PERIODIC OSCILLATIONS FOUND IN THE VELOCITY FIELD OF A QUIESCENT PROMINENCE

TOKIO TSUBAKI and AKITSUGU TAKEUCHI*
Department of Earth Science, Shiga University 2-5-1 Hirasu, Otsu 520, Japan

(Received 27 August, 1985; in final form 15 January, 1986)

Abstract. With the purpose of detecting periodic oscillations or waves in a quiescent prominence, temporal variations of a CaII K line profile have been studied. The most conspicuous phenomenon found here is the fact that the edge of the prominence showed, over some 20000 km along the spectrograph-slit, periodic velocity fluctuations of nearly the same phase with periods of 210-240 s and with an amplitude of up to ± 2 km s$^{-1}$. At other portions, several different periods of peaks (160-400 s) can also be seen in the power spectra, but less distinctly. As to the intensity and the line width, however, no periodic variations have been detected.

1. Introduction

According to many studies published to date, oscillatory phenomena in prominences (including dark filaments) seem to be classified roughly into the following three types. The first is the so-called winking filament which is the most prominent event that has been studied extensively by a number of authors (for instance, Ramsey and Smith, 1965, 1966; Hyder, 1966; Kleczek and Kuperus, 1969; Landman et al., 1977). The second is the long-period line-of-sight velocity oscillation recently found by several authors. Malville and Schindler (1981) detected oscillations of a loop prominence, having a period near 75 min and an amplitude of 1-2 km s$^{-1}$, approximately 90 min before the onset of a flare. Bashkirtsev et al. (1983) and Bashkirtsev and Mashnich (1984) obtained oscillation periods of 42-82 min with amplitudes in excess of 200 m s$^{-1}$ for 15 prominences observed. Wiehr et al. (1984) have also obtained similar periods of 50, 60, and 64 min, with amplitudes of 1-2 km s$^{-1}$ for 3 prominences.

The third type is the short-period oscillation for which only very weak evidence has been given. Although it has often been suggested that oscillatory motions can exist in the line-of-sight velocity fields of prominences (for instance, Malville, 1968; Liszka, 1970; Ramsey, 1977), very few studies have been made to detect temporal variations of this type. Vršnak (1984) reported that he found horizontal velocity oscillations of a loop prominence having a period of 8 min, and Wiehr et al. (1984) obtained slight indications of short-period oscillations with periods near 3 and 5 min. In studying the small-scale velocity field of a quiescent prominence, Engvold (1981), however, failed to find clear evidence for oscillations or waves. Malherbe et al. (1981) reported that the chromospheric oscillations ($P = 240$ s) were almost undetectable in a filament and were reduced around it.

With the purpose of detecting periodic oscillations of this type, we made time series observations of CaII K line spectra of a quiescent prominence. The purpose of the

* Present address: Department of Astronomy, University of Kyoto, Sakyo-ku, Kyoto 606, Japan.

© 1986 by D. Reidel Publishing Company
2. Observations

Using the domeless solar telescope and the vertical spectrograph of the Hida Observatory, University of Kyoto, time series observations of a quiescent prominence were carried out on 12 November 1981. Over a 20 min period, 81 frames of Ca II K-line spectra, together with Hα slit jaws monitor pictures, were obtained with a constant interval of 15 s and with a 10 s exposure time. An example of the spectrogram and a monitor picture thus obtained are given in Figure 1.

The prominence was located at a comparatively high latitude in the south-western hemisphere (PA = 249°) well isolated from any active regions. According to Solar...