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Ultra High Frequency Geomagnetic Radiation from Extensive Air Showers

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Using the ZHAireS Monte Carlo code, we show that the Fourier-spectrum of the radio emission of inclined air showers can have a sizable intensity up to the GHz frequency range. At these frequencies, only the fraction of shower development seen at an angle close to the Cherenkov angle contributes to the observable emission, which is mainly due to the geomagnetic and charge excess mechanisms. At ground level, the maximum emission at high frequencies is concentrated in an elliptical region related to the intersection with ground of a Cherenkov cone with origin close to shower maximum. Moreover, the lateral distribution of the signal at ground contains information on the shower longitudinal profile. In this work we characterize this effect which can be very important for ground-based radio experiments aiming at detecting molecular bremsstrahlung radiation in the GHz range - a different mechanism not included in ZHAireS simulations. We also show that the simulated spectrum is consistent with the pulses detected by ANITA attributed to radio emission from UHECRs.

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