

Ultrahigh Resolution X-Ray Astronomy using Steerable Occulting Satellites

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The diffraction limit for a 1m X-ray telescope is about 3 milli-arcseconds at 1keV, yet current X-ray telescopes achieve about 0.5 arcseconds, and future planned telescopes will do less well in order to collect more X-rays. Only X-ray interferometry has been presented as a possibility for higher resolution. We suspect that by transiting an occulting satellite across the field of view of an ordinary X-ray telescope, such as an envisaged Constellation-X unit, one could achieve unprecedented angular resolution, at or near the diffraction limit, for X-rays below approximately 100keV. This resolution would be limited only by photon flux and source stability. This improvement in resolution would be equivalent to moving from a 10cm optical telescope to the 10m Keck telescope. In the history of astronomy, such improvements have always heralded revolutions in understanding. We also believe that the technological challenges are not insurmountable. We therefore propose to determine whether using image reconstruction techniques, the theoretical angular resolution such a system would afford, would be sufficient to investigate reasonable models of known and expected X-ray sources, given their expected stability, and to make a preliminary determination of the technological hurdles to be overcome for the occulter. We anticipate this effort to require approximately six person-months of effort by a senior postdoctoral researcher, with the timely assistance of one undergraduate with experience in code development.