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Research position in electrical propulsion at Yale: Master's, PhD and postdoctoral positions available

2.5 years of funding by the US Air Force Office of Scientific Research are available at Yale for studies relating to electrospray propulsion. Electrosprays form when the meniscus of highly conducting electrolytes or pure molten salts are charged to a sufficiently high electrical potential with respect to neighboring grounded electrodes. The meniscus then becomes conical and emits a nanojet, which in turn breaks up into nanodrops that are accelerated to high speeds, producing thrust. Under certain conditions, the emissions are simply molecular ions. Work at Yale is of a basic nature, as each emitter produces only about 1 μN of thrust. The approach of combining thousands of such emitters is nevertheless being pursued in earnest by groups at MIT and elsewhere. Electrospray propulsion is of considerable interest in micropropulsion, as no alternative efficient propulsion system is presently available.

Students currently enrolled in Master or PhD studies outside of Yale are encouraged to join this Yale effort as part of their PhD or Master's studies. Postdoctoral candidates are also welcome.

The activity will be in pure research, and may be used for purposes of PhD or Master's Theses presentations at home (in addition to being published in the literature).
Selected applicants will receive free tuition and a monthly salary of at least $3000/month. An ideal duration of the Yale visit would be one year or more, though shorter periods may be negotiated. The position is already open, but the appointment process takes 3 months after the application to Yale's Graduate School is initiated by the student (https://gsas.yale.edu/admissions/non-degree-application-process/visiting-assistant-research-var).

Three types of studies are open. They are primarily experimental, yet open to original theoretical analysis:

1. Mass spectrometric investigations of the emissions of electrified liquid cones in vacuum, including the characterization of the emitted nanojet. A specialized home built facility is already available for these studies.[1]
2. Studies on the natural fragmentation of electrosprayed clusters. These studies take place under atmospheric conditions at a specialized facility, where a desired cluster is purified by mobility analysis, passed into a reaction chamber, and the products of decomposition are then analyzed also by mobility.[2]
3. Studies on the development of new particularly heavy ionic liquid propellants in collaboration with colleagues at the Edwards Air Force Base. This research relies on an existing facility where the mobility and the mass of the electrosprayed ions are analyzed in series (https://www.eng.yale.edu/DMAMSfacility/).

Interested candidates, please contact
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[1] L. J. Perez-Lorenzo, J. Fernandez de la Mora, Probing electrically driven nanojets by energy and mass analysis in vacuo, J. Fluid Mech. (2022), vol. 931, A4, doi:10.1017/jfm.2021.771
[2] J. Fernandez de la Mora, M. Genoni, L.J. Perez-Lorenzo, M. Cezairli, Measuring the Kinetics of neutral pair evaporation from ionic liquid clusters in the drift region of a mobility spectrometer. J. Phys. Chem. A, 2020, 124, 12, 2483-2496