SUBMILLISECOND VIDEO AND ELECTROMAGNETIC OBSERVATIONS OF TLE DEVELOPMENT AND STRUCTURE

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During the 2005 summer observation campaign at Yucca Ridge, Colorado, numerous instruments aimed at observations of high altitude optical emissions driven by lightning. Included in this set were a flexible intensified high speed camera (Vision Research Phantom 7.1) and wideband magnetic field sensors (0.1 Hz to 30 kHz, built by QUASAR, Inc.) that were employed in an effort to probe the details of the connection between the low altitude lightning processes and high altitude transient luminous events (TLEs). The low frequency sensitivity of the magnetic field sensors enabled measurement of the continuing lightning current that is involved in many of the complex sprites but that can be difficult to detect by other means, while the high speed video gave precise timing of TLE onset and features relative to the driving lightning processes below.

A total of 76 TLEs were captured on high speed video during this campaign; 10 were halos or elves without sprites, and 66 were sprites, many of which were also accompanied by halos and elves. Sprites were imaged between 5000 and 10000 frames per second on 13 August 2005 during a storm that was as close as 250 km from the camera. The combination of proximity and camera speed revealed a detailed view of the spatial and temporal development of the sprites observed on this night. Some new features were also seen; for example, it appears that at least some sprite beads with persistent optical emissions form when a downward streamer head collides with an adjacent, preexisting streamer channel. We also analyze a variety of different mesospheric optical emissions, from time resolved elves and halos to complex, long duration sprite sequences.

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2. H - Waves in Plasma

3. (a) S-H/G2

4. I - Invited Paper, Program chair: Gerken, Pasko

5. No special instructions