# SPECTRAL CLASSIFICATION OF COMETS

J. Bouska

ABSTRACT

Up to now a few hundred of spectra of several tens of comets have been obtained at different observatories over the whole world. On the one hand, there are high dispersion spectra photographed with slit spectrographs attached to large telescopes, and on the other, small dispersion spectra obtained by means of objective prisms. These objective prism spectra, showing the principal emission bands only, are known for a considerable number of comets, and its appearance is usually described verbally.

It seems therefore to be useful to introduce a classification of the spectra of the cometary heads. It is evident that it is impossible to put into practice a similar classification as that used for stellar spectra. The classification of cometary spectra could rather be like the classification of meteoric spectra.

The cometary spectra show mostly two components:

(C) continuum which is the solar spectrum reflected on the dust particles present in the cometary coma, and

(E) emission bands (CN, $C_2$, $C_3$ and some others) connected with the intrinsic radiation of molecules in the cometary atmosphere.

The apparent intensity of these components may be weak (1), normal (2) or strong (3). In some exceptional cases continuum or emission bands may be absent (0). Consequently, the classification may be as follows:

| Continuum | Emission Bands | Apparent Intensity |
|---|---|---|
| C0 | E0 | absent |
| C1 | E1 | weak |
| C2 | E2 | normal |
| C3 | E3 | strong |

In most cometary spectra the CN (0, 0) band is dominant, in others the Swan bands of $C_2$ (mostly the $\Delta v = +1$); this may be expressed by the following symbols:

c — cyanogen bands dominant,
s — Swan bands dominant.



https://doi.org/10.1017/S0252921100034278 Published online by Cambridge University Press

The presence of the sodium doublet $D_{1,2}$ observed sometimes in cometary spectra at the heliocentric distance $r \leqslant 1$ AU may be denoted by the symbol n.

Metallic lines are observed exceptionally, for instance in the spectra of Sun-grazing comets. Such spectra may be denoted by the symbol M.

The shape of the cometary spectra depends, of course, on the comet's heliocentric distance and this distance must therefore be an inseparable component of the classification of the cometary spectra. The comet's heliocentric distance is to be added (with the sufficient accuracy of 0.1 AU) to the spectral type of cometary spectrum. The heliocentric distance $r < 0.1$ AU, for instance for Sun-grazing comets, may be denoted as 0.0.

The following examples illustrate the proposed classification:

| | |
|---|---|
| C3E1c(1.7) | Comet Kohoutek 1970 III. Very strong continuum, weak emission bands, CN (0.0) dominating. Heliocentric distance $r = 1.7$ AU [1]. |
| C3E2c(0.6) | Comet Arend-Roland 1957 III. Strong continuum, normal intensity of emission bands, CN (0.0) dominating; $r = 0.6$ AU [2]. |
| C2E2c(1.8) | Comet 1942 IV. Normal intensity of continuum and emission bands, CN (0.0) dominating; $r = 1.8$ AU [3]. |
| C1E2s(1.2) | Comet Ikeya-Everhart 1966 IV. Weak continuum, normal intensity of emission bands, Swan band $C_2$ ($\Delta v = +1$) dominating; $r = 1.2$ AU [4]. |
| C1E3n(1.0) | Comet Mrkos 1955 III. Weak continuum, strong emission bands, of which CN (0.0) dominates, Na-emission ($D_{1,2}$) present; $r = 1.0$ AU [5]. |
| C2E0(2.7) | Comet Kohoutek 1970 III. Continuous spectrum only, emission bands absent; $r = 2.7$ AU [6]. |
| C3M (0.0) | Comet Ikeya-Seki 1965 VIII. Very bright continuum with many metallic emission lines (iron, nickel, chromium, and also D-lines of natrium and K and H lines of ionized calcium); $r < 0.1$ AU [7]. |

The proposed classification may be very important not only for the short description of the cometary spectrum but it may also be very useful for communicating the shape of a cometary spectrum by means of the international astronomical telegraphic code.



https://doi.org/10.1017/S0252921100034278 Published online by Cambridge University Press

## REFERENCES


Bouska J., Mrkos A., Publ. Astr. Inst. Univ. Prague No. 65 = Acta Univ. Carol. Prague 12, No. 1, 65 (1971).

Bouska J., Hermann-Otavsky K., Bull. Astr. Inst. Czech. 9, 79 (1958).

Swings P., Haser L., Atlas of Representative Cometary Spectra, Plate XXa-5. Liege (1956).

Bouska J., Bull. Astr. Inst. Czech. 19, 179 (1968).

Bouska J., Astronom. Nachr. 284, 161 (1958).

Kohoutek L., I. A. U. Circ. No. 2256 (1970).

Marsden B. G., Sky Telescope 30, 332 (1965).




https://doi.org/10.1017/S0252921100034278 Published online by Cambridge University Press