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A semi-analytic treatment of radio emission from air showers

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A fast semi-analytic frequency domain calculation for the 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 account for geometry and varying index of refraction along the shower profile. Current distributions are described as the product of longitudinal, transverse, and shower thickness profiles, with additional parameters to account for creation of charge excess, and transverse currents due to multiple soft coulomb scattering and magnetic deflections. Comparisons are made to REAS 3.0, without index of refraction, and to COREAS with index of refraction.

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