ELSEVIER

Journal of Quantitative Spectroscopy & Radiative Transfer 95 (2005) 127–131

Journal of Quantitative Spectroscopy & Radiative Transfer

www.elsevier.com/locate/jqsrt

Note

The study on fine structures in solar prominences

A. Adjabshirizadeh, H. Ebadi*

Department of Theoretical and Astrophysics, Faculty of Physics, Tabriz University, Iran; Research Institute for Astronomy and Astrophysics of Margha, Iran

Received 7 March 2004; accepted 7 September 2004

Abstract

There are some solar prominence fine structures which are not observable. Thus, we need to use theoretical methods to study their geometric and physical properties. It is believed that observed intensities, and their fluctuations are related to such fine structures in the line of sight. Regarding the fact that analysis of intensity and its fluctuations necessitates the knowledge of the dependence of scattering albedo relative to optical depth, the present study is an attempt to determine scattering Albedo functions which are more probable to reality from the astrophysics' perspective.

Keywords: Radiative transfer; Sun; Prominences; Fine structures

1. Introduction

Studies demonstrate that the choice of geometrical models of fine structures do not influence the results [1]. In other words, it is not important whether we analyze these structures by way of slab-like geometry in which the central core is thick from the point of optical depth. The central core is surrounded with two interface regions which have a thin optical depth. In this study, core and interface emissions in these structures are investigated (Fig. 1).

In this concern, the study by Pojoga et al. [2] worked only on the atmospheres with absorption processes. Their findings were obtained on core and interface emissions and their fluctuations

*Corresponding author.
E-mail address: h_ebadie@yahoo.com (H. Ebadi).

0022-4073/$ - see front matter
doi:10.1016/j.jqsrt.2004.09.039

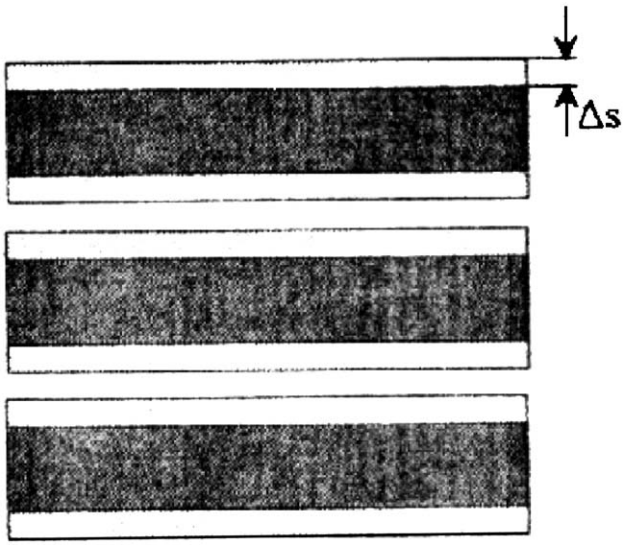

Fig. 1. The slab-like geometry of fine structures is showed.

from fine structures. However, absorption processes cannot include only processes in solar prominences, so the present study takes into account scattering processes in addition to absorption processes. With the adoption of these assumptions, the present study is conducted.

2. Statement of the problem

Fine structure emissions consist of two parts :

(1) *Core emission*: Lines formed only in central layers of fine structures which can have either thin or thick optical depth.

(2) *Interface emission*: Some lines formed in the fine structures can be due to their interface emission which have a thin optical depth. The absorption processes occur solely in the central part. It is assumed that in this region no absorption takes place.

Pojoga et al. [1] calculated core and interface emissions and their fluctuations via the statistical mechanics. The findings are reported below. The following are the core and interface emissions respectively

$$\frac{\langle I \rangle}{s} = 1 - \mathrm{e}^{-Nq(\tau)}, \tag{1}$$

$$\frac{\langle I \rangle}{\varepsilon \Delta s} = \left[\frac{2 - q(\tau)}{q(\tau)}\left(1 - \mathrm{e}^{-Nq(\tau)}\right)\right] \tag{2}$$

in which s, τ are source function and optical depth of central layer. Also $\varepsilon, \Delta s$ are line emissivity and geometrical depth of interface region, respectively.