



# Plasma Physics Group

## Research lines on Space Applications

Prof. L. Conde

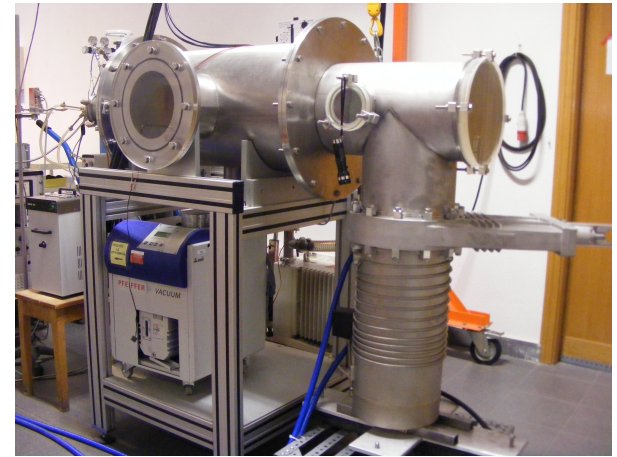
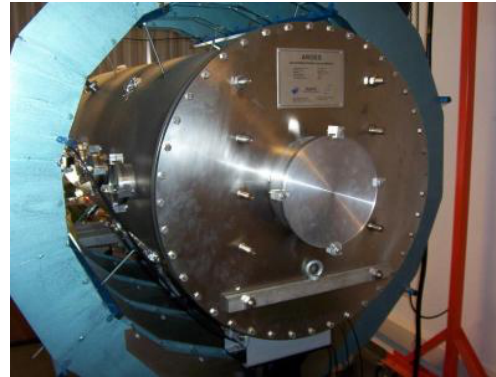
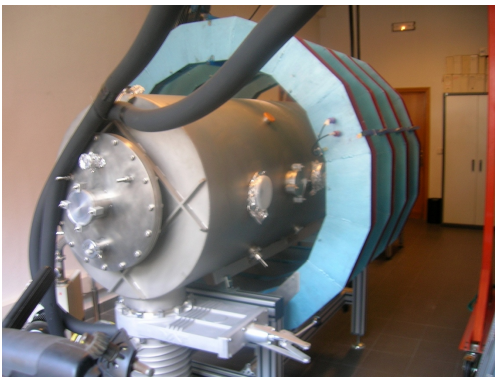
Departamento de Física Aplicada  
Web Site: <http://plasmalab.aero.upm.es/>

# Cold Plasmas Laboratory

Prof. L. Conde

- Plasma thrusters for medium and small satellites.
- Plasma diagnostic using electric probes.
- Atmospheric plasmas for materials modification

The large *Arges* plasma chamber is a stainless steel cylinder of 2 meters of length and 0.8 meters in diameter. This vacuum tank was initially designed for basic plasma physics experiments. The baseline pressure is  $10^{-6}$  mBar and the external set of coils impose to the plasma column an axial magnetic field.

