Development of High Power Electric Propulsion systems for Space Use

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Commercial space companies and space agencies are responding to society's growing interest in access to space, i.e. satellites on low or geostationary Earth orbits and long term exploratory missions to moons, planets or asteroids. Radiofrequency plasma engines are good candidates for providing extended lifetime, power scaling and broad choice of propellant (including use of spacecraft systems' residues and of `green' and safe propellants). Here the physics behind the development of new-generation low-cost radiofrequency (rf) plasma thrusters such as the high-power Helicon Double Layer Thruster (HDLT) and the low-power Pocket Rocket will be presented. New technological challenges such as the design of low-weight rf matching networks and rf generators are being addressed to determine the thrusters' performance (thrust, specific impulse, efficiencies). Testing of our plasma sources is carried out in various size vacuum chambers (IRUKANDJI, WOMBAT and WOMBAT XL at Mount Stromlo) using a range of diagnostics (thrust balance, optical and electrostatic probes) and the results are used to develop analytical models and computer simulations aiming at a better understanding and control of the thrust generation mechanisms.