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Probing the physical parameters of the solar chromosphere and the corona through radio observations in the 18-26 GHz frequency range

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The radio Sun in the centimetric range (18-26 GHz) is dominated by the quiet-Sun emission, which covers the entire surface of the solar disk as a mostly uniform background. The quiet-Sun is mostly characterised by bremsstrahlung (free-free) emission at local thermal equilibrium. The solar disk at these frequencies shows dynamical chromospheric structures and phenomena – such as Active Regions, Coronal Holes, Polar Brightening, and Flares – whose emission generally takes place by the interaction between the solar matter and the variable local magnetic fields. This kind of radiation provides gyro-magnetic component, in addition to the free-free component typical of the quiet-Sun.

Using about 450 radio solar maps obtained in the context of the SunDish project – devoted since 2018 to the radio imaging and monitoring of the Sun and its atmosphere through the large single-dish radio telescopes of the Italian National Institute for Astrophysics (INAF) – we present the phenomenology of the chromosphere in the radio K-band (18-26 GHz), still characterised today by poor observing coverage. The low noise, the accurate absolute calibration, and the great sensitivity of INAF radio telescopes make these data crucial to probe the physical parameters of the chromosphere and corona in terms of solar size, density, temperature, and magnetic fields. We also describe the instruments and scientific tools that allow us to study the physics of these solar atmospheric layers, developed for our early scientific works and future developments in the context of the SunDish project.

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