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# Recent Advances in Cometary Spectroscopy

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## Abstract

Comets represent some of the least altered bodies left over from the formation of the Solar System. Thus, understanding their compositions is important to constrain models of the conditions in the solar nebula. The first spectra of comets were obtained in ∼1865, though many of the detected species could not be identified at that time. Since those first spectra, many improvements have been made in laboratory studies so that most of the species seen in cometary spectra today can be identified.

The spectra of comets observed from the ground are composed of three parts: 1) the comet's composition creates a molecular emission-line spectrum (often the result of resonance fluorescence); