Initial results from CLASP2 rocket experiment to measure magnetic fields in the solar chromosphere

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The magnetic field in the chromosphere is one of the most important parameters needed to understand the dynamics of the solar atmosphere and to solve the coronal heating problem. To verify a new technique proposed to determine the magnetic field in the upper solar chromosphere, we developed a new instrument, CLASP2 (Chromospheric LAyer SpectroPolarimeter), which allows to measure the four Stokes profiles across the Mg II k and h lines around 280 nm. The launch operation was performed on 2019 April 11 at the White Sands Missile Range in New Mexico, USA. During its suborbital flight, CLASP-2 observed for 6 minutes three targets, including the center of the solar disk for 18 s to calibrate the instrument, a strong plage for 155 s to measure magnetic fields via the Hanle and Zeeman effects, and a quiet limb region for 136 s to measure scattering polarization and its modification through the Hanle and magneto-optical effects.
The spectropolarimetric observations were successfully done and we detected clear polarization signals in the plage and in the quiet limb region. Here we show some preliminary results. First, we confirm the theoretically-predicted scattering polarization pattern across the Mg II k and h lines. The spatial variation of the observed polarization signals encodes information on the magnetic field via the Hanle, Zeeman, and magneto-optical effects. Second, we show clear circular polarization signals in several spectral lines induced by the Zeeman effect, from which we derive the spatio-temporal variations of the line-of-sight field strength in the upper chromosphere. Third, with the slit-jaw instrument, we could observe the predicted broad-band scattering polarization of the hydrogen Lyman-alpha line, including its center-to-limb variation. During the CLASP2 flight, we also carried out coordinated observations with the IRIS and Hinode satellites.

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