

Mineralogy of Interstellar Dust with High Resolution X-ray Spectroscopy

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When light from a bright X-ray source travels through interstellar dust, a unique spectroscopic absorption fingerprint becomes visible with high resolution X-ray spectroscopy. This X-ray absorption fine structure (XAFS) arises from the quantum interference of an excited electron probability wave as it scatters from the crystalline lattice in a solid material. XAFS features can be used to study dust crystallinity and atomic spacing, elemental composition, grain size, and orientation. Measuring XAFS from absorption and scattering by dust is frontier science that can answer key science questions about the composition and evolution of dust in the diffuse interstellar medium. I will discuss the state of current observations, where absolute elemental abundances, gas phase absorption, and the effect of X-ray binaries on their environment are key questions for interpreting low-resolution XAFS. I will then describe observations to be expected from next-generation X-ray telescopes, *Athena* and JAXA-led mission XRISM, which will provide crucial insights for the composition of interstellar dust by measuring high resolution spectra from dust scattering halos.