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Detection of CN Emission From (2060) Chiron . . . . . E. Bowell

Spectrophotometric observations of (2060) Chiron were obtained in January 1990 using the Ohio State University Longslit CCD Spectrograph on the 1.8-m Perkins reflector at Lowell Observatory. The primary goal of these observations was to look for subtle differences in color between Chiron and its surrounding coma, and to search for possible absorption or emission features in Chiron's spectrum. Chiron started to exhibit comet-like behavior in late 1987, when, at a heliocentric distance of 13 AU, it slowly brightened more than expected for an asteroid approaching the Sun. According to Meech and Belton (*Astron. J.* **100,** 1323-1338, 1990), this activity peaked in January 1989, and has since been slowly declining. They, along with Luu and Jewitt (*Astron. J.* **100,** 913-932, 1990), and West (*The Messenger* No. 60, 57-59, 1990) all noted a substantial coma around Chiron, but did not report gaseous emission.

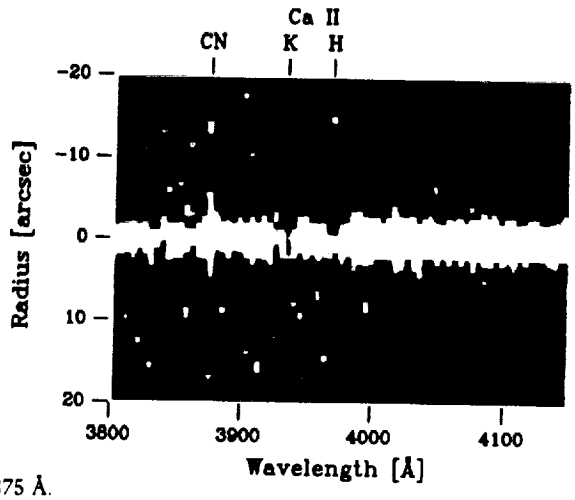

Fig. 1. A portion of the two-dimensional spectral image of Chiron resulting from the average of seven individually reduced exposures from which Chiron's reflected solar continuum has not been subtracted. The spatial scale along the slit is 0.75 arc sec per pixel, and the dispersion is 4.555 Å per pixel. A 3 by 1 pixel smoothing function, equivalent in extent to the characteristic seeing of 2 arc sec and weighted in the form [0.25, 0.50, 0.25], has been applied to the image in the direction parallel to the slit, reducing the apparent level of background noise while not affecting the spectral resolution. Visible are the CaII H and K absorption lines in the solar continuum, and the extended CN (0-0) band centered at 3875 Å.

Our observations were obtained on 1990 January 29 and 30 UT, when Chiron was at a heliocentric distance of 11.3 AU. They consisted of several 20-minute exposures taken in each of three overlapping spectral regions, giving complete coverage from 3300 to 10000 Å, with a dispersion of 4.5 Å per pixel. We identified the presence of the CN (0-0) emission band, centered near 3875 Å at the 5-σ level (see the figure above). This faint feature can be traced about 7 arcsec (50,000 km) on both sides of Chiron along the E-W orientation of the slit. Our detection of CN proves Chiron's cometary nature and breaks the record heliocentric distance for cometary gaseous emission.

The presence of CN in Chiron's spectrum can be interpreted either as the result of continuous outgassing or of a recent outburst. Photometric observations by Luu and Jewitt (*op. cit.*) show that an outburst of dust was occurring at the time of our January observations.

Spectroscopic observations of Chiron at other times have failed to show any emission features, supporting the idea that gaseous emission is linked directly to cometary outbursts on Chiron. Our observations suggest that the outgassing seen in Chiron is primarily being driven by isolated outbursts of a volatile species such as CO_2 or CO from a rather small fraction of Chiron's surface.

Reference: Detection of CN Emission from (2060) Chiron. S. J. Bus, M. F. A'Hearn, D. G. Schleicher and E. Bowell. (1991). *Science* **251,** 774-777.

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