

# Reflective Hard X-ray Optics: Recent Developments for Astronomy and Free Electron Lasers

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Recent advances in multilayer and thin-film science and substrate fabrication have led to the development of hard x-ray optics for a broad range of applications. The astronomy and light source communities, in particular, have driven much of the innovation for these types of x-ray mirror. In astrophysics, the use of telescopes will lead to dramatic increases in sensitivity, compared to earlier hard x-ray missions that rely on collimation or coded aperture techniques. At user facilities, the continued improvement of relay mirrors and focusing optics will allow the full potential of new light sources to be realized.

I begin this talk with a brief primer on the operational principles of reflective X-ray optics and the breakthroughs that enable new classes of instruments. I will then discuss two projects whose success depends on hard X-ray optics: NuSTAR, Nuclear Spectroscopic Telescope Array, a NASA-sponsored mission scheduled for launch in February 2012, and LCLS, the Linac Coherent Light Source, the US Department of Energy-funded x-ray free electron laser commissioned in 2009.