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On the Magnetospheric Engine Behind Kilometric Radiation at Earth and Saturn

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The planets of the solar system display a range of different space environments and solar interaction regimes, from non/weakly magnetized, to magnetized with convective- versus rotation-dominated magnetospheres. All magnetized planets with an appreciable magnetosphere are immersed in a dynamic energetic particle (hot plasma), as well as cold plasma, environment. These five planetary magnetospheres (Earth, Jupiter, Saturn, Uranus and Neptune) are also significant emitters of low-frequency radio waves that are consistent with a cyclotron-maser instability set up in a field-aligned current region.

Radio observations in the <200 MHz range is so far the only technique that shows promise to provide constraints on the magnetospheric processes of exoplanets and their stellar-wind interaction. The thrust of this presentation is therefore to understand the relation between radio emissions and magnetospheric acceleration processes in our own solar system as a laboratory to determine what remote radio observations of exoplanets may tell us about magnetospheric processes.

Terrestrial Auroral Kilometric Radiation (AKR) emissions in the $\sim$30-800 kHz range have long been known to be associated with auroral intensifications and magnetospheric substorms. In a similar fashion, recent remote imaging using Energetic Neutral Atoms (ENAs) obtained by the Cassini mission have revealed that the periodic Saturn Kilometric Radiation (SKR) emission from Saturn's high-latitude magnetosphere is highly correlated with simultaneous large-scale injections of energetic particles in the night side magnetosphere. These observations imply that the engine behind the AKR and SKR is current system associated with the planet ward fast plasma flows during an injection and/or the resulting plasma pressure gradients of the heated plasma.