

”Non-standard sprites at 1ms time resolution”

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In 1999 the University of Alaska Fairbanks deployed a 1-ms high speed imager to Wyoming to observe sprites above thunderstorms as part of the 1999 NASA Sprite Balloon Campaign [Bering et al, 2002, Geophys. Res. Lett. 29(5), 10.1029/2001GL013267]. During the night of August 17-18 (August 18 Universal Time), a thunderstorm over Nebraska produced many upper atmospheric optical events, with 26 sequences imaged using the high speed imager. The events covered a range of sprite types, and also some unusual examples, which will form the basis of this presentation. While the examples are unusual in that we have only one or few examples of each, they contain clues to sprite mechanisms. Previous work [Stenbaek-Nielsen et al, 2000, Geophys. Res. Lett. 27(23), 3829] has shown examples where new sprite tendrils are initiated from beads leftover from a previous sprite. In this presentation, a similar example is presented, where the new sprite tendril appears initiated from the upper end of an upward branch of the previous sprite. Two examples are presented of puffs forming on top of sprite branches, and subsequently the puffs rebrightening during the next halo occurrence approximately 60 ms later. Examples of long-duration (>50 ms) sprites will also be presented: some include multiple temporally-separate sets of downward moving tendrils, others include only one set of downward tendrils followed by long-duration beads. In one sprite, beads left at two different altitudes move towards each other and, upon reaching the same altitude, create a new carrot sprite. This occurs during continued lightning activity in the underlying thundercloud which is visible as Rayleigh-scattered light above the cloudtops. All of these examples point to additional processes occurring in sprites besides the conventional breakdown and streamer processes suggested in the past decade [Barrington-Leigh et al., 2001, J. Geophys. Res. 106 (A2), 1741; Liu et al., Eos Trans. Suppl. - Amer. Geophys. Union, 2002, 83(47), A11C-0108].