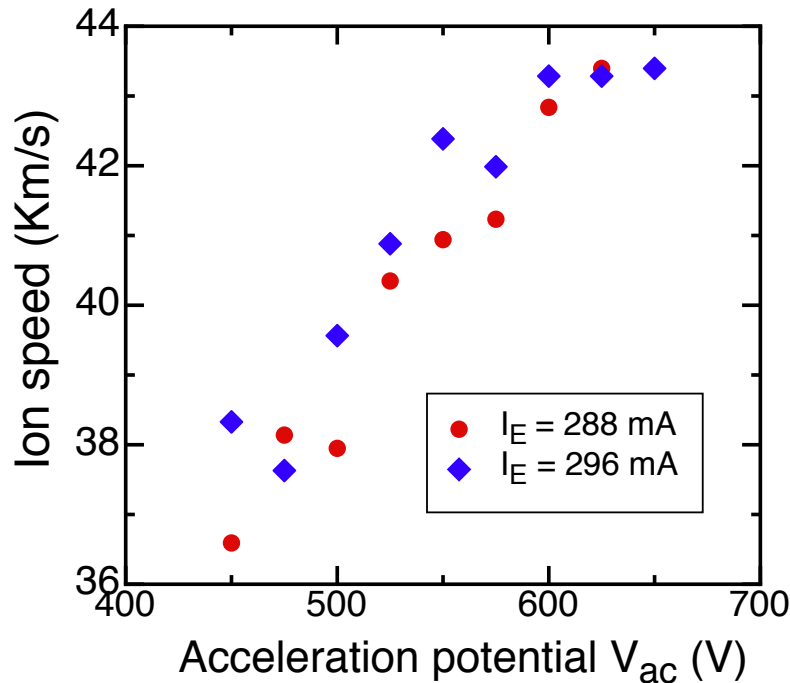


The small plasma chamber is operative since 1992 and is also a stainless steel cylinder of 0.8 meters in length and 0.4 in diameter. The baseline pressure is  $10^{-7}$  mbar and the working pressures when operating our small plasma thrusters are between  $10^{-5}$  and  $10^{-4}$  mbar of Argon with a gas flow around 1 sccm

# Project ALPHIE: Alternative Low Power Hybrid Ion Engine

This 10 X 12 cm gridded ion thruster operates with less than 400 W and is intended for small and medium satellites (\*).

The *plasma plume* has different regions characterized by different collisional mean free paths and all objects placed into produce a plasma wake behind



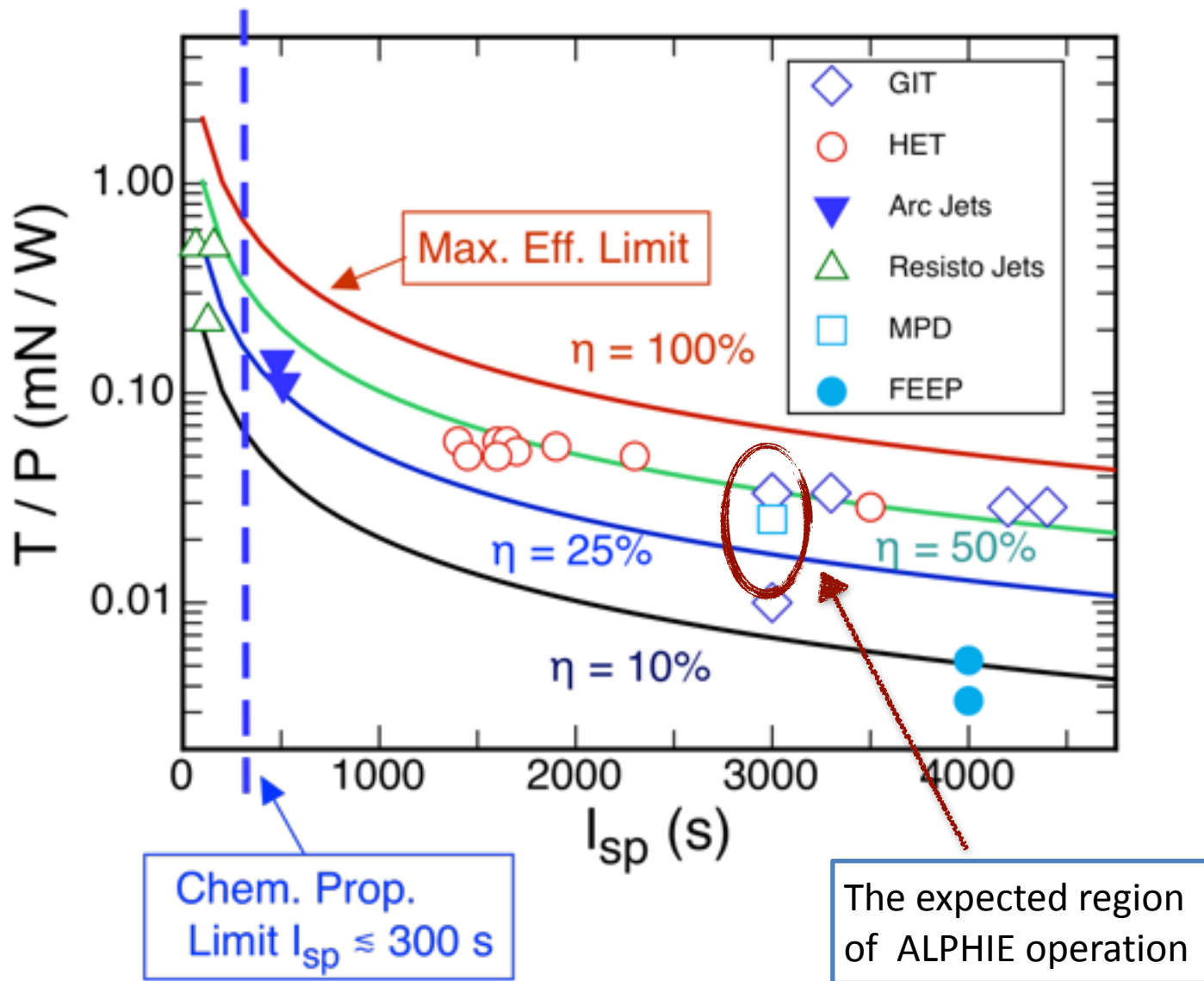
The electric probes are employed to characterize the spatial profile properties of plasmas

