

AEM012-02

Room: 202

Time: May 28 09:15-09:30

Optical and electromagnetic detection of lightning activity on Saturn

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Lightning activity on Saturn was first detected by the Voyagers in the form of short radio bursts called Saturn Electrostatic Discharges (SEDs). While the Voyager cameras could not identify a corresponding storm in Saturn's atmosphere, the Cassini mission has removed all doubts about their origin. First, Cassini ISS (Imaging Science Subsystem) imaged bright storm eruptions in Saturn's storm alley at a planetocentric latitude of 35 deg. south that correlated with SED observations. At last, direct flashes of light were identified in night side images of a storm cloud around Saturn's equinox, and at the same time the RPWS (Radio and Plasma Wave Science) instrument as well detected SEDs. The reduced ring shine has allowed this first visible detection of Saturn lightning, whose source is located about 125-250 km below the cloud tops. In this presentation we will show these combined ISS/RPWS observations and highlight the importance of the dual-phenomenology approach. The radio observations by the RPWS instrument allow a long-term monitoring of lightning activity that has been going on now for almost 6 years. Since the bright storm clouds on Saturn can also be seen by astronomers from Earth, we will also try to identify SED storms in the pre-Cassini era. By the end of the Cassini mission in 2017 we will have monitored lightning activity for almost half a Saturnian year which should allow us to discern a potential seasonal influence on the lightning activity.

Keywords: Saturn, lightning, SED, Cassini ISS, Cassini RPWS