SOFIA/HAWC+ observations of the Crab Nebula: dust properties from polarized emission

Jérémy Chastenet, Ilse De Looze, Brandon Hensley, Bert Vandenbroucke, Mike Barlow, Jeonghee Rho, Aravind Ravi, Haley L. Gomez, Florian Kirchschlager, Juan Macías-Pérez, Mikako Matsuura, Kate Pattle, Nicolas Ponthieu, Felix D. Priestley, Monica Relaño, Alessia Ritacco, Roger Wesson

Supernovae are recognized dust factories, but whether they predominantly produce carbon- or silicate-type of grains remains poorly understood. Constraining the dust composition and grain size in supernova remnants (SNR) is vital to estimate the net supernova dust production rate and gauge their importance in building up galactic dust budgets. Combined with dust infrared emission, the polarized and unpolarized emission spectral energy distributions can be brought together to constrain grain properties, and answer critical questions.
I will present our results using SOFIA/HAWC+ C and D polarisation measurements of the Crab supernova remnant (SNR). Using radio synchrotron measurements, we remove the contaminating contribution of synchrotron polarisation, and derive supernova dust-only polarisation fraction, ranging from 3 to 10% in dusty filaments, and polarization angle. From these new observations, we constrain the fraction of carbon grains (from 12 to 70%), dust composition and size, and temperature and mass of silicate- and carbon-rich grains, spanning 30 to 70 K and 10^{-4} to 10^{-1} $M_{\odot}$, in the Crab Nebula.