EXCITATION CONDITIONS OF IRON FLUORESCENT LINES IN SOLAR FLARES

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ABSTRACT. The conditions of the excitation of the fluorescent lines Fe I 4063, 4123 Å in the solar flares are discussed based on the previous work (Bayazitov U.Sh., Sakhibullin N.A., *Pisma Astron. Zh.*, 1991, **17**, 337). These conditions are not challenging the theoretical picture and the observational data for these objects.

Key words: Stars: spectra; Sun : flares

Fluorescent iron lines Fe I (43) 4063, 4132 Å are rare phenomena because they first of all have been discovered in extremely young T Tauri stars (Joy, *Ap.J.*, 1945, **110**, 424) and further in solar flares (Cowley & Marlborough, *Ap.J*, 1969, **152**, 803). The explanation of this anomaly strengthening has been given by Herbig (*P.A.S.P.*, 1945, **57**, 156) – fluorescent iron lines Fe I 4063, 4132 Å caused by coincidence of the Fe I(43) 3969 Å line and H + H Ca II blend.

This problem for the solar flares has been investigated in a number of our works (Bayazitov & Sakhibullin, 1991, *Pisma Astron. Zhurn.*, **17**, 377 and references in this paper). Our results have been obtained by the detailed simulations of H +H Ca II radiation field in our Non–LTE calculations. The method has been described in our work (1990, *Pisma Astron. Zhurn.*, **16**, 560). We have used the semiempirical hydrostatic chromosphere models of solar flares (Machado & Linsky, 1975, *Solar Phys.*, **42**, 803). By means of the numerical experiments with various line broadening parameters it is shown that the main reason for the *in* lines fluorescence is the velocity gradient in the flare atmosphere. It was concluded, that this fluorescence is connected with H line because this line is more broader that H Ca II line in the solar flares. These circumstances determine the dynamic picture in these objects – the gas flowing down toward to photosphere by negative velocity gradient.

How this dynamics agrees with observational data?

It is well known that the spectral line profiles are asymmetrical in the many solar flares (Svestka: 1976, *Solar flares*). Ishimoto and Kurocawa (1984, *Solar Phys.*, **93**, 105) observed the line center shifts and the asymmetry in the Hp red part of profile in the flares near the Solar disc center. Authors have interpreted this phenomenon as the downflowing which has velocities in range of 40 – 100 km/s. Canfield et al. (1990, *Ap.J.*, **348**, 333) also observed red shifted H flare lines with the velocities approximately equal to 40 km/s.

All these observational data are agree with our numerical modeling results. We also add to this new fact – the downflowing of solar flares gas has the braking and this fact may be explained by the gas friction of dense lower chromosphere and photosphere layers. The estimates of this braking were published in our work (1990, *Pisma Astron. Zhurn.*, **16**, 560).

The conclusions are the following. The presence of the fluorescent lines Fe I 4063, 4132 Å proofs the presence of downflowing gas in solar flares. This stream has negative velocity gradient. Therefore the hydrostatic atmosphere models of the solar flares seems to be inadequate to the real conditions.