R009-17
B 会場 ：11/24　PM2 （15:30-18:15）
17:45〜18:00

#大野 辰遼 [1)], 高橋 幸弘 [2)], 佐藤 光輝 [3)], 高木 聖子 [4)], 今井 正尭 [5)]
([1] 北海道大学, [2] 北大・理・宇宙, [3] 北大・理, [4] 北海道大学, [5] 東大 天文センター

Development of Planetary Lightning Detector (PLD) and Venusian lightning Model comparing with JEM-GLIMS data

#Tatsuharu Ono[1)], Yukihiro Takahashi[2)], Mitsuteru SATO[3)], Seiko Takagi[4)], Masataka Imai[5)]
([1]Department of Cosmosciences, Graduate School of Science, Hokkaido University, [2]Faculty of Science, Hokkaido University, [3]Faculty of Science, Hokkaido University, [4]Hokkaido University, [5]Institute of Astronomy, The University of Tokyo

Lightning is the electric discharge through the atmosphere that occurs not only on Earth. The previous observations detected the possible signal originating from Venusian lightning. LAC onboard AKATSUKI recorded a potential signal on March 1, 2020 (Takahashi et al., 2020). If the lightning discharge generated its signal, the occurrence rate is similar to the estimated rate by the ground-based telescope observation (Hansell et al., 1995). Lightning could help understand the Venusian atmospheric dynamics. Moist convection is one of the possible mechanisms for generating lightning discharge in dense clouds. Lightning activity has correlated with the convection activity. However, there are many unknowns about Venusian lightning's existence, mechanism, and distribution due to a lack of global observations and continuous monitoring over several years.

To enable us to achieve high-frequency monitoring observations, we have developed the Planetary Lightning Detector (PLD) for the 1.6-m Pirka telescope of Hokkaido University. PLD can distinguish between the lightning and the variation of the other light sources using two-band simultaneous photon counting. The first photomultiplier tube observes the wavelength of Venusian lightning(777 nm, FWHM = 1nm). The second photomultiplier tube simultaneously observes the background variation with the broadband filter, 700 nm (FWHM = 10 nm). If the PMT's signal of 777 nm has a considerable count increasing above the trigger level estimated by the noise amplitude, unlike the second PMT, the candidate waveform has been detected. From the data of observing Venus since 2021, we triggered several possible signals. We cannot rule out the possibility that all recorded light curves originate from noise or Cosmic rays. It might be disputable to conclude that we have detected lightning. To understand the Venusian lightning optical waveform, we developed the Venusian lightning scattering model compared with the Earth lightning model and Earth lightning light curve observed by JEM-GLIMS to test if the observed lightning is possible. JEM-GLIMS observed the VLF and optical light curve at the same time. We can understand the difference between the optical and lightning current duration time. Assume that the emission waveform of lightning can be represented by the convolution of a single photon scattering waveform and the waveform of an electric current. We analyze the waveform of the Earth's lightning to confirm the relationship using the scattering model and data of the Earth's lightning. The atmospheric conditions of the same model are adjusted to Venus, and Venusian lightning is discussed. Only a few milliseconds of lightning emission duration waveforms were obtained from a single flash when considering Venusian atmospheric conditions. LAC observed waveforms on the scale of 100 milliseconds. This difference in time scale needs to be discussed.