Synthetic Spectra of Radio, Millimeter, Sub-millimeter and Infrared Regimes with NLTE approximation

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We use a numerical code called PAKALMPI to compute synthetic spectra of the solar emission in quiet conditions at millimeter, sub-millimeter and infrared wavelengths. PAKALMPI solves the radiative transfer equation, with Non Local Thermodynamic Equilibrium (NLTE), in a three dimensional geometry using a multiprocessor environment. The code is able to use three opacity functions: classical bremsstrahlung, H-and inverse bremsstrahlung. In this work we have computed and compared two synthetic spectra, one in the common way: using bremsstrahlung opacity function and considering a fully ionized atmosphere; and a new one considering bremsstrahlung, inverse bremsstrahlung and H- opacity functions in NLTE. We analyzed in detail the local behavior of the low atmospheric emission at 17, 212, and 405 GHz (frequencies used by the Nobeyama Radio Heliograph and the Solar Submillimeter Telescope). We found that the H- is the major emission mechanism at low altitudes (below 500 km) and that at higher altitudes the classical bremsstrahlung becomes the major mechanism of emission. However the brightness temperature remains unalterable. Finally, we found that the inverse bremsstrahlung process is not important for the radio emission at these heights.

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