

Genealogy of Nuclear Fusion, Lasers & Plasmas at IST

In these notes, I try to collect information for a possible scientific genealogy for Nuclear Fusion, Lasers & Plasmas at IST, based on the discussions with the founder of the field in Portugal, Prof. Tito Mendonça, and other information that I have been collecting.

§{1} Plasmas in Portugal An excellent account of the first steps of plasma physics in Portugal is given by J. Costa Cabral [1], identifying the critical role played by Prof. Abreu Faro on stimulating the first PhDs abroad on Plasma Physics.

¶ The pioneering scientists that have performed their PhDs in Plasma Physics are [1]: A. Rocha Trindade (Orsay, 1970), J. Costa Cabral (Leiden, 1971), Rui Namorado Rosa (Oxford, 1971)¹, Armando Brinca (Stanford, 1973)², Carlos Matos Ferreira (Orsay, 1976), J. Tito Mendonça (Orsay, 1976), António Costa (Manchester, 1979), and Filipe Romeiras (Cambridge, 1977).

¶ According to [1], the topics of their PhDs are on³ Gas Electronics (Trindade, Rosa, Ferreira), Space Plasmas (Brinca), Fundamental Plasma Physics (Cabral, Romeiras), Astrophysical Plasmas (A. Costa), Nuclear Fusion (Mendonça).

¶ All have been professors at IST at some point in their career, which clearly places IST as the birthplace for Plasma Physics, Nuclear Fusion, and Lasers & Plasmas in Portugal.

§{2} PhD thesis of Prof. Tito Mendonça According to the ORCID webpage of Tito Mendonça [2] the degrees after the "licenciatura" are: Docteur de Spécialité, in Physics of Gases and Plasmas, Faculty of Sciences Orsay, University of Paris (France), February 1973, "Docteur-ès-Sciences" (Ph. D), Faculty of Sciences of Orsay, University of Paris (France), November 1976

¶ The thesis for "Docteur de Spécialité" was on "La Polarimétrie en Ondes Millimétriques et L'effet Cotton-Mouton dans les Plasmas" with a committee presided by J. L. Delcroix (President), M. Fitaire, R. Sardos, F. Koechlin, C. Etievant [3].

¶ The thesis for "Docteur-ès-Sciences" was on "Diffusion d'une onde élec-

¹The website [here](#), accessed August 26 2022, indicates 1969 as the date of the PhD

²The document [here](#), accessed August 26 2022, indicates the date of the PhD as 1972

³I use here modern descriptors

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tromagnetique dans un plasma au voisinage de la resonance hybride superieure” (english version: ”Scattering of an electromagnetic wave in a plasma in the vicinity of the higher hybrid resonance”⁴) Unfortunately, it was not possible to check who was on the committee. This can be checked at the Library of the Center for Plasma Physics which, as far as I remember, carries a copy of this thesis.

¶ The first publications of Mendonça are clearly on nuclear fusion (diagnostics) resorting to electromagnetic waves and nuclear fusion (theory) (full publication list in the Google Scholar profile [4]).

¶ From the publication list of Tito Mendonça, it is possible to trace the first paper on (nonlinear) laser-plasma interactions as Brinca and Mendonça in 1979 [5].

¶ This places Tito Mendonça as the pioneer of nuclear fusion and lasers & plasmas in Portugal.

¶ At a meeting at the end of July 2022, J.T. Mendonça also discussed how his thesis was developed:

- formally, J.L. Delcroix was his supervisor (as a PhD student in the Faculty of Sciences, University of Paris, Orsay);
- the thesis work was developed at CEA (Fontenay-aux-Roses) – there the supervisor was C. Etievant;
- however, this supervisor left plasma physics during the thesis, and the work at CEA was mostly supervised by R. Cano (that moved to Princeton) also in collaboration with I. Fidone (theory);
- due to these changes, at the thesis defense another committee member was also formally supervisor (affiliated with Observatory of Paris, Meudon) – this can be checked from the committee members at the frontispiece of the PhD thesis;
- J. L. Delcroix should be considered as a formal supervisor.

⁴The information and the thesis is [here](#).

§{3} Scientific ascendancy of J. L. Delcroix J. L. Delcroix is considered one of the fathers of plasma physics in Europe and in the World. His work was mostly on gas discharges/gas electronics.

¶ The [wikipedia link for Delcroix](#) lists his supervisor as [Yves Rocard](#), considered the father of the French atomic bomb.

¶ From here on the [physics tree](#) can be used, taking us from Yves Rocard (ENS Paris) to [Charles Fabry \(Marseille\)](#) to [Jules Macé de Lepinay \(Marseille\)](#) to [Julles Violle \(CNAM\)](#) to (Louis Paster & Emile Verdet).

¶ As a curiosity, from [Louis Pasteur](#), it is possible to reach Lavoisier and, from there Galileo or it is possible to reach Laplace, d'Alembert, [Leibniz](#), up to some of the most famous theologians (e.g. [Melanchton](#) connecting to Paulus Venetus (Padova) to William of Ockham (Oxford, Merton College).

¶ Vasco Guerra has worked on a genealogy of J. L. Delcroix that can be found [here](#).

References

- [1] J. Costa Cabral. Situação actual da investigação sobre física dos plasmas em portugal. *Gazeta da Física*, 13:32, 1990.
- [2] <https://orcid.org/0000-0001-8951-3395>. accessed aug 26, 2022.
- [3] https://inis.iaea.org/collection/NCLCollectionStore/_Public/05/095/5095418.pdf.
- [4] [Google Scholar profile](#). accessed aug 26, 2022.
- [5] A L Brinca and J T Mendonça. Refraction into a Nonlinear Medium: Wave Profiles and Hysteresis. *Physica Scripta*, 19(5-6):545–549, 1979.