- Langmuir probe
- Emissive probe
- Retarded Potential Analyzer
- Faraday Cup (under development)

UPM-Aernnova application patent PCT/EP2015/074879 submitted to the European Patent Office on October 2015

(\*) “Desarrollo y caracterización de un sistema híbrido de propulsión espacial por plasma”. ESP2013-41078R, Grant funded by MINECO (Spain).

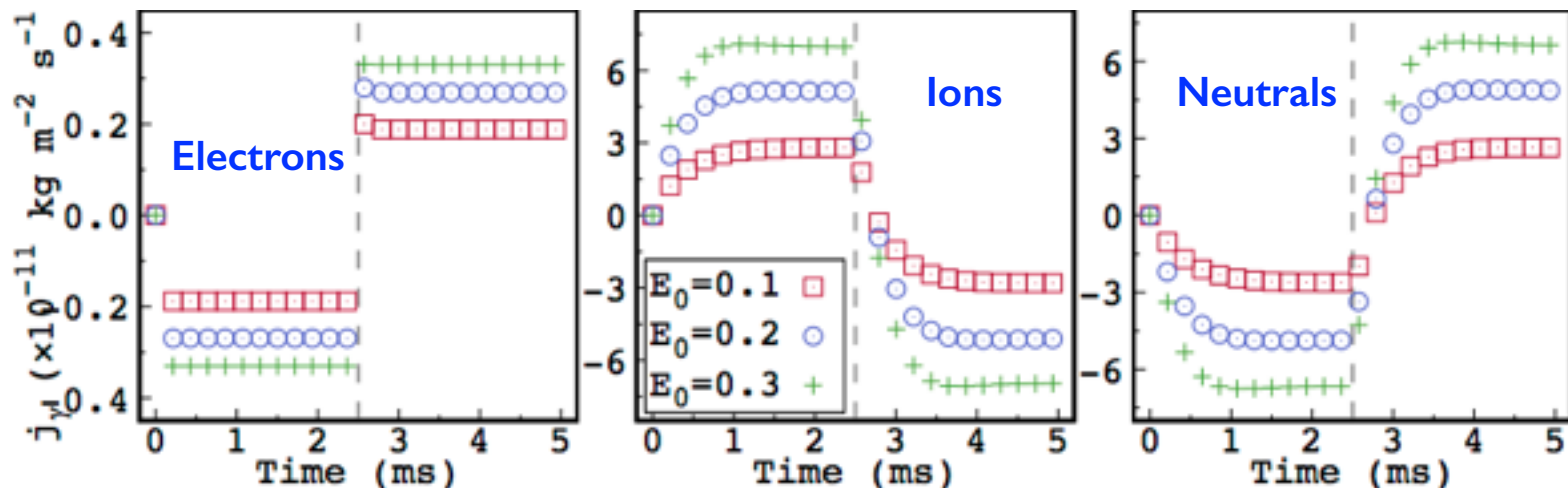
# ALPHIE compares to, ...



## Prof. D. José Manuel Donoso Vargas.

- Development of semi-analytical methods for solving the transport equations with abrupt boundary conditions
- Such new methods are applied to kinetic and fluid transport equations of non-thermal, weakly ionized plasmas in our experiments.
- The objective is to model the charged particle transport under spatially inhomogeneous and time dependent electromagnetic fields.
- Two PhD students with ESA funding in collaboration with DLR (Germany).

The following figures show the response of plasma species to a sudden jump in the electric field. The new methods permit to cope with multiple time scales.



Thank you, ...

Thank you for your time and interest

For further information,

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