DAMOP17-2017-000016

Abstract for an Invited Paper
for the DAMOP17 Meeting of
the American Physical Society

Interstellar dust grain composition from high-resolution X-ray absorption edge structure[1]

LIA CORRALES, University of Wisconsin-Madison

X-ray light is sufficient to excite electrons from n=1 (K-shell) and n=2 (L-shell) energy levels of neutral interstellar metals, causing a sharp increase in the absorption cross-section. Near the ionization energy, the shape of the photoelectric absorption edge depends strongly on whether the atom is isolated or bound in molecules or minerals (dust). With high resolution X-ray spectroscopy, we can directly measure the state of metals and the mineral composition of dust in the interstellar medium. In addition, the scattering contribution to the X-ray extinction cross-section can be used to gauge grain size, shape, and filling factor. In order to fully take advantage of major advances in high resolution X-ray spectroscopy, lab measurements of X-ray absorption fine structure (XAFS) from suspected interstellar minerals are required. Optical constants derived from the absorption measurements can be used with Mie scattering or anomalous diffraction theory in order to model the full extinction cross-sections from the interstellar medium. Much like quasar spectra are used to probe intergalactic gas, absorption spectroscopy of Galactic X-ray binaries and bright stars will yield key insights to the mineralogy and evolution of dust grains in the Milky Way.

[1]Support for this work was provided by NASA through Einstein Postdoctoral Fellowship grant number PF6-170149 awarded by the Chandra X-ray Center, which is operated by the Smithsonian Astrophysical Observatory for NASA under contract NAS8-03060.