



PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 38th cycle

THEMATIC Research Field: DEVELOPMENT OF ADVANCED FACILITIES FOR CALIBRATION OF OPTICS AND OPTICAL ELEMENTS FOR FUTURE HIGH-ENERGY ASTRONOMICAL SPACE OBSERVATORIES

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	<p>The development of increasingly large X-ray observatories in space asks for X-ray facilities able to quickly test a large number of modular optics in a short timeframe, exploiting a parallel and board X-ray beam. The design, realization, and calibration of these facilities like BEaTriX (INAF OABrera) and VERX (MediaLario) have recently become an important field of research to fill the gap between conventional, diverging X-ray sources like PANTER (MPE) or the 500m beamline at NASA_MSFC, and synchrotron light sources like Bessy. Even if the main driver is represented by Silicon Pore Optics of the ATHENA space telescope, a broad and parallel beam is suitable for a number of on-ground applications (e.g., tests of Fresnel lenses). Generating a broad and parallel beam requires handling in a high vacuum a number of optical components (mirrors, crystals, detector, etc) which need to be manufactured and aligned very precisely. Finally, the beam needs qualification and calibration prior to testing the optical modules. The Ph.D. activity will be focused on the development of the 2nd beamline of the BEaTriX test facility and the realization of the VERTX calibration facility, and chiefly on the aspect of the beam qualification in terms of intensity, uniformity, collimation, vs. the scientific requirement of the space mission</p>
Methods and techniques that will be	



<p>developed and used to carry out the research</p>	<p>OABrera group engaged in the realization of test and calibration facilities for ATHENA. Namely, the projects will be focused on: the 2nd beamline (at 1.49 keV) of the BEaTriX (Beam Expander X-ray Testing) facility, at INAF OABrera; the VERTX vertical calibration X-ray facility, whose components are being developed by a collaboration between INAF OABrera, MediaLario, and other companies; other calibration campaigns at, e.g., PANTER, NASA-MSFC, etc. The student tasks shall: take advantage of the presence of mirror manufacturing and metrology tools for the diagnostic of the optical components; analyze metrology data and infer the expected imaging quality; develop simulation programs for BEaTriX and VERTX, based on physical optics; develop and improve techniques for wavefront sensing in order to provide accurate criteria for beam diagnostic (uniformity, intensity, collimation) and return feedback information to the alignment of the optical components; check the beam performance with respect to the scientific requirements; play a role in the testing/calibration campaigns and in data reduction and interpretation.</p>
<p>Educational objectives</p>	<p>The Ph.D. student is expected to: acquire full knowledge of the X-ray telescope under test and awareness of the calibration techniques; get familiar with the methods for the characterization of X-ray elements (X-ray sources, grazing incidence mirrors, monochromators, crystals, X-ray detectors, vacuum components); learn to write simulation programs for the elements of the facility or the performance of the full facility; get acquainted with wavefront sensing techniques, wavefront reconstruction, and aberration diagnostics in chains of optical elements; learn to operate in a research team in a hands-on approach to the facility equipment</p>
<p>Job opportunities</p>	<p>Excellent hiring perspectives at partner companies such as MediaLario or aerospace industries like Thales Alenia Space, Leonardo, and industries that develop and test complex instrumentation not limited to space.</p>
<p>Composition of the research group</p>	<p>1 Full Professors 0 Associated Professors 2 Assistant Professors</p>



	14 PhD Students
Name of the research directors	Prof. Michelle Lavagna

Contacts	
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	2100.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
From INAF the tutor is Daniele Spiga and the team the candidate will interact with is composed of: Number of Technologists II lev.: 1 Number of Researchers II lev.: 1 Number of Technologists III lev.: 1 Number of Researchers III lev.: 1 The Ph.D. candidate will receive a desk and a personal computer. In addition to compulsory ones, the Ph.D. candidate will have the opportunity to follow additional courses, receive economic support to attend summer schools, and participate in conferences. There will be the possibility of paid teaching assistantship.