Total mass loading of prominences estimated from their multi-spectral observations

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Abstract

The total mass of several quiescent prominences observed in EUV by the AIA instrument on board SDO, in soft X-rays by the XRT on Hinode and in Hα by the MFS spectrograph of the Ondřejov observatory was estimated using a spectroscopic method based on the work of Heinzel et al. (2008). The optical thickness in EUV, and subsequently the column mass of the prominence plasma, is derived by comparison of the depression of the EUV radiation at prominences under study caused by the absorption in the resonance continua of hydrogen and helium and by the coronal emissivity blocking, with the depression in X-rays, where only the emissivity blocking occurs. The total mass of the prominence is then obtained by integration of the column mass over the whole prominence area. Moreover, nonsymmetrical distribution of the coronal X-ray and EUV emissivity in front of and behind the prominence was taken into account using a fraction of the emissivity from behind the prominence estimated iteratively by comparing the ratio of the optical thickness at 193 Å and 211 Å derived from observations with the theoretical value calculated according to Anzer and Heinzel (2005). Ionization degree of hydrogen is determined from Hα spectra using empirical dependences and the extensive catalog of non-LTE models calculated by Heinzel et al. (1994). Asymmetry of coronal emission estimated from 193 Å and 211 Å AIA channel is compared with the unique average value estimated from 193 Å intensities measured at the disk edge and just above the limb. It was found that also the quiet corona around the prominence is rather inhomogeneous and using a unique average asymmetry of its emissivity for the whole prominence can cause errors in estimation of the total prominence mass.

Keywords: prominences, total mass, multi, spectral observations

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