Physics Department Colloquium
Special Colloquium, Monday March 9

"Cassiopeia A in 3D: A Spectacular View of the Explosion"

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Supernovae deposit enormous amounts of energy into their surroundings. They play a key role in the heating of their host galaxies and in the enrichment of the interstellar medium with heavy elements that form the building blocks of life. Yet, the actual explosion mechanism is not well understood. One way to study the explosion is through the dynamics of the stellar debris that comprise supernova remnants such as Cassiopeia A. Cas A is the 2nd youngest known supernova remnant in the Galaxy (approximately 340 years old) and is also among the brightest. It is well studied at radio, X-ray, infrared, and optical wavelengths and is known to have two oppositely directed jets of ejecta with expansion velocities as high as 15,000 km/s. We have used the Spitzer Space Telescope, the Chandra X-ray Observatory, and existing ground-based optical data to create a 3-dimensional representation of the remnant. The 3-D model is based on a Doppler reconstruction of both shocked (heated) and unshocked (cold) ejecta. We find that the shocks in Cas A (blast wave and reverse shock) are spherical, but the ejecta are distributed in a flattened plane that is oriented approximately 20-30 degrees from the plane of the sky. The distribution of the jets and the Fe-rich emission suggests that the ejecta were expelled in a series of "blowouts" in the flattened plane. This flattened explosion geometry has been observed in recent supernovae and has major implications for explosion models.

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4:00 PM in 334 JFB
Refreshments served, 3:45 in 334 JFB