

Relation between EIT waves and phenomena seen in H-alpha

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In 1960, Moreton reported a flare-associated wave seen in H-alpha, which propagated on the chromosphere. These waves (hereafter, Moreton waves) are directional and their speeds are 500 - 1500 km/s. Uchida (1967) established that they are a chromospheric manifestation of MHD fast-mode shocks propagating in the corona. Now, this model is widely accepted. Thompson et al. (1997) reported the discovery of a flare-associated wave propagating in the corona with the Extreme ultraviolet Imaging Telescope (EIT) aboard the Solar and Heliospheric Observatory (SOHO). This wave is now called EIT waves. Many EIT waves have been found to be associated with coronal mass ejections (CMEs) and type II radio bursts (Biesscker et al. 2001). However, almost all the EIT-wave speeds are one-half or one-third of the Moreton-wave speeds. Hence it is difficult to conclude that EIT waves are the coronal counterpart of Moreton waves. The question what an EIT wave is has not been solved.

In this report, to find a clue to solve the question what an EIT wave is, we compared EIT waves with simultaneous phenomena seen in H-alpha for the first time. We surveyed the events associated with solar flares larger than GOES M-class after 1999 (hereafter, M/X-class flares). The H-alpha data are taken with the Flare-Monitoring Telescope (FMT) at the Hida Observatory of Kyoto University. As a result, 35 EIT waves were indentified in 358 M/X-class flares which occurred during Japan observing time (22:00 - 07:00 UT). Among such 35 EIT waves, 15 events were found to be observed by full Sun H alpha telescope FMT. Of the 15 FMT H-alpha events, 2 were found to have Moreton waves and 1 was found to have only filament oscillations. This shows that we cannot see clear wave fronts in H-alpha even if EIT waves exist, but that it is possible to recognize invisible waves by means of filament oscillations. Through the analysis of the event associated with filament oscillations, it is found that filament oscillations are caused by EIT waves.