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Prominence diagnostics from IRIS Mg II, MSDP Hα and ALMA observations using NLTE radiative transfer modelling

Multiwavelength co-temporal observations of solar prominences are still rare, even if many space and ground-based observatories and techniques are available. In April 19, 2018 a quiescent prominence with fine structures was observed with IRIS, ALMA (band 3) and in Hα line with Wroclaw MSDP (Multichannel Subtractive Double Pass) spectrograph. Both UV and Hα data contains spectra which makes the available dataset extremely valuable. IRIS and MSDP provided 2D spectral maps, which together with ALMA T_b maps and NLTE (i.e., departures from Local Thermodynamic Equilibrium) techniques gives an unprecedented opportunity for a novel diagnostic, not available so far.

In this work we present analysis of the prominence spectral characteristics in Mg II h & k and Hα lines, looking for the statistical dependence between different parameters (metrics) in these line profiles. These combined data are also used for determination of plasma parameters in the prominence fine structures. Detailed diagnostics is based on extensive NLTE numerical simulations of the radiative transfer inside fine prominence structures. For model determination we use both the large grid of 1D-slab prominence models in NLTE computed with Multilevel Accelerated Lambda Iteration (MALI) techniques and 2D NLTE multithread models that take into account the prominence-corona transition region (PCTR) with the temperature increasing and pressure decreasing from the cool prominence core toward the surrounding coronal environment. Moreover, IRIS and MSDP spectral maps are compared with the brightness temperature mosaics from ALMA, providing an additional constraint on the plasma kinetic temperature.

Primary author: BERLICKI, Arkadiusz ((1) Center of Scientific Excellence-Solar and Stellar Activity, University of Wrocław, Poland, (2) Astronomical Institute, The Czech Academy of Sciences)

Co-authors: HEINZEL, Petr ((1) Center of Scientific Excellence-Solar and Stellar Activity, University of wrocław, Poland; (2) Astronomical Institute, The Czech Academy of Sciences); GUNÁR, Stanislav (Astronomical Institute, The Czech Academy of Sciences); BARCZYNSKI, Krzysztof (ETH-Zürich, Switzerland); JEJČIČ, Sonja (Faculty of Education, University of Ljubljana, Slovenia); SCHMIEDER, Brigitte (CmPA, KU-Leuven,Be); BÁRTA, Miroslav (Astronomical Institute, The Czech Academy of Sciences); RUDAWY, Paweł (Astronomical Institute, University of Wrocław, Poland)

Presenter: BERLICKI, Arkadiusz ((1) Center of Scientific Excellence-Solar and Stellar Activity, University of Wrocław, Poland, (2) Astronomical Institute, The Czech Academy of Sciences)

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