



Institute for Space Weather Sciences Colloquium

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Recent spectroscopic observations of stellar flares and possible stellar mass ejections

Flares are frequent energetic explosions in the stellar atmosphere, and are thought to occur by impulsive releases of magnetic energy stored around starspots. Large flares (so called “superflares”) generate strong high energy X+UV emissions and coronal mass ejections (CMEs), which can greatly affect the planetary environment and habitability. Recent Kepler/TESS photometric data have revealed the statistical properties of superflares on G, K, M-type stars. Young rapidly-rotating stars (e.g., “Young Suns”) and cooler stars (“M dwarfs”) tend to have frequent flares, which can be more “hazardous” for the habitable planets. However, we still do not know the emission mechanisms of superflares, and how large CMEs are associated with superflares on these active stars. Then recently, these active flare stars have been investigated in more detail through multi-wavelength campaign observations. In particular, we have worked on the observation campaigns of young G-dwarfs (young Sun analogs) and M-dwarfs, and have reported candidates of stellar filament/prominence eruptions, probably leading to CMEs, as a blue-shifted absorption/emission of chromospheric lines associated with stellar flares. Notably, the erupted masses for superflares are larger than those of the largest solar CMEs, indicating severe influence on various planets including exoplanets and young Earth/Mars.

In this presentation, I will overview our recent observation results of flares and stellar CME candidates described in the above, and discuss future prospects on further multi-wavelength observations, and the importance of more collaborations with solar-based observation/modeling studies.



Dr. Yuta Notsu received his PhD in March 2019 at Kyoto University in Japan, in the solar physics group, supervised by Prof. Kazunari Shibata. After that, he came to Laboratory for Atmospheric and Space Physics (LASP), University of Colorado Boulder (CU Boulder) with JSPS research fellowship in 2019, and then transitioned to postdoc and currently Research Scientist at the same institution. He is mainly studying stellar magnetic activities, especially “superflares” and potential stellar CMEs on solar-type (G-type) stars and cooler K, M-type stars, using the various photometric and spectroscopic data from space and ground telescopes. Through these observational studies, he investigates how frequently superflares occur on G, K, M-type stars, how large superflares & CMEs occur in the stellar atmosphere, and how are affected from these flares. At Colorado, he has been mainly working with the stellar flare team members led by Adam Kowalski. Recently he also joined MAVEN EUV team to apply his Young Sun studies into early solar system evolutions.