

Edited by Emma Sanders

Supernova supports negative energy theory

Images of a supernova 10 billion light-years from Earth give new weight to Einstein's theory of negative gravitational energy (the cosmological constant). The observations of the exploding star, made using the Hubble Space Telescope, appear brighter than they should if the universe had been expanding at a constant rate.

The bright supernova, the most distant ever

detected, supports a picture of the universe where gravity dominated in the early years, slowing down expansion and holding galaxies relatively close together so that they appeared brighter. Later, a repulsive force – a kind of “negative energy” – started to counteract the attraction of gravity and the rate of expansion of the universe began to accelerate, stretching the expanse between galaxies and making

objects within them appear to be dimmer.

This view is supported by microwave observations, and calculations of dark matter using gravitational lensing techniques (June 2000 p11; October 2000 p15). At such a great distance, the observation of this new supernova is an important step forward. It is 50% farther away than the next farthest supernova observed by other survey groups.

Gamma-ray bursts are linked to star-forming regions

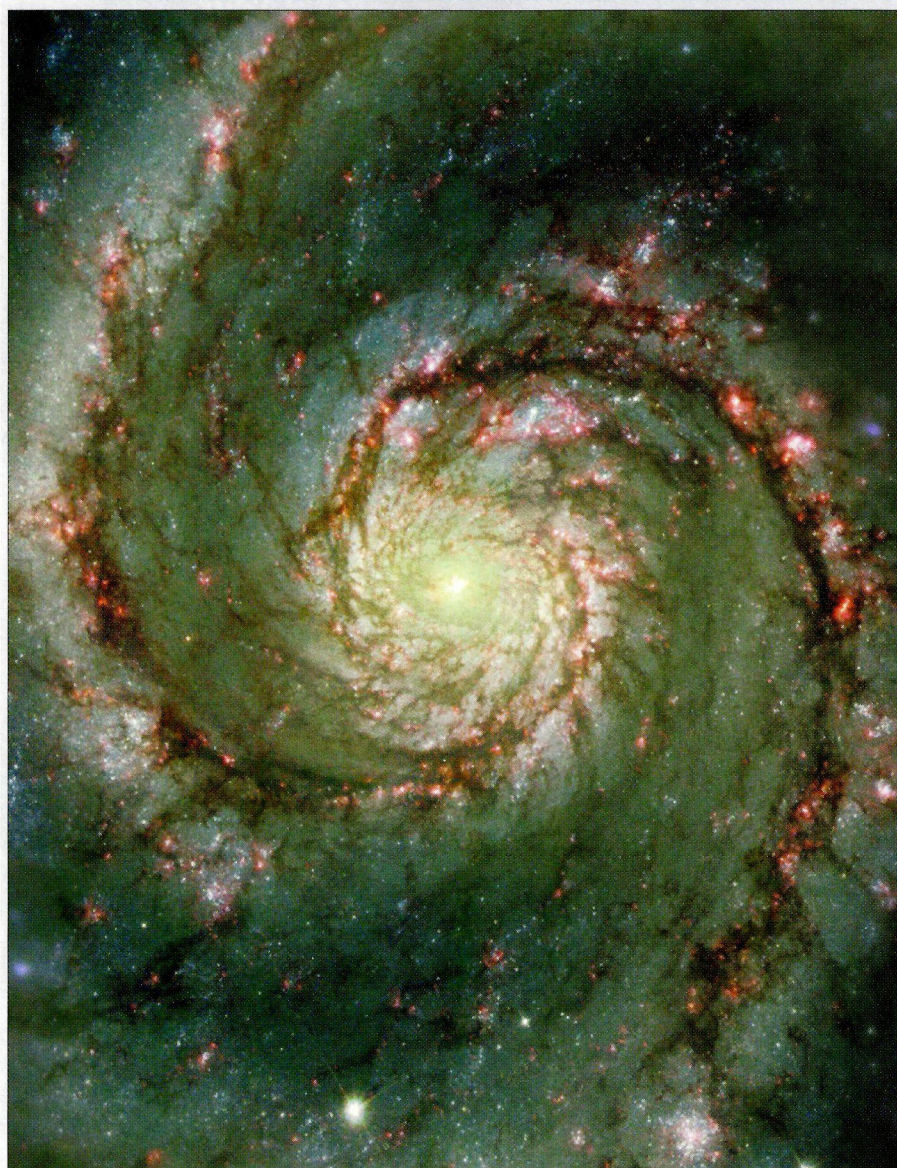
At the Gamma Ray 2001 conference in Baltimore, Luigi Piro of the Istituto Astrofisica Spaziale in Rome presented new evidence linking gamma-ray bursts to dense regions of star formation.

Gamma-ray bursts (GRBs) are by far the most powerful events known to occur in the universe since the Big Bang. Their brightness can be enormous – it has been known to reach 1 billion times that of the combined emission from all of the stars in the host galaxy. The mechanisms fuelling GRBs are, however, still unknown.

Piro and collaborators observed the afterglow emission that follows GRBs and found evidence that the blast wave was braking against very dense gas, such as would be found in regions where new stars were forming. The results support the hypernova model of GRBs, in which the explosion of an extremely massive star produces an enormous blast of material. This fireball expands at relativistic speeds. The observations were made using NASA's Chandra X-ray observatory and the Italian-Dutch BeppoSax observatory.

Meanwhile, astronomers using the Parkes radiotelescope in Australia have found 30 young pulsars, counterparts of otherwise unidentified galactic gamma-ray sources. Previously, seven gamma-ray sources had been identified with pulsars. Pulsars are neutron stars formed by the collapse of massive stars during supernova explosions. Their intense magnetic fields are expected to make them prolific sources of high-energy radiation.

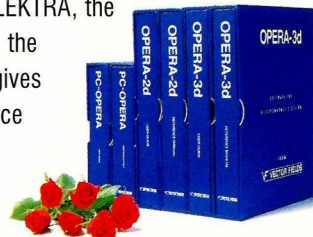
Picture of the month



This Hubble Space Telescope image shows the Whirlpool galaxy's spiral arms and dust clouds. The gravitational influence of a companion galaxy is triggering intense star formation, shown by the numerous clusters of bright young stars highlighted in red. (NASA/ESA.)

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