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Title: Properties and Spatial Distribution of Dust Emission in the Crab Nebula

Authors: G. Sonneborn (NASA/GSFC), T. Temim (NASA/GSFC & ORAU), E. Dwek (NASA/GSFC), R. Arendt (NASA/GSFC & UMD), R. Gehrz (U. Minnesota), and P. Slane (Harvard-Smithsonian CfA)

Abstract:

The nature and quantity of dust produced in supernovae (SNe) is still poorly understood. Recent IR observations of freshly-formed dust in supernova remnants (SNRs) have yielded significantly lower dust masses than predicted by theoretical models and observations high-redshift galaxies. The Crab Nebula's pulsar wind is thought to be sweeping up freshly-formed SN dust along with the SN ejecta. The evidence for this dust was found in the form of an IR bump in the integrated spectrum of the Crab and in extinction against the synchrotron nebula that revealed the presence of dust in the filament cores. We present the first spatially-resolved emission spectra of dust in the Crab Nebula acquired with the Spitzer Space Telescope. The IR spectra are dominated by synchrotron emission and show forbidden line emission from both sides of the expanding nebula, including emission from [S III], [Si II], [Ne II], [Ne III], [Ne V], [Ar III], [Ar V], [Fe II], and [Ni II]. We extrapolated a synchrotron spectral data cube from the Spitzer 3.6 and 4.5 micron images, and subtracted this contribution from our 15-40 micron spectral data to produce a map of the residual continuum emission from dust. The emission appears to be concentrated along the ejecta filaments and is well described by astronomical silicates at an average temperature of 65 K. The estimated mass of dust in the Crab Nebula is 0.008 solar masses.