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Metric-Decametric Gyrosynchrotron Radio Emission From the Quiet Solar Corona

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The radio emission of the quiet Sun in the metric and decametric bands has not been well studied historically due to limitations of existing instruments. It is nominally dominated by thermal brehmsstrahlung of the solar corona, but may also include significant gyrosynchrotron emission, usually assumed to be weak under quiet conditions. In this work, we investigate the expected gyrosynchrotron contribution to solar radio emission in the lowest radio frequencies observable by ground instruments, for different regions of the low and middle corona. We approximate the coronal conditions by a synoptic magnetohydrodynamic (MHD) model. The thermal emission is estimated from a forward model based on the simulated corona. We calculate the expected gyrosynchrotron emission with the Fast Gyrosynchrotron Codes framework by Fleishman and Kuznetsov (2010). The model emissions of different coronal regions are compared with quiet-time imaging observations between 20-90 MHz by the LOw Frequency ARray (LOFAR) radio telescope. The contribution of gyrosynchrotron radiation to low frequency solar radio emission may shed light on effects such as the hitherto unexplained brightness variation observed in decametric coronal hole emission, and help constrain measurements of the coronal magnetic fields. It can also improve our understanding of electron populations in the middle corona and their relation to the formation of the solar wind.