Geophysical Research Abstracts
Vol. 16, EGU2014-4279-1, 2014
EGU General Assembly 2014

Low Frequency Radio Emissions: Remote Sensing of the Energetic Heliosphere

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Low frequency radio emissions (below about 50 MHz) are tracers of energetic plasma instabilities. Their observation provides us with a unique proxy for instable energetic electron populations. In the solar wind, two types of emissions can be monitored: Type II and Type III radio bursts. The former are related to interplanetary shocks, while the latter are linked to energetic electron beams going out from the solar corona. The magnetized planets are also producing low frequency radio emissions linked to the auroral activity, and thus to the interaction between the planet and the solar wind. These radio emission are non-thermal emissions. They are very powerful (Jupiter is as intense as the Sun in this frequency range). Furthermore, the low frequency radio instrumentation in space has the advantage to be quasi-isotropic. The antenna systems have no intrinsic directivity. However, goniopolarimetric inversions have been developed to derive the observed radio waves parameters (assuming we see a single source at a given time). Hence, the low frequency radio systems can monitor the whole sky at once and provide direction of arrival for each event. We will present the various emission mechanisms involved for the low frequency radio emissions in the solar system, the various propagation effects along the wave path and the radio instrumentation necessary to derived all relevant wave parameters. We will discuss how these radio emissions can be used in a space weather perspective. We will finally overview the possible future steps in terms of instrumentation for this frequency range.