

### Scientific Initiation Studentships

Applications are open for 1 (one) Scientific Initiation Studentships, within the framework of project PEP 1018P.05859.1.09.07, IPFN BASICO 2025-2029, financed by national funds through FCT/MCTES (PIDDAC), under the following conditions:

**Scientific Area:** Plasma Physics, Lasers and Nuclear Fusion.

#### Admission Requirements:

- a) *To be enrolled at a professional higher technical course, at a bachelor degree, at an integrated master or master degree, or to have a bachelor degree and be enrolled at a course that does not award an academic degree and it is integrated in the educational project of a higher education institution, performed in association or cooperation with one or several R&D units;*
- b) *not to exceed with this contract, including the possible renovations, an accumulated period of one year in this type of studentship, continuously or with interruptions;*
- c) *not to have held any other fellowship directly or indirectly funded by FCT.*

**Workplan:** The present work focuses on the investigation of the behavior of single-crystal niobium (Nb) when exposed to irradiation with helium (He) and hydrogen (H) ions, a topic of great relevance for the development of structural materials in fission and fusion nuclear reactors. Prolonged exposure of these metals to intense neutron radiation can lead to the formation of defects, particularly He bubbles, which contribute to material swelling and embrittlement, ultimately compromising their structural integrity.

To better understand this phenomenon, Nb samples will be irradiated with He and He+H ions at different fluences (low, moderate, and high). The characterization of defects will be carried out using various experimental techniques. Out-of-plane strain will be analyzed through High-Resolution X-Ray Diffraction (HRXRD), in combination with MROX simulations. The presence and morphology of He bubbles will be evaluated using Rutherford Backscattering Spectrometry/Channeling (RBS/C) and Transmission Electron Microscopy (TEM). Additionally, nanoindentation tests will be conducted to study the evolution of defects and their impact on the material's mechanical properties.

The main objective of this study is to contribute to the understanding of the effects of ion irradiation on metals considered for nuclear applications, enabling the prediction and mitigation of structural degradation over time. The relevance of this work to the academic training of the scholarship holder lies in the practical application of advanced material characterization methods and the development of essential skills for scientific research in materials engineering and applied physics. Moreover, the results obtained may have direct implications for the design of more resilient materials for future fusion facilities, contributing to technological innovation in this field.

**Legislation and Regulations:** Statute of Scientific Research Fellow, approved by Law nr. 40/2004, of August 18, as worded by Decree-Law nr. 123/2019, of August 28; FCT Regulation for Research Studentships and Fellowships, available on <https://www.fct.pt/apoios/bolsas/docs/RegulamentoBolsasFCT2019.pdf> and <https://dre.pt/application/file/a/127230968>.

**Workplace:** The work will be developed at Institute of Plasmas and Nuclear Fusion (IPFN), Instituto Superior Técnico, Technological and Nuclear Campus (Bobadela), under the scientific supervision of Dr. Sérgio Magalhães and Prof. Marija Vranic.

**Duration:** The research fellowship(s) will have the duration of 3 months (*renewable more 3 months*). It's expected to begin in June 2025.



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**Monthly maintenance allowance:** According to the values for Research Fellowships awarded by FCT in Portugal (<https://www.fct.pt/fct-atualizou-o-valor-das-bolsas-para-2025/>), the amount of the monthly maintenance allowance is € 651,12, being the payment method an option of the Fellow by Wire Transfer/Check.

**Selection methods:** The selection methods will be the following: Curriculum evaluation and individual interview, with the respective weight of 60% and 40%, respectively.

**Composition of the selection Jury:** Dr. Sérgio Magalhães (ist46927), Dr. Rodrigo Mateus (ist23913) e Dr<sup>a</sup>. Marta Dias (ist46980).

**Announcement/ notification of the results:** The final evaluation results will be communicated to all applicants by email.

**Deadlines and procedures of complaint and appeal.** A complaint may be lodged from the final decision within 15 working days, or an appeal to the Executive Board of IST within 30 working days, both counted from the respective notification

**Application deadline and formalization:** The call is open from May 5 until May 16, 2025.

It is mandatory to formalize applications with the submission of the following documents: i) B1 Form – Fellowship application (<https://ist-id.pt/concursos/bolsas/>); ii) *Curriculum Vitae*; iii) academic degree certificate, where applicable; iv) proof of enrollment at an academic degree course or at a course that does not award an academic degree; v) motivation letter; vi) declaration on honour that the applicant does not exceed with this contract, including the possible renovations, an accumulated period of one year in this type of studentship, continuously or with interruptions, and has not held any other fellowship directly or indirectly funded by FCT.

Applications must be submitted to the email: [bolsas@drh.tecnico.ulisboa.pt](mailto:bolsas@drh.tecnico.ulisboa.pt)



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