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Detection and multi-wavelength analysis of swirling structures in the solar atmosphere

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High-resolution solar observations from both space-borne and ground-based telescopes have revealed ubiquitous photospheric vortical motions in quiet, as well as in active regions. In observations of the chromosphere, obtained in spectral lines, such as the Hα and the Ca II IR, they appear as spiral-shaped or circular dark patches. These so called "chromospheric swirls"are considered to be of great significance due to their ubiquity, and to their suggested contribution to the energy transfer from the sub-photospheric layers to the transition region and corona. Therefore, statistical information concerning their population and a number of significant physical properties, such as radii, lifetimes and line-of-sight velocities are imperative in order to understand their nature and estimate the amount of the upwards energy transfer. We have developed a novel, automated chromospheric swirl detection method based on their morphological characteristics, in an attempt to complement visual inspection methods and velocity field derivation techniques used to date, with a more reliable to chromospheric observations method. We will be presenting the designed algorithm, and its evaluation on different observational datasets in several chromospheric spectral lines, obtained with the CRisp Imaging SpectroPolarimeter (CRISP) and the CHROMosheric Imaging Spectrometer (CHROMIS) of the Swedish 1-m Solar Telescope (SST). In addition to the swirl detection results, various parameters derived from a multi-line and multi-wavelength analysis conducted on detected swirls, within selected areas, will be presented and discussed.

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