

Status of lightning hunt in Venus with Akatsuki/LAC and Pirka telescope

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The existence of lightning discharge in Venus has been controversial for 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. It is expected that LAC could conclude this 30-year discussion on the existence of lightning in Venus. 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.

The triggering parameter was set so as to optimize for the light curve similar to the normal lightning in the Earth and data obtained totally for about 4 hours were examined. However, we couldn't find any lightning signals. Adding to this triggering parameter set, we added one more parameter set, optimized for sprite type emission with duration of up to 10s of ms. Furthermore, in order to investigate fainter emissions, we are now conducting successive force triggering recordings without any threshold, achieving 5 times better sensitivity than the intensity of 1 digital unit at best.

The total coverage of the LAC lightning hunt became 81.6 [million km²-hr], meaning 81 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 2018, and discuss the future observation plan.

Also we will make ground observation with a high-speed photometer installed at Pirka telescope, a 1.6-m reflector deployed by Hokkaido University. Here we report the initial results of lightning flash observation with it.

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