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X-RAY MIRROR DEVELOPMENT AND PRODUCTION FOR THE ATHENA TELESCOPE

Abstract

Athena, the largest space-based x-ray telescope to be flown by the European Space Agency, uses a revolutionary new modular technology to assemble its 2.6 m diameter lens. The lens will consist of several hundreds of smaller x-ray lenslets, called mirror modules, which each consist of about 70 mirror pairs. Those mirror modules are arranged in circles in a large optics structure and will focus x-ray photons with an energy of 0.5 to 10 keV at a distance of 12 m onto the detectors of Athena. The point-spread function (PSF) of the optic shall achieve a half-energy width (HEW) of 5" at an energy of 1 keV, with an effective area of about 1.4 m2, corresponding to several hundred m2 of super-polished mirrors with a roughness of about 0.3 nm and a thickness of only 150 m. Silicon Pore Optics (SPO), using the highest grade double-side polished 300 mm wafers commercially available, have been invented to enable such telescopes. SPO allows the cost-effective production of high-resolution, large area, x-ray optics, by using all the advantages that mono-crystalline silicon and the mass production processes of the semi-conductor industry provide. SPO has also shown to be a versatile technology that can be further developed for gamma-ray optics, medical applications and for material research. This paper will present the status of the technology and of the mass production capabilities, show latest performance results and discuss the next steps in the development.