

The TRILL project: increasing the technological readiness level of Laue lenses for hard X/soft Gamma-ray astronomy

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Hard X/soft Gamma-ray astronomy is a key field for the study of important astrophysical phenomena such as the electromagnetic counterparts of gravitational waves, gamma-ray bursts, black holes physics and many more. However, the spatial localization, imaging capabilities and the sensitivity of our measurements are strongly limited for the energy range >70 keV due to the lack of focusing instruments operating in this energy band. A new generation of instruments able to focus hard X-/ soft gamma rays is necessary to shed light on the nature of astrophysical phenomena which are still unclear due to the limitations of current direct view telescopes.

Laue lenses can be the answer to those needs. A Laue lens is an optical device consisting of a large number of properly oriented crystals which are capable, through Laue diffraction, to focus the radiation into the common Laue lens focus. In contrast with the grazing incidence telescopes commonly used for soft X-rays, the Laue transmission configuration allows us to obtain a significant sensitive area even at energies of hundreds of keV. At the University of Ferrara, we are actively working on the development of the Laue lens technology with the TRILL (Technological Readiness Increase for Laue Lenses) project. TRILL is dedicated to the advancement of the technological readiness of Laue lenses by developing the first prototype of a sector of a broad energy-band Laue lens made by cylindrically bent crystals of Germanium, which are glued to a quartz frame with a low-shrinkage, space-qualified glue. In this talk we present the technological advancements which mainly concerns the crystals preparation method, its repeatability over a large number of crystals and the crystals assembly technique. We also present the criticalities and alternative designs for orienting a plurality of crystals and for bonding them on a common substrate.

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