VARIABLE ACTIVITY AT COMET HALLEY MARCH 23-25, 1986: IUE OBSERVATIONS; L.A. McFadden, M.F. A'Hearn, U. Maryland, College Park, MD 20742, P.D. Feldman, Johns Hopkins Univ., Baltimore, MD 21218.

Ultraviolet (UV) emission bands of OH, CS, CO_2^+ and continuum reflectance in Comet Halley were measured with the International Ultraviolet Explorer (IUE) satellite during its 1985-86 apparition to monitor the variation in gases and dust as a function of heliocentric distance. Part of our acquisition and tracking protocol involved measuring a 432 arcsec^2 area over the center of brightness of the comet with the Fine Error Sensor (FES) which has spectral sensitivity between 0.38 and 0.65 μm. The FES is therefore sensitive to emission due to CN, C_2 and dust. These tracking observations have higher temporal resolution than the spectrometer camera exposures. During two US shifts on March 23-24 and 24-25, the magnitude of the comet brightened by a factor of 3.2 in 24 hrs. (Fig. 1). The flux of the emission bands of OH and CS increased in brightness at a rate dependent on the lifetime of the parent molecules. The CS (Fig. 2), which has a parent molecule with a lifetime of 300 s increased in abundance much more rapidly than the OH (Fig. 1) with a parent lifetime of about a day. The OH and dust curves are in phase with the FES indicating that C_2, which also has a long parent lifetime, is the dominant component in the FES curve. The ionization timescale for CO_2 must be less than a few hours which is the shortest interval between which changes in CO_2^+ were observed. The dust flux as measured by the continuum between 0.2940 and 0.2980 μm also follows the FES lightcurve (Fig. 2).

Upon examination of the FES flux during other observing runs, we can see that this event repeats itself, although this is the only time we observed both a minumum and maximum in flux. When we compare the time of this event with the lightcurve of Millis and Schleicher (1) we see that this is one of the markers in their lightcurve and that this event recurs every 7.4 days. The rate of change of the flux as seen in the FES on the 23-25 is very different from that seen on 18-19 March and the behavior of the molecular species is very different (Fig. 3). This event has been reported by Feldman et al. (2) and it occured during minimum activity of the event of the 23-25 described here. The 18-19 event was a transient outburst of short duration probably controlled by vaporization of CO_2 in a region about 50° from the 23-25 active area. 23-25 is the result of a long-lasting area of surface activity controlled by incident sunlight. These data indicate that comets can have regions of constant and transient activity and represent advances in our ability to measure the cometological process at different regions on a comet's surface (cometary geology).

References

(1) Millis, R.L. and Schleicher, D.G. (1986) Nature, 324, 646-649.
(2) Feldman, P.D. et al. (1986) Nature, 324, 433-436.

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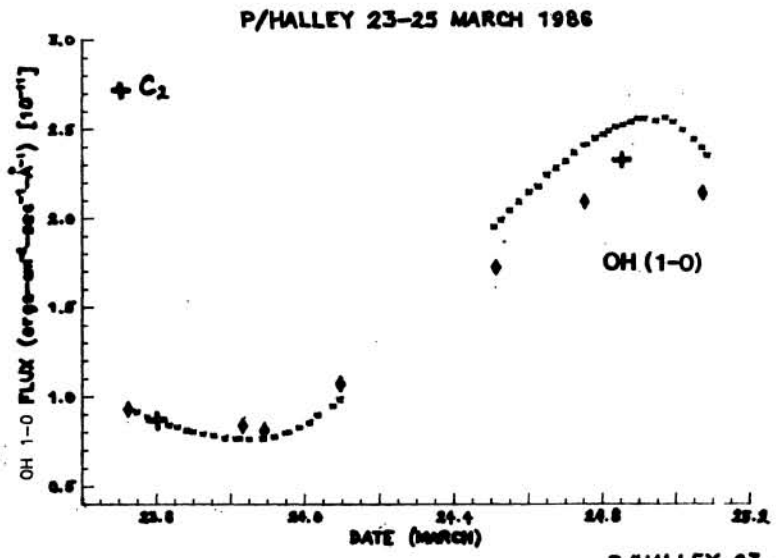

Figure 1:FES flux (x) and OH (1-0) band flux(♦) and 2 measurements of C_2 (+) made by the IUE on 23-25 March, 1986.

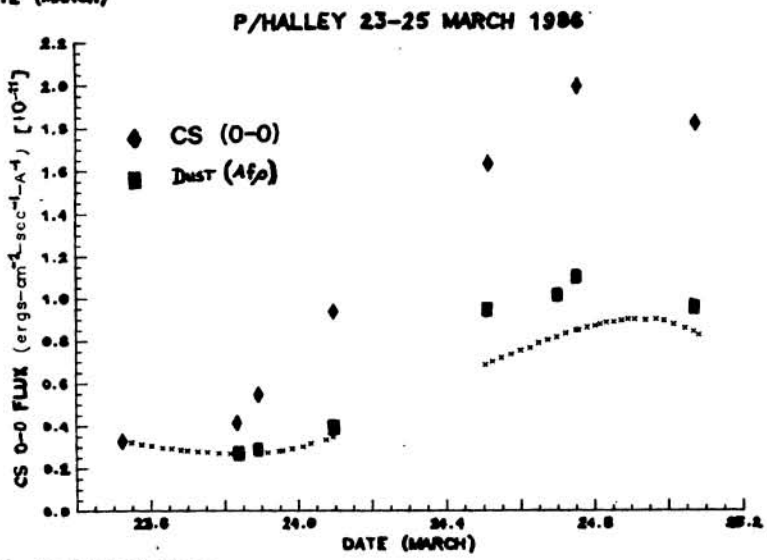

Figure 2: FES flux (x) dust flux and CS flux during active event on surface of comet Halley 23-25 March, 1986.

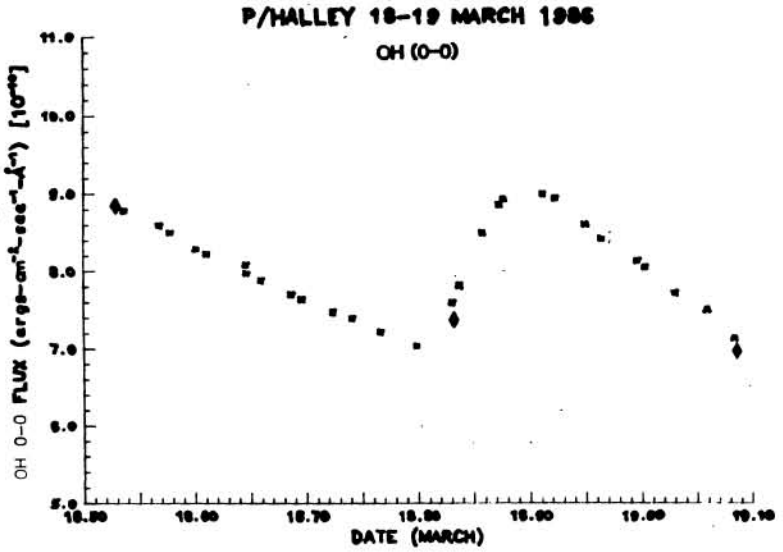

Figure 3:FES flux (x) and OH (0-0) band flux (♦) variations 18-19 March, 1986. Note expanded time and flux scale compared to figures 1 and 2.