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# Research and development of next generation electrodeless plasma thrusters

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Electric thruster is a form of spacecraft propulsion that uses electric energy to accelerate plasma propellant. Due to its large specific impulse, the electric thrusters are suited for long duration operations such as missions to outer planets. On the other hand, the performance of many of the conventional electric thrusters is severely limited by electrode wastage. In order to overcome this difficulty, we have initiated the HEAT (Helicon Electrodeless Advanced Thruster) project to pursue research and development of completely electrodeless plasma thrusters. In the presentation, we first briefly describe the background and the targets of the project, and then introduce the concepts of electrodeless plasma production using the so-called helicon waves (i.e., bounded whistler waves) and the electrodeless plasma acceleration via externally applied time-varying electromagnetic fields. In particular, we discuss some details on the three plasma acceleration schemes we consider: the Rotational Magnetic Field (RMF), the Rotational Electric FIeld (REF), and the Ponderomotive Acceleration (PA) schemes, and compare their thrust based on a scaling argument. Although the helicon plasma is collisional and dissipative, it actually shares many intrinsic features with space plasmas, implying that there are realistic possibilities that SGEPSS members make substantial contributions in the field of electric thrusters. We will stress importance of future collaborative interaction between the two fields.

Keywords: helicon plasma, electric thruster, electrodeless thruster