TEMPORAL AND SPATIAL FLUCTUATIONS IN WIDTHS OF SOLAR EUV LINES

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Abstract

Analyses of some 300 hours of time sequences of solar EUV line profiles obtained with OSO-8 show large fluctuations in line widths. At a given location on the sun, line widths fluctuate temporally on time scales ranging from less than a minute to over an hour. At any given time, line widths fluctuate spatially on a variety of scales ranging from active region size to arc second size. Temporal and spatial fluctuations are of approximately the same amplitude. Thus, the sun can be characterized by an aggregate of small cells in each of which line widths are fluctuating in time and which have random phases with respect to each other.

Spatial fluctuations in line width are correlated with large scale spatial fluctuations in brightness for some lines but not for others. Temporal fluctuations in width are sometimes correlated with either Doppler shifts or intensity fluctuations, but more often such correlations are absent.

For a given line, the line width varies through an extreme range of about a factor of two. Nonthermal components of line width vary from approximately the local sound speed to a small fraction of the sound speed.

FORMATION OF THE PROFILES OF ABSORPTION LINES IN THE INHOMOGENEOUS MEDIUM

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Abstract

The shapes of weak fraunhofer lines, including their asymmetry, are explained by the influence of acoustic waves and granular motions. The following pattern of granula

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is adopted: the ascending (granular) and descending (intergranular) velocities V_1 and V_2 as well as the relevant temperatures T_1 and T_2 are maximum (minimum) at the center of granula (intergranula) and decrease (increase) sinusoidally outwards. There is also tangential outflow of the matter from the center of granula with the velocity V_3 = const. and temperature T_3 equal to the temperature of the photospheric model T_0. The areas occupied by ascending, descending, and tangential motions are S_1, S_2, S_3 respectively.

The inhomogeneities caused by granulation are perturbed by the acoustic waves with the velocity amplitude V_0 = 0.4 km/s and with the period T = 300 sec. The formula for the absorption line coefficient was derived, and the center-to-limb profiles of 11 weak fraunhofer lines were calculated. The comparison of calculated and observed line profiles have resulted in determining "best fit" values of V_1, V_2, V_3, S_1, S_2, S_3 and $\Delta T = T_1 - T_2$. Tangential motions occupy the larger part of the solar surface $S_3 = 0.7$, $V_3 \approx 2.7$ km/s, $V \approx 1.0$ km/s, ΔT ranges between 270° - 400°.

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