's spectrographs use more than 2,000 large metal plates which are placed in the focal plane of the 2.5-metre telescope. Each of these plates has thousands of minute holes into which optical fibres are plugged to guide the light from each observed galaxy to the BOSS spectrographs.

More information:

[1] SDSS website
[2] SDSS-III website

Provided by Max-Planck-Gesellschaft (news : web)

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