GENERATION OF AN ALFVENIC WAVE RESONATOR IN THE MAGNETOSPHERE*

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It is known that whistler waves, through reflection at the lower-hybrid resonance, can form a resonator[1]. We find that in a multi-ion species environment, such as the Earths magnetosphere, the bi-ion rotation[2] (cutoff) frequency and Buchsbaum (resonance) frequency are important for the propagation and evolution of Alfvenic waves near the ion-cyclotron frequency. The physics of the reflection process between Alfvenic and whistler mode waves is similar. Here we show that Alfvenic waves with ($k_\perp \gg k_z$) can be captured by a magnetic cavity to form a strongly localized Magnetospheric Resonator which can interact with the electrons over a long time period and can lead to both energization and loss of the electrons, and as known, couples to the ions. This possibility would have important consequences for the evolution of the ring current and radiation belts during storms and substorms. A novel feature of this approach is that the Alfvenic waves can be generated by a ring distribution of one of the ion species. Ring ion distributions are known to form when the solar wind interacts with the magnetosphere or a comet interacts with the solar wind, and by the release of chemicals in the magnetosphere. This type of instability is in contrast to the usual temperature anisotropy instabilities invoked for the generation of ion-cyclotron waves, as this is a reactive instability, and therefore presents unique questions pertaining to the absolute versus convective growth of these waves and the loss of these waves through tunneling out of the resonator.

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1. Thorne, R. M. and Kennel, C. F. JGR 72, 857.
2. Ganguli, G. and L. Rudakov. Phys. Plasmas 12. April 2005.

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