Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Nonlinear Scattering of VLF Waves in the Radiation Belts[1] CHRIS CRABTREE, Naval Research Laboratory, LEONID RUDAKOV, Icarus Research, GURU GANGULI, MANISH MITHAIWALA, Naval Research Laboratory — Electromagnetic VLF waves, such as whistler mode waves, control the lifetime of trapped electrons in the radiation belts by pitch-angle scattering. Since the pitch-angle scattering rate is a strong function of the wave properties, a solid understanding of VLF wave sources and propagation in the magnetosphere is critical to accurately calculate electron lifetimes. Nonlinear scattering (Nonlinear Landau Damping) is a mechanism that can strongly alter VLF wave propagation [Ganguli et al. 2010], primarily by altering the direction of propagation, and has not been accounted for in previous models of radiation belt dynamics. Laboratory results have confirmed the dramatic change in propagation direction when the pump wave has sufficient amplitude to exceed the nonlinear threshold [Tejero et al. 2014]. Recent results show that the threshold for nonlinear scattering can often be met by naturally occurring VLF waves in the magnetosphere, with wave magnetic fields of the order of 50-100 pT inside the plasmapause. Nonlinear scattering can then dramatically alter the macroscopic dynamics of waves in the radiation belts leading to the formation of a long-lasting wave-cavity [Crabtree et al. 2012] and, when amplification is present, a multi-pass amplifier [Ganguli et al. 2012]. By considering these effects, the lifetimes of electrons can be dramatically reduced.

[1]This work is supported by the Naval Research Laboratory base program.

Chris Crabtree
Naval Research Laboratory

Date submitted: 11 Jul 2014 Electronic form version 1.4