Oscillations with a period of 5.6 min were observed on 10 July, 1978 while tracking at 22 GHz the active region McMath 15403. The oscillations were strong, clearly defined, had no damping, and lasted for about two hours. The rarity of the phenomenon is indicated by the fact that it occurred only once in more than 250 hr of solar observations. The possibility that these oscillations are due to a standing Alfvén wave driven by the photospheric velocity field is discussed.

1. Introduction

Photospheric velocity oscillations with periods around 300 s have been known for some time (Leighton et al., 1962). Attempts to observe related intensity variations at radio wavelengths have produced contradictory results. Several authors have found various periodicities in the range 10-1000 s (e.g., Durasova et al., 1971; Simon and Shimabukuro, 1971; Lang, 1974a; Avery, 1976; Kobrin et al., 1976), while others report negative or inconclusive results (Shuter and McCutcheon, 1973; Sentman and Shawhan, 1974; Kundu and Alissandrakis, 1975; Zirin et al., 1978; Morita, 1979). In general the signal to noise ratio is so low that the oscillations appear only as peaks in the power spectra of long records of radio data, and their significance has often been questioned. Instrumental and atmospheric effects have also been cited as possible causes of the observed oscillations. In the present paper we report one instance of strong oscillations, quite different from the ones previously observed.

2. Observations

Preliminary results of two weeks of solar observations made in July 1978 were previously reported (Kaufmann et al., 1980). The Sun was very active during this period, with most of the activity centered at McMath plage 15403 (NOAA, 1979). On 10 July, 1978 we operated the 45ft Itapetinga antenna at 22 GHz (half power beam width ~4.5 arc min), and a standard patrol dish at 7 GHz (full Sun observation). After mapping the Sun with the large antenna, the pointing was set at the position of maximum intensity of the active region which was continuously tracked with an accuracy of better than 10 arc sec. The data were stored in analog form on a standard FM magnetic tape recorder.

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At 17:29 UT a burst occurred in the region under observation, accompanied by a class 2B flare, X-rays, and SID (NOAA, 1979). Although large, it was not the most important event produced by this active region. The reported microwave spectrum had a minimum around 10 cm wavelength, increasing to ~10^4 s.f.u. (solar flux units of 10^{-22} W m^{-2} Hz^{-1}) at 120 cm and to ~300 s.f.u. at 2 cm (NOAA, 1979). Our 7 GHz data show a complex event followed by an extended post burst increase (PBI) lasting about 2 hr, with some superimposed activity (Figures 1 and 2). The 22 GHz record, set for high sensitivity, went off scale at the peak of the burst, and was followed by a remarkable oscillation that continued without damping until it ended abruptly around 19:25 UT when the PBI at 7 GHz began to disappear. The period of the oscillation was 5.6 min.

3. Discussion

This unique occurrence is a very rare phenomenon. It was only observed for 2 hr out of more than 250 hr of tracking of active and quiet regions during runs performed in 1974, 1978, and 1979. This makes it very unlikely that it was caused by instrumental or atmospheric effects. It falls in a somewhat different class from the quiet Sun oscillations discussed in Section 1, being apparently more related to the quasi-periodic structures superimposed on some radio bursts reported by several authors (cf. Cliver et al., 1976; Kaufmann et al., 1977). However, those structures, seen sometimes also in hard X-rays, are usually of shorter period, less regular, and show only a few evenly spaced peaks. While the shorter period structures have been

![Fig. 1. Tracing of radio data stored on magnetic tape. Bursts are indicated by arrows. The slope in the 22 GHz data is due to increasing atmospheric attenuation due to the decreasing elevation of the Sun.](image)