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ASTRONEWS

What's new with Hale Bopp?

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The comet Hale-Bopp has provided a great opportunity to astrophysicists. It is bright and it has been available for observations for a long period of time. A good number of large telescopes all over the northern hemisphere have been deployed for observations of this comet. Within a month of its discovery came the first result that the comet was quite active even when it was beyond Jupiter. Jets of gas and dust continued to stream out one after the other. This created the suspicion that the magnitude estimates may turn out to be only the limits rather than the actual values. The anxiety, so created disappeared only when the comet reached the visibility limits in late 1996. By the time it reached the perihelion on April 1, it was not fooling around anymore and kept up the promise of a 'civilized comet', the one that could be located without a finding chart. As is well known, the magnitude after the perihelion passage, would be slightly higher than the estimated value.

The two-tail structure was first noticed a few months prior to the perihelion. The gradation in colour from blue of the ion tail to yellow of the dust tail was quite conspicuous. A simple binocular could easily resolve the two.

Interestingly, just after the perihelion, there was a flare and the associated storm on the sun due to which a temporary increase in the solar wind particle density can occur. It would be extremely interesting to find the related effects on the tail, especially on the ion component. The solar and cometary physicists are (as on April 26th) eagerly looking forward to monitoring the changes. The ion tail has grown to about 15 degrees in the sky and is expected to get disrupted after the solar storm. On the other hand, the dust tail which grew to a full length of 45 degrees offered a glorious sight in the evening sky. The new moon at the time of perihelion enhanced the spectacle. In the middle of April quite suddenly, a third tail, a sharp yellow one, showed up. This was attributed to the presence of the neutral sodium component. Comets Halley and Hyakutake both had shown this type of tail structure.

Last year comet Hyakutake made news for it was emitting soft X-rays not a known cometary trait until then. Hale Bopp has followed suit. The LECS instrument onboard BeppoSAX spacecraft provided the news for the Netherlands Team. (Lisse *et al.*, 1996, Science, 274, 205). A thermal bremstrahlung model for 0.36 keV X-rays compares well with that of Hyakutake. This implies that the luminosity of the lines of carbon or oxygen in X-rays is less than 10 per cent of the continuum.

Results on the coma structure and rotation of the nucleus of the Hale Bopp have started appearing already. A change in the direction of rotation during February 1997 has been observed.

The list of molecules detected from spectroscopic investigations is ever increasing – H_2O, HDO, OH H_2O^+, CO, CO_2, CO^+, HCO^+, H_2S, SO, SO_2, H_2CS, OCS, CS, CH_3OH (Plenty of alcohol!) H_2CO, HCOOH, CH_3CN, HNC, HC_3N, HNCO, CN, NH_3, NH_2, NH_2CHO, $NHCH_4$, C_2H_2, C_2H_6, C_3, C_2, Na and many isotopes! The detection of deuterated water (HDO, heavy water) has provided a first measure of D/H ratio. Meir (University of Hawaii) and his team calculated HDO production rate of 4×10^{26} molecules/sec. The production rate of water is 2×10^{30} making the HDO/H_2O ratio as 2×10^{4}. This makes Hale Bopp a "normal comet", akin to Halley and Hyakutake.

With more than 3000 images on the web sites, the comet Hale Bopp is providing a wealth of information on the various aspects of the cometary science. With almost 300 tons of cometary material falling onto the earth every year and with the detection of frozen water on moon and mercury (obviously the sources have to be comets) the comets are believed to be promoters of life on earth. Although the aminoacids themselves have not been detected on any comet so far, their probable progenitors have been detected in the interstellar material. Will the studies of the Hale Bopp answer some of these questions? Will they address the issues of the fragile nature of cometary nuclei, their composition, the sources of jets and other structural peculiarities? Let us wait and see.

(Based on information from various web sites on comet Hale Bopp)