The VASIMR Ion Cyclotron Heating Experiment

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The development of electric propulsion systems for spacecraft use has become a more active area of research in recent years. One of these systems, the Variable Specific Impulse Magnetoplasma Rocket (VASIMR), uses a helicon source with a power of 20 kW to generate plasma. The plasma is then boosted to a higher velocity using left hand polarized slow mode waves injected into the ion cyclotron resonance region. This ion cyclotron heating in the VASIMR can be used to simulate processes of ion acceleration and heating that take place in the Birkeland currents of auroral arc systems. This is similar to the ion cyclotron heating in tokamaks, but in the VASIMR the ions only pass through the resonance region once. The rapid absorption of ion cyclotron waves has been predicted in recent theoretical studies and these theoretical predictions have been confirmed with several independent measurements. The ion cyclotron resonance heating (ICRH) should show an increase in ion velocity perpendicular to the magnetic field. This increase should take place in the resonance region where the ion cyclotron frequency is equal to the frequency on the injected RF waves. Downstream of the resonance region the perpendicular velocity boost should be converted to axial flow velocity through the conservation of the first adiabatic invariant as the magnetic field decreases in the exhaust region of the VASIMR. This talk will focus on the VX-100 upgrade to the VASIMR during the summer of 2007 and the progress since the 2007 North American Radio Science meeting in Ottawa, Canada in July, 2007.