# *NICMOS/HST Post-Perihelion Images of Comet Hale Bopp in Outburst*

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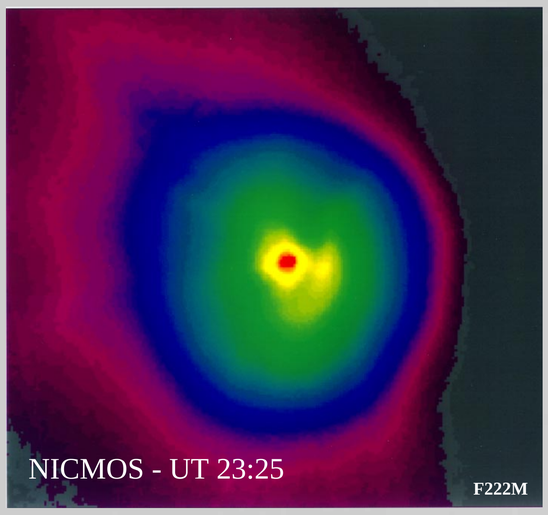
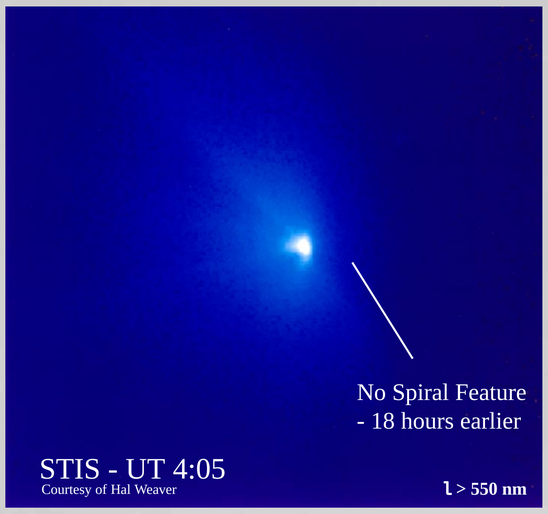
## Time Evolution UT Aug. 27-28, 1997

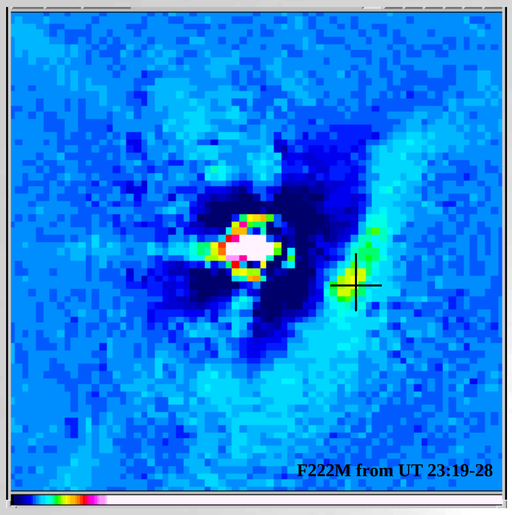


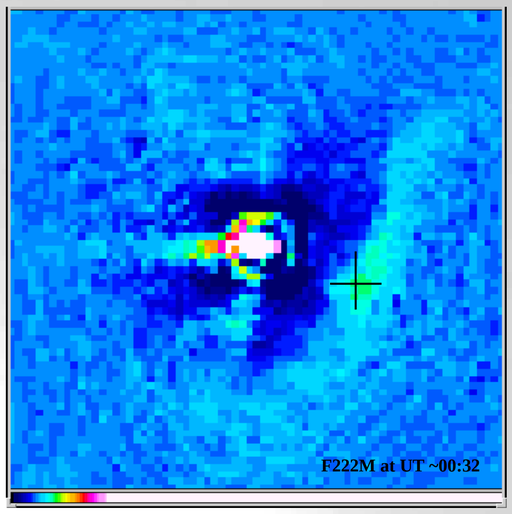




The NICMOS and STIS images have several linear features in common. The spiral arm feature which appears only in the NICMOS image is evidently a result of an outburst that occurred after the STIS image was taken (*left*). The NICMOS and STIS images are shown at the same scale (~17 x 15 arcsec) with North up and East to the left.

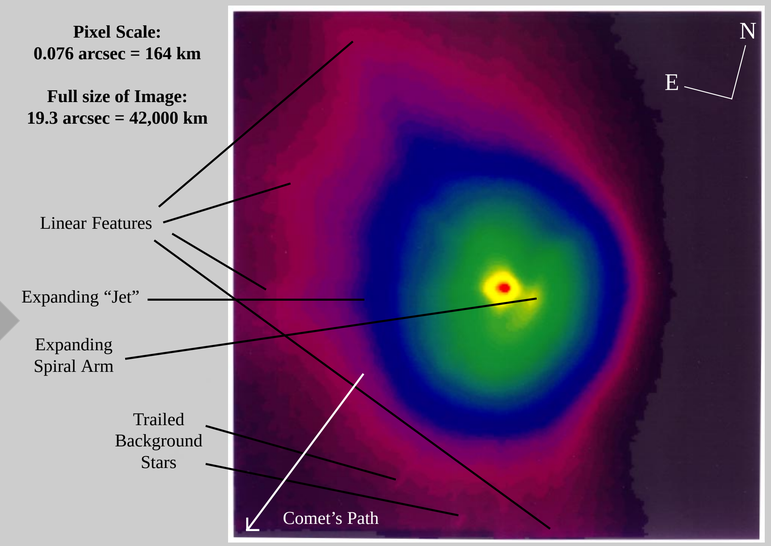
In order to enhance details such as linear features, the spiral arm and a "jet" emanating from the nucleus towards the left, unsharp masks were made. These masks were created by subtracting a smoothed image from each original. The spiral arm is seen to expand and diffuse with time. For reference, a cross is placed in the same position in each image near the peak of the spiral feature at a projected distance of ~2000 km from the nucleus (*below*).

