Abstract Submitted
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Whistler amplification: a free electron laser in the Earth's magnetosphere[1] A.R. SOTO-CHAVEZ, A. BHATTACHARJEE, Space Science Center, University of New Hampshire, Durham NH 03824, C.S. NG, University of Alaska Fairbanks, Fairbanks, AK 99775 — Whistler mode emissions are very low frequency (VLF) waves in the Earth's magnetosphere that arise due to the interaction of whistler waves with radiation belt electrons. They have the characteristic feature of having typical frequencies of half the electron gyro-frequency at the geomagnetic equator and with saturation amplitudes of more than 30 dB. They also chirp in frequency. The amplification of these VLF waves has been studied both analytically and with simulations. However, while the analytic approaches have made use of the Hamiltonian equations for the electron motion, what has been missing is an analytical equation for the radiation field that brings closure to the problem of amplification of the whistler wave. Based on the similarities between free electron lasers (FELs) and whistler mode emissions, we present here a new set of closed relativistic equations. We show that these equations predict, through a cubic equation, whistler amplification levels well in agreement with those observed in the Earth's magnetosphere. We also discuss the implications of our formulation on the phenomenon of chirping of these modes.

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