

Edited by Emma Sanders

Gas reveals secrets of universe evolution

New observations using the ROSAT X-ray telescope endorse a "bottom-up" model of the evolution of the universe.

Most ordinary matter in the universe is in the hot gas that makes up the intergalactic medium. ROSAT observed X-ray emission from this gas, both in small groups of galaxies (where it has a temperature of around 10 million degrees) and in large clusters (around 100 million degrees). The gas in the small groups contained more energy than expected. This extra energy comes from galaxy formation, and modelling the evolution of the system showed that it had to be injected before the group formed. This supports a "bottom-up" picture, with small objects being

formed, then clustering together.

This is the first time that such energy comparisons have been made. Observations are difficult because the intergalactic gas is so thin. The result has important implications for cosmology and may help to explain why we see no galaxies forming today. The original phase of galaxy formation heated up the intergalactic gas so much that it is too energetic to collapse and form stars.

The ROSAT satellite is a collaboration between Germany, the UK and the US. After eight years in orbit and recording 20 times more X-ray sources than had been seen before, ROSAT ceased to function in December 1998.

Stars seeing stars

Subaru, a new Japanese telescope, saw first light in January. It joins the UK infrared telescope, the Dutch, UK and Canadian James Clerk Maxwell Telescope and the US Keck Observatory on the 4000 metre Mauna Kea site in Hawaii.

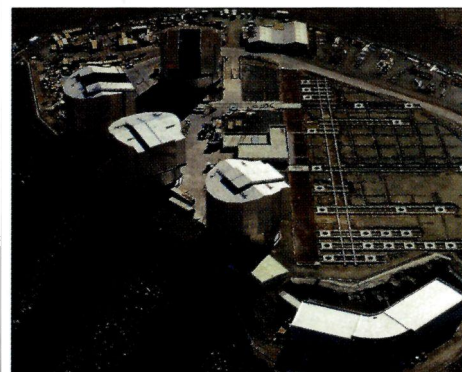
As well as its connotations for the motor industry, "Subaru" means "to bring together" in

Japanese and is also the Japanese word for the Pleiades star cluster.

The 8.3 metre primary mirror is composed of 44 one-ton glass hexagons and its surface is polished to an accuracy of two hundred billionths of a centimetre.

The telescope will be optimized for near-infrared observations, where it will have a resolution of 0.06 arc-seconds. This is three times as great as the resolution of the Hubble Space Telescope.

Top telescopes



The VLT site, 2650 m above sea level in the Chilean Atacama Desert. (Pic: ESO.)

The European Southern Observatory inaugurates its new observatory at Paranal, Chile, during the first week of March. Two of the four 8.2 metre telescopes that will make up the Very Large Telescope (VLT) are now complete. The third will follow this autumn.

Construction of the subterranean laboratory, where light from the telescopes will be analysed, is well under way. The first interferometric images are expected next year. The VLT will be the world's most sensitive telescope.

Cluster rides again

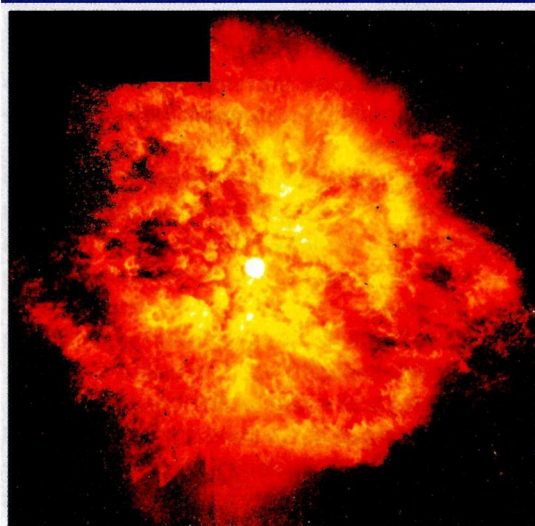
The Cluster 2 mission has been given the go-ahead by the European Space Agency review board and is scheduled for launch by two Russian Soyuz rockets in mid-2000. The four satellites will, for the first time, study the solar wind and the Earth's magnetosphere in 3-D.

Scientists are particularly interested in the coupling of the Sun and Earth's magnetic fields. This phenomenon, called magnetic reconnection, occurs in large-scale plasmas. Without it, the Sun and Earth's magnetic fields would not mix and the stream of electrons and ions in the solar wind would not be channeled into the Earth's ionosphere.

The process is also important for star formation, where magnetic pressure would otherwise stop the star from condensing. However, despite its crucial role, little is known about magnetic reconnection.

Cluster 2 is almost identical to the original Cluster spacecraft, which was lost when the first Ariane 5 flight was destroyed in an explosion in June 1996.

Picture of the month



This Hubble Space Telescope image shows a Wolf-Rayet star ejecting its outer atmosphere. Hot clumps of gas, some 100 billion kilometres wide, are thrown into space at speeds of more than 100 000 kilometres per hour. All massive stars will eventually evolve through a Wolf-Rayet phase. (Pic: NASA.)