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A novel test-facility for ECRIS plasma diagnostics: optical spectroscopy, X-ray imaging and spectroscopy, mm-wave polarimetry

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In the frame of the PANDORA project and the SAMOTHRACE ecosystem (Italian PNRR in the EU Next Gen Program contest), two new plasma diagnostics testbenches –PYN-HO and VESPRI2.0 setups –have been developed at INFN-LNS, with the aim to design and improve detectors and techniques beyond the state of art. The PYN-HO prototype is conceived to operate in four configurations: two of them to enhance high resolution X-ray imaging and space-resolved spectroscopy, also including X-ray tomography using multi pin-hole CCD systems, involving algorithms for Single Photon-Counted and High-Dynamic-Range analysis, with related calibrations via SDD; the other two are dedicated to high energy resolution diffractometric spectroscopic measurement in the X-ray and optical domains, based on micrometric gratings. The VESPRI2.0 mm-wave polarimeter is based on an innovative superheterodyne approach to measure plasma-induced Faraday rotation from Lissajous figure detection and estimate the plasma line-integrated density. **Prototypes can be installed in ECRIS for several plasma physics studies****, such as investigations of plasma structure, confinement dynamics, instabilities and turbulence, in-plasma and plasma vessel elemental composition, local thermodynamic parameters, etc. which are directly related to ion beam performances in ECRIS. The design and features of the prototypes and the first characterizations performed with Ar plasma in the INFN-LNS Flexible Plasma Trap will be presented.

Footnotes

D. Mascali et al., *Universe* 8 80, 2022E. Naselli et al., *Condens. Matter* 7(1) 5, 2022G. Torrisi et al., *Front. Astron. Space Sci.* 9 949920, 2022**E. Naselli, *Eur. Phys. J. Plus* 138: 599, 2023

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Yes

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