POLITECNICO DI MILANO

PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 39th cycle

THEMATIC Research Field: IONIC PROPULSION IN ATMOSPHERE

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	Today electrohydrodynamics (EHD) and the interaction between electric discharges and fluid flows are objects of broad interest. Many application areas are actively studied: a possible list, not necessarily complete, would include biomedical applications, air ionizers, industrial and agricultural disinfection, water treatment, chemical catalysis and surface treatment, electrostatic precipitators, ionic wind cooling, aerodynamic flow control, ionic propulsion. Thrust generation by means of ions acceleration is a propulsion technique often used in space applications but much less studied for atmospheric ones. It potentially allows the development of devices with a much higher thrust per unit power than for thermochemical propulsion. Despite the knowledge about the underlying physical principle, the problems of maximizing ionic production and thrust in a suitable electrode geometry still require wide-range investigations.
Methods and techniques that will be developed and used to carry out the research	The research program relies on both theoretical studies and laboratory activity, externally supported by computational methods. The theoretical approach is used to modify the existing models for ion generation processes, ion drift and momentum transfer, also investigating the scaling of thrust and related quantities as a propulsive unit changes in size. Different experiments will be carried out on the laboratory side to validate the theoretical models and test promising ideas in the field, including studies with parametric conditions variations.

	The laboratory studies would also permit to easily include technological aspects not considered in the modelling phase, and lead to design flying prototypes.
Educational objectives	The first goal is a deep understanding of the physics of air-breathing plasma thrusters in standard atmosphere. Additional objectives arise with the applications of this topic: design of complex EHD systems, the aerodynamics of plasma thrusters, integration of plasma thrusters in flying prototypes and system control.
Job opportunities	A multidisciplinary approach characterizes the above research field and involves a wide range of engineering applications that interest both industry and academia. The job opportunities may include (but are not limited to) profiles of senior fluid dynamicists for complex applications, aerodynamic laboratory specialists, senior test engineers, and designers of laboratory facilities.
Composition of the research group	0 Full Professors 4 Associated Professors 3 Assistant Professors 5 PhD Students
Name of the research directors	Prof. Marco Belan

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	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
The PhD candidate will be provided with office space and a personal computer if needed. Apart from the compulsory ones, the PhD 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.