



Jovian thundercloud research with ground-based telescope and spacecraft

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The latest observational and theoretical studies suggest that thunderstorms, i.e., strong moist convective clouds in Jupiter's atmosphere are very important not only as an essential ingredient of meteorology of Jupiter, which determines the large scale structures such as belt/zone and big ovals, but also as a potentially very useful tool for probing the water abundance of the deep atmosphere, which is crucial to constrain the behavior of volatiles in early solar system. Here we suggest a very simple high-speed imaging unit onboard Jovian orbiter, Optical Lightning Detector, OLD, optimized for detecting optical emissions from lightning discharge in Jupiter. OLD consists of radiation-tolerant CMOS sensors and two H Balmer Alpha line (656.3nm) filters. In normal sampling mode the frame intervals is 29ms with a full frame format of 512x512 pixels and in high-speed sampling mode the interval could be reduced down to 0.1ms by concentrating a limited area of 30x30 pixels. Weight, size and power consumption are about 1kg, 16x7x5.5 cm (sensor) and 16x12x4 cm (circuit), and 4W, respectively, though they can be reduced according to the spacecraft resources. Also we plan to investigate the optical flashes using a ground-based middle-sized telescope, which will be built by Hokkaido University, with narrow-band high speed imaging unit. Observational strategy with such optical lightning detectors and spectral imagers, which enable us to estimate the horizontal motion and altitude of clouds, will be introduced.