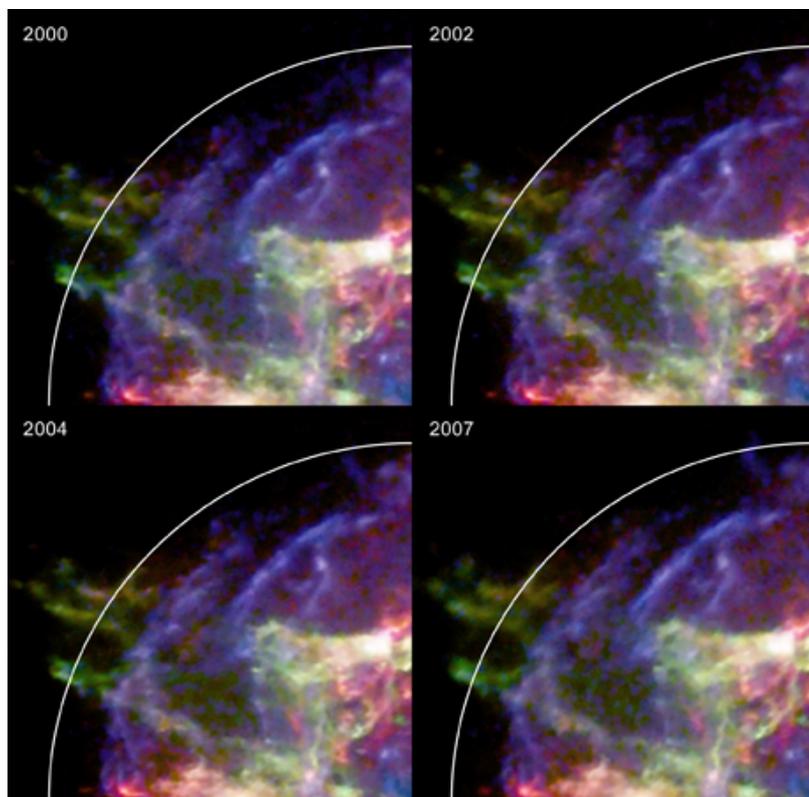




# Chandra Science Highlight

## Cassiopeia A Movie: A Remnant Evolves



Scale: Image is 9/4 arcmin across. Estimated Distance: About 10,000 light years

A new movie of X-ray data from Chandra of the supernova remnant Cassiopeia A (Cas A) was made by combining observations taken in January 2000, February 2002, February 2004, and December 2007. In these images, the lowest-energy x-rays detected by Chandra are shown in red, intermediate energies are in green, and the highest energies are in blue. The expansion of the supernova remnant over these 8 years is visible, along with “flickering” of synchrotron radiation (shown in blue) generated by the acceleration of particles to high energies.

- Using this movie the velocity of the remnant’s forward shock (the outer blast wave) was estimated to range between 4200 and 5200 km/s. This is significantly slower than expected, given the energy that was estimated to have been released in Cas A.
- A model for Cas A was constructed that combined the measured expansion velocity and the observed size of the remnant, with estimates of the explosion energy, the mass of the ejected material and efficient acceleration of charged particles by the forward shock. A self-consistent model is possible if about 35% of the energy of the original supernova went into accelerating cosmic rays. This explains the slower than expected expansion velocity.
- The flickering provides important clues about the location of particle acceleration. For the first time, flickering is seen in the forward shock. This casts doubt upon the possibility, suggested previously, that particle acceleration occurs in the so-called “reverse shock”. This is a shock that travels backwards into the expanding remnant and is therefore located inside the forward shock.
- The flickering was also used to constraint on the magnetic field strengths of 0.1-0.3 mG for the forward shock.

Reference: D.Patnaude et al. 2008 astro-ph arXiv:0808.0692

Credit: NASA/CXC/SAO/D.Patnaude et al.

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