

Formation of the O I 135.56 nm and the C I 135.58 nm Lines

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The O I 135.56 nm and C I 135.58 nm lines are covered by NASA/SMEX mission Interface Region Imaging Spectrograph (IRIS) and their behaviour has also been reported during solar flare in 1970s (Cheng et al. (1980)). The formation of these two lines is therefore interesting because they can potentially become powerful tools that probe the solar chromosphere. In this work we study the 3D-RMHD atmosphere performed by the Bifrost code (Gudiksen et al., 2011) and the RH1.5D code (Uitenbroek, 2001) to carry out the full radiative transfer. We found that the O I 135.56 nm line forms optically thin while the C I 135.58 nm line forms optically thick at mid-chromosphere (1.2Mm ~ 1.6Mm). The O I line itself can already provide interesting information: the doppler shift of its maximum emission is sensitive to the velocity field at the line-forming region, therefore can be useful as a good velocity diagnostic; and its line-width will serve as the constraint of the line-broadening due to the velocity field, as the O I line appears to be the thinnest emission line in the IRIS window; the intensity of its maximum emission can also provide the information of the electron density at its forming region. By using the O I and the C I line together, one can get the velocity gradient diagnostic as they form at slightly different heights. From their line ratio it is also possible to get a hint of the formation height of the lines.

References:

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