Discovery of Ubiquitous Fast-propagating Intensity Disturbances by the Chromospheric Lyman Alpha Spectropolarimeter (CLASP)

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High-cadence and high-sensitivity observations by the slit-jaw (SJ) optics system of the CLASP sounding rocket experiment [1] reveal ubiquitous intensity disturbances that recurrently propagate in either the chromosphere or the transition region or both at a speed much higher than the speed of sound [2]. The CLASP/SJ instrument provides a time series of two-dimensional images taken with broadband filters centered on the Lyα line (121.6 nm) at a 0.6 s cadence. The sky-blue arrows in Figure 1 point out one example of the fast-propagating intensity disturbances at the outer boundary of an active region. In this case, the propagation speed is about 300 km/s, and the similar moving patterns appear at least four times in the same area. The multiple fast-propagating intensity disturbances appear in the quiet Sun and in the active region, and they are clearly detected in at least 20 areas in a field of view of 527″ × 527″ during the 5 minute observing time, as shown by the green boxes in Figure 2. The apparent speeds of the intensity disturbances range from 150 to 350 km/s. These speeds are much faster than the speed of sound in the chromosphere or the transition region (< 50 km/s), and comparable to the local Alfvén speed in the transition region. The intensity disturbances tend to propagate along bright elongated structures away from areas with strong photospheric magnetic fields. This suggests that the observed fast-propagating intensity disturbances are related to the magnetic canopy structures. The maximum distance traveled by the intensity disturbances is about 10″, and the widths are a few arcseconds, which are almost determined by a pixel size of 1″.03. The timescale of each intensity pulse is shorter than 30 s. One possible explanation for the fast-propagating intensity disturbances observed by CLASP is magnetohydrodynamic fast-mode waves.

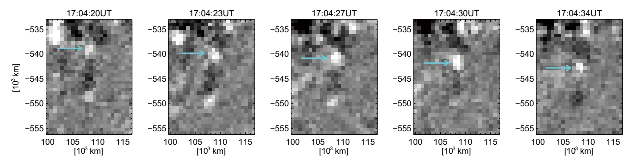

Figure 1: One example of the fast-propagating intensity disturbances (sky-blue arrows). This event occurs in Box 1 of Figure 2. The background is Lyα image with the CLASP/SJ after removal of the 30 s running temporal average.

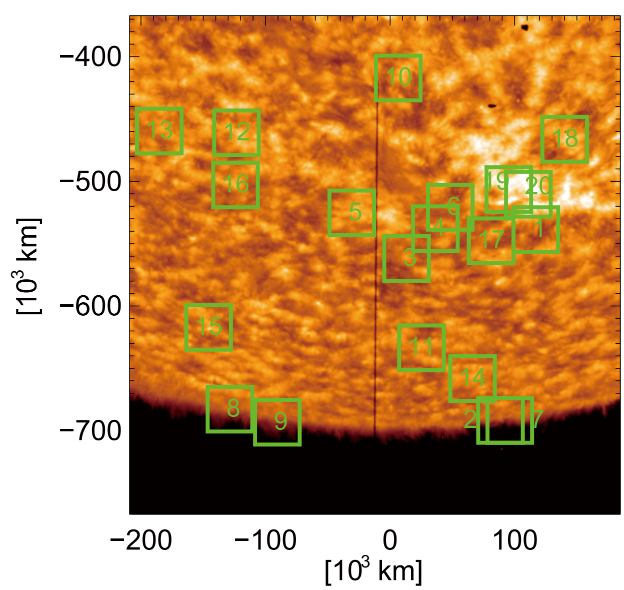

Figure 2: Fast propagating intensity disturbances are clearly observed around the centers of the green boxes. The background image is Lyα image taken by the CLASP/SJ.

References

[1] Kano, R., et al.: 2017, *ApJL*, **839**, L10.
[2] Kubo, M., et al.: 2016, *ApJ*, **832**, 141.