IAF SYMPOSIUM ON ONGOING AND NEAR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Technology Needs for Future Missions, Systems, and Instruments (3)

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THE GLOSS EXPERIMENT: AGEING OF COMPONENTS FOR FUTURE GAMMA-RAY ASTROPHYSICS TELESCOPES

Abstract

There is a distinct possibility that forthcoming hard X-ray telescopes designed for high-energy astrophysics will rely on concentrating radiation through diffractive systems and utilizing high-Z solid-state detectors at the instrument focal plane. These systems have not yet been deployed on satellites, therefore it is crucial to study the impact of the Low Earth Orbit (LEO) environment on the materials constituting these components. Our current focus involves exploring the feasibility of employing Laue lenses, made from curved Germanium and Silicon crystals, in combination with Cadmium Zinc Telluride (CZT) 3-D sensitive focal plane detectors. In this study, supported by the Italian Space Agency, we aim to assess the effects of radiation damage and aging on CZT sensors and diffractive Ge and Si crystals under in-orbit conditions aboard the Bartolomeo platform of the International Space Station, as well as through

ground-based irradiation facilities. These tests will offer valuable insights into the operational longevity of scientific instruments in space. Environmental radiation and thermal cycles in orbit may adversely affect the stability of Ge and Si bent crystals used in Laue optics, impacting their curvature radius and diffraction efficiency. In addition, exposure to the space environment could potentially induce changes in fundamental electrical and electronic properties of CZT sensors, such as bulk and surface currents and charge transport, thereby influencing the spectroscopic and imaging capabilities of the final detectors.