Paper ID: 89471
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IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Interactive Presentations - IAF MATERIALS AND STRUCTURES SYMPOSIUM (IPB)

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PRELIMINARY DESIGN AND TESTING OF A NON-MECHANICAL COVER FOR SPACE TELESCOPES: CRYSTALS

Abstract

Current technologies for the protection of space telescopes involve mechanical covers, which present several challenges and risk of failures during operations. In this field, the University of Padova has a solid background, further strengthen by the recent development of the Cover Mechanism (COM) of the JANUS telescope, onboard the JUICE satellite set off toward Jupiter. Such system presents an inherent complexity due to the high number of actuators and mechanisms; for this reason, it was deemed interesting to investigate and develop a novel, simpler solution.

CRYSTALS (ChRomatic, Yielding, and Smart Technologies for Anti-Light Shielding) is the first prototype of this device, functioning as a non-mechanical space telescope cover. With respect to the state of the art, CRYSTALS presents numerous advantages, including the absence of mechanisms, that reduces the complexity of the system, the risk of mechanical failures, and in general the mass and the volume of the cover mechanism. In more details, CRYSTALS was developed drawing inspiration from the existing technology on domestic window shading. Through metal electrochemical deposition on ITO glass (a glass with a coating of indium tin oxide), when voltage is applied, the device can switch between a clear state, which allows space observation, and a dark state that protects the optics from the incoming light.

This paper presents the working principle of the device and its development, validation and testing. The performance and the limitations of such solution are discussed and the integration of a first prototype (25 x 25 mm) into a PocketQube platform is introduced. Last, the verification activities planned for the next months are presented, to obtain a qualified and ready-to-launch system for spring 2025. CRYSTALS is the basis from which to develop a device that can be integrated on future missions employing advanced optical systems.