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Comparison of activity indicators in a 3D model atmosphere

The Sun, being the nearest star, can be used as a reference case for solar-like stars due to the availability of many spatiotemporally resolved solar spectra. Amongst several spectral lines, some of the strongest chromospheric diagnostics are the Ca II H & K lines which can be used to gauge the temperature stratification of the atmosphere as the line core and wings are formed in different regions of the solar atmosphere. Furthermore, the Hα line is a tracer for the magnetic structures and its line core provides an estimate of the mass density. The brightness temperatures from ALMA observations provide a new complementary view of the activity and the thermal structure of stellar atmospheres. Therefore, the synthetic Ca II and Hα spectra are compared to corresponding millimetre continuum maps to get insights into the stellar structure.

The 1.5D radiation transfer codes RH and Multi3D are used to obtain synthetic spectra for the Ca II lines and the Hα line from an enhanced network atmosphere model simulated with the state-of-the-art Bifrost code. The activity indices generated from these lines could further be used to compare the spectra of sun-like stars with the solar spectrum. These indices can shed light on the physical properties like temperature stratification, magnetic structures, and mass density distribution in stellar atmospheres. The overall aim of the presented study is to establish more robust solar/stellar activity indicators using ALMA observations in comparison with classical diagnostics.

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