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Miniaturization of electrostatic ion engine through ionization/acceleration coupling: corona model

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<p>Electrostatic ion propulsion systems resist miniaturization due to constraints imposed by the size of the discharge chamber. We introduce a thruster concept where the same field is responsible for both ionization of the neutrals and acceleration of the ions, by letting the neutral propellant gas escape into a high field region through a thin, hollow needle at high electric potential. The ionization mechanism is thus reminiscent of corona ionization. Although the thruster only ionizes a small fraction of the neutral gas, the ions nevertheless impart a great deal of momentum to the plume, creating an ion wind. We propose a model to estimate the electric behavior of the system, and two further models for the obtained thrust. A comparison with experimental data shows that the models capture the dominant physical effects and give a reasonable description of the system. Apart from being about a thousand times less massive than conventional systems, the thruster, which is at the proof-of-concept stage, performed quite well yielding around 0.3 mN/Watt during initial tests. The thruster small size and simplicity are advantageous in many situations, such as for satellite station keeping and deep space probes.

Level (Hons, MSc,
   PhD, other)?

MSc

Consider for a student
   award (Yes / No)?

yes

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

yes

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