Difference of two F222M exposures taken 65 minutes apart. White shows an increase of brightness with time; dark shows a decrease with time. The nuclear flux decreases by 10%.




**Unsharp Mask Images Displaying Spiral Arm and Jet Outbursts**
Images are 5.6 arcsec (12,200 km) on a side.




## *Comet Hale-Bopp in Outburst!*

Hale-Bopp imaged by NICMOS at 0.2 arcsec resolution, corresponding to ~440 km.

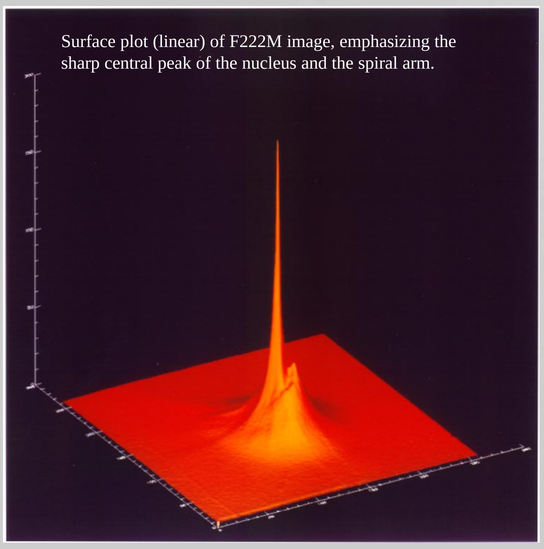
I. Outburst(s)
- -- Apparently not imaged by STIS 18 hours earlier.
- -- Two features
  - - one ~8 hours prior to our observation.
  - - one on-going during observation.

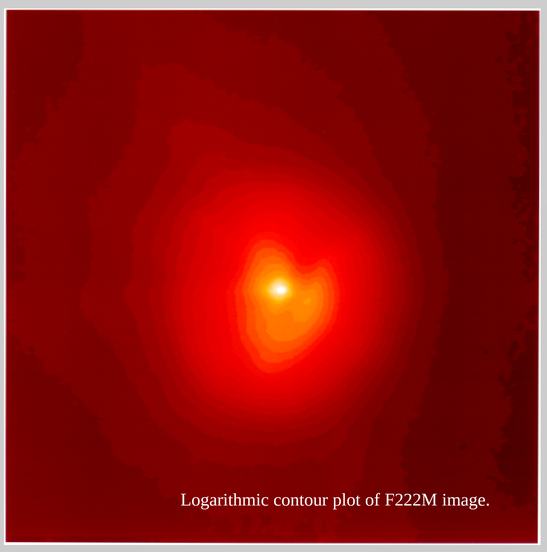
II. Time evolution
- -- Over 1.5 hours both features expand and diffuse.
- -- Unforeshortened expansion rate 80 m/s.

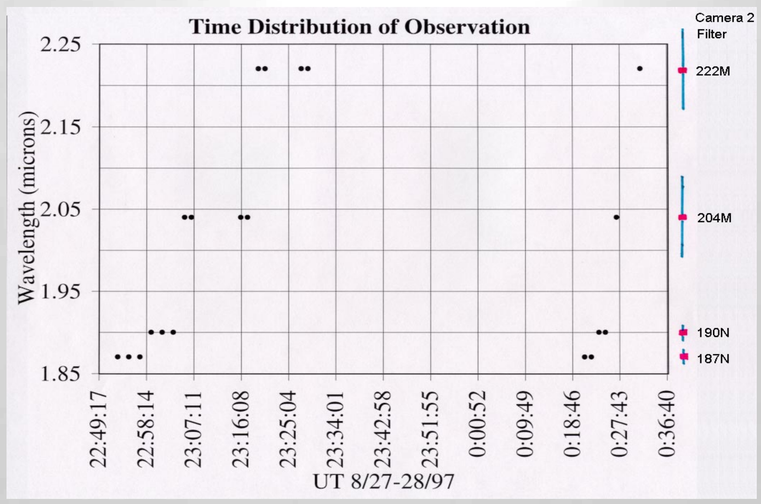
III. Linear structures (4)
- -- Apparently align with STIS observations.

IV. Chemical composition
- -- Water vapor sampled by F187N/F190N ratio.
- -- Water ice sampled by F204M/F222M ratio.

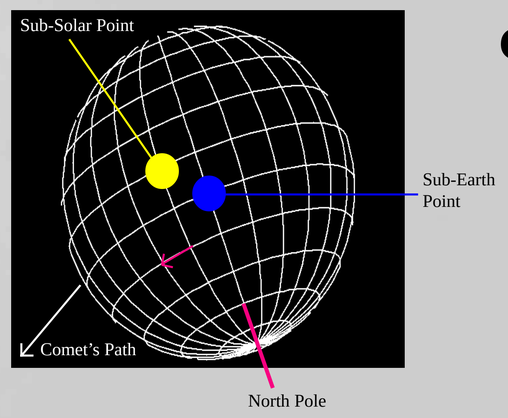
## Morphology



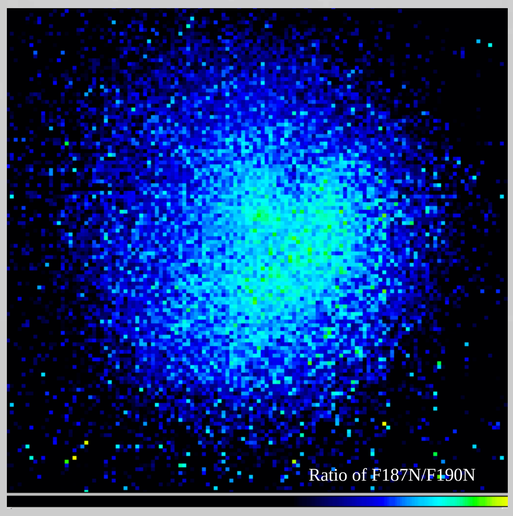

## Geometry

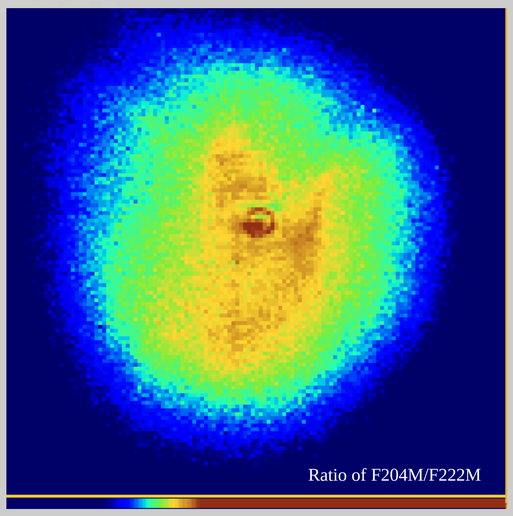



Earth Distance = 2.992 AU
Sun Distance = 2.486 AU
Phase Angle = 18.5 degrees

Assumed rotational pole position (Kidger, M.): 315,-46 ecliptic coord. (J2000)

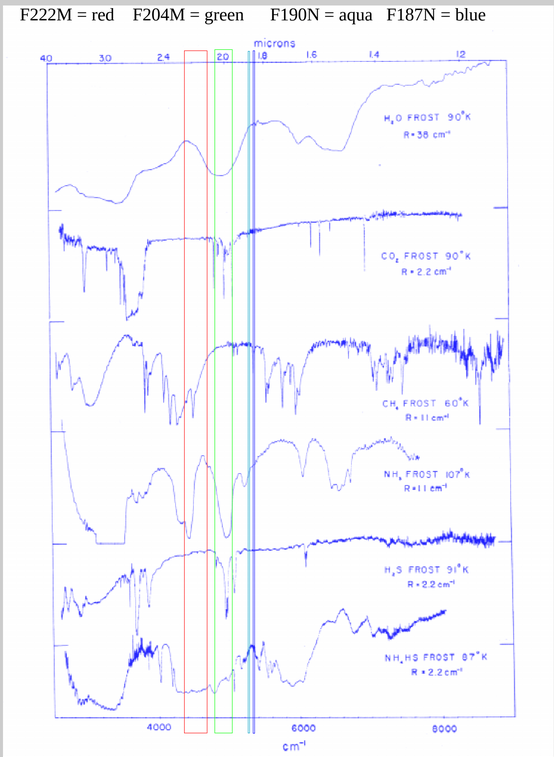
## Spatial Dependence of Water Vapor and Water Ice




Laboratory spectra of solid frost features that may be seen in comets (*right*). NICMOS filters used for these observations are indicated. The F187N and F190N filters were chosen to detect a possible water vapor emission feature. The ratio of the F187N to F190N images taken at the earlier epoch is shown above with a color scale varying from 0.9 to 1.1. There is evidence for subtle spatial variations in the ratio.

The F204M and F222M filters were chosen to detect a possible water frost absorption feature in Hale-Bopp. The ratio of the F204M to F222M images taken at the earlier epoch is shown above with a color scale varying from 0.9 to 1.1. There is clear evidence for spatial variations in this water frost feature. The absorption is strongest at the nucleus, but is also seen in the extended coma more than 4000 km from the nucleus.




Adapted from Larson, H. & Fink, U. 1977, *Applied Spectroscopy*, 31,386.