M16c Doppler velocity differences of ions and neutral atoms in a solar surge

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In many astrophysical systems, the plasma is partially ionized, in which neutral atoms feel Lorentz force indirectly through the collisional friction with between charged particles. Therefore neutrals may diffuse across the magnetic field in a process called ambipolar diffusion and there exist velocity differences between ions and neutrals. This diffusion process plays a key role in modifying important physical process such as magnetic reconnection, damping of megneto-hydrodynamic waves, transport of angular momentum in plasma through the magnetic field, and heating.

In the previous studies, Khomenko et al (2016) detected Doppler velocity differences in a prominence of the order of 0.1 km/s, while T.Anan et al (2017), also targeting a prominence, interpreted the difference of Doppler velocities as being a result of motions of different components in the prominence along the line of sight. In our study, we analyzed an off-limb surge, observed on May 8th 2015 simultaneously in He I 706.5 nm, Ca II 849.8 nm and O I 777.2 nm, using the high dispersion spectrograph of the Domeless Solar Telescope at Hida observatory. This study aims to investigate the Doppler velocity differences between neutral and ionized species in erupting plasma.