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Time-Lapse CCD Imagery of Plasma-Tail Motions in Comet Austin . . . .

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Introduction. The appearance of bright comet Austin 1989c1 in April-May of 1990 allowed us to test a new imaging instrument at the Joint Observatory for Cometary Research (JOCR): a 300mm lens/CCD system with interference filters appropriate for cometary emissions. This system lacks the spatial resolution of JOCR's "Comet Schmidt" (using 4"x5" glass plates as detector), but has the advantage that the data are in digital form and, being filtered, are much less susceptible to moonlight and bright sky. In addition, the ability to monitor activity in real time means that a night's observing sequence can truly be tailored to the comet's behavior. These factors came together on the night of May 21, 1990 with the observation of impressive activity in the plasma tail/ray system of comet Austin.

Instrumentation. Our optical system consists of the 300mm f/2.8 Nikon lens used by Parker, Gull, and Kirschner (1979) to conduct emission-line sky surveys. A set of interference filters is available for cometary work at JOCR, and has been described by Klinglesmith *et al.* (1990). The detector is a cooled Tektronics 512 times 512 CCD camera system built by Princeton Scientific Instruments, the entire system being mounted piggy-back on the JOCR 16-in Newt./Cass. telescope. The CCD field of view is 1.9 degrees square (good for inner plasma tail), and each pixel is of width 13.6 arcsec. The installation of this system at JOCR was largely the work of D. A. Klinglesmith during a sabbatical year at JOCR/NMIMT.

Observations of comet Austin. Klinglesmith and M. B. Niedner were on the mountain on May 21, and intended to obtain CCD imagery through the entire set of four available filters (H_2O^+, C_2, red and blue cont.) during a 2.5 hour run. However, the first H_2O^+(λ6205, FWHM=50A) exposure suggested to one of the authors (MBN) that a period of high plasma-tail activity, possibly disconnection of the entire tail, was beginning. We decided to dedicate the entire morning's run to H_2O^+ exposures, in the hope of resolving any event(s) in time. A series of 13 exposures was obtained; cf. Klinglesmith *et al.* (1990) for details.

Data Description, Generation of Movie. The 13 frames have been made into a time-lapse movie showing the evolution of the plasma tail. Specifically, we were able to follow at least two large-scale waves out through the main tail structure. During the sequence we saw two new tail rays form and undergo similar wave motion. Several condensations, possibly representing disconnected material, were seen to develop and move out along the tail ray with a velocity of about 60 km s^{-1}. It remains to be determined what solar-wind agents were associated with this activity, but it seems clear that the bending or "flapping" of the tail was caused by sharp changes in the solar-wind flow direction. We are continuing to work with this sequence as well as with several others generated on other nights.

References

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Parker, R., Gull, T. R., and Kirschner, R. P. 1979, NASA Publication SP--434, "An Emission--Line Survey of the Milky Way".