Ubiquitous Fast Propagating Intensity Disturbances in Solar Chromosphere


Abstract

High cadence observations by the slit-jaw (SJ) optics system of the sounding rocket experiment “the Chromospheric Lyman Alpha SpectroPolarimeter (CLASP)” reveal ubiquitous intensity disturbances that recurrently propagate in either the chromosphere, transition region, or both at a speed much higher than the sound speed (Kubo et al. 2016, accepted).

Case 1: Edge of AR

The observed fast propagating intensity disturbances are related to the magnetic canopy structures.

The apparent propagation speeds are much faster than the typical sound speed (~20 - 50 km/s) in the chromosphere or the transition region. They are comparable to the local Alfvén speed in the transition region. ⇒ MHD phenomena

The timescale is much shorter than quasi-periodic propagating intensity disturbances with periods of several minutes that are interpreted as slow propagating magnetico-acoustic waves.

Temporal evolution of Stokes I profile

CLASP simultaneously obtained Stokes-I profiles of Ly-alpha line (121.6nm) and Si III line (120.7nm) at 0.3s cadence.

- The weak intensity enhancements of the entire Lyα line profile are observed during the intensity disturbances pass across the slit (green arrows).
- No significant Doppler shift > 150km/s in Lyα or Si III lines is observed during the fast propagating intensity disturbances in SJ images.

⇒ It suggests that SJ fast propagating intensity disturbances correspond to apparent pattern motions (waves or oscillations). One possible explanation for the fast propagating intensity disturbances observed by CLASP/SJ is MHD fast mode waves.

- It is also found that antisymmetric changes of blue and red peaks of Lyα lines alternately and recurrently appear in the short timescale in the period without the propagating intensity disturbances (sky-blue boxes).