

Status of lightning search in Venus

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The existence of lightning discharge in Venus has been controversial well over three decades, which might be attributed to the lack of conclusive observational evidence. There had been no satellite payload intentionally designed for the detection of lightning phenomena using radio wave or optical sensor. LAC, lightning and airglow camera, on board Akatsuki spacecraft, is the first sensor optimized for the lightning optical flash measurement in planets other than the Earth. Unique performance of LAC compared to other equipment used in the previous exploration of Venus is the high-speed sampling rate at 20 kHz with 32 pixels of Avalanche Photo Diode (APD) matrix, enabling us to distinguish the natural optical lightning flash from other pulsing noises, including artificial electrical noise and cosmic rays. We selected OI 777 nm line for lightning detection, which is expected to be the most prominent emission in CO₂-dominant atmosphere based on the laboratory experiments.

We are conducting lightning search in about 40 passes of AKATSUKI with triggering parameter set optimized for the light curve similar to the normal lightning and also sprite type in the Earth. However, we couldn't find any lightning signals up to now. The total coverage of the LAC lightning hunt became 96.9 [million km²-hr], meaning 86 percent detectability of previous results with ground-based telescope by Hansell et al. (1995). Here we report the detailed strategy and the latest status of the LAC observation in 2020, and discuss the future observation strategy including ground observation with a high-speed photometer installed at Pirka telescope, a 1.6-m reflector deployed by Hokkaido University.

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