Small-scale pulsating auroral distribution obtained with the auroral camera on the LAMP rocket

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We report the results of a multi-spectral auroral camera AIC2 installed on the NASA’s LAMP rocket which was successfully launched from Poker Flat at 11:27:30 UT on March 5, 2022. The purpose of LAMP rocket mission is to clarify the relationship between pulsating aurora and microbursts. AIC2 measures two auroral emissions in the E-region at 670 nm (N2 1PG) and in the F-region at 844.6 nm (OI) using two CMOS cameras called AIC-S1 and AIC-S2. Two cameras take images simultaneously with a time resolution of ~10 frame/s. AIC-S1 is pointed toward the magnetic footprint with a 29 deg x 29 deg FOV covering 180 km x 180 km area with a resolution of 3 km x 3 km at the apex altitude (~430 km altitude). AIC-S2 has a 106 deg diameter circular FOV covering the wide range from nadir to limb of the Earth. AIC2 is mounted on the despun table to cancel the rocket spin. Total weight and power of AIC2 are 3.0 kg and 20 W, respectively.
At ~10:30 UT on March 5, 2022, a typical auroral break up with a negative excursion of geomagnetic east-west component of ~500 nT (Kp=4-) happened at Poker Flat, and afterward significant pulsating auroral patches with several Hz modulations appeared in the northward sky of Poker Flat. The LAMP rocket was successfully launched into and flew over the active pulsating auroral patches. AIC2 worked satisfactorily throughout the flight. The despun table worked correctly and small-scale aurora were continuously obtained by AIC2 for the first time. Auroral image data taken by AIC2 were analyzed as follows: 1) subtraction of dark count, 2) field flattering, 3) unit conversion from count to Rayleigh. From AIC-S1 data, we see significant pulsating auroral patches with sub-second modulations during the flight time of ~160-200 s, ~450-500s, and black arcs at ~600s. From AIC-S2 data, we identified the limb and large-scale auroral emission in the equatorward of auroral oval. Other onboard instruments and ground-based high-speed imagers at Poker Flat, Venetie, and Fort Yukon succeeded to observe during the flight. We compared auroral images taken by AIC2 with high-energy electrons (>100keV), low-energy electrons (several to 10 keV) and ground auroral images and found that they showed good correspondence on the main pulsating aurora (~5s) and even on the sub-second variations which is probably microbursts.

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