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A parametric model for radio emission from air showers.

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A parametric model for the “geo-synchrotron” radio emission from cosmic ray air showers is presented. The shower is treated as a smooth macroscopic current source, separable in cartesian “shower”-coordinates, which facilitates calculation of phase coherence at a remote detector. Time delays are kept to second order in shower size/distance (d/R), and account for varying index of refraction along the shower profile. Local current distributions within the shower attempt to account for particle generation, energy losses, multiple soft coulomb scattering, and magnetic deflections in the altitude dependent radiation length upstream of the emission point. For highly inclined showers at high frequencies (f>200 MHz), the model predicts a quasi geo-synchrotron polarization pattern, within a sharp Cerenkov-like phase coherent ring of less than 1 deg radius. For lower frequencies and more vertical showers, the phase coherent region widens and partially fills in to form a disk like beam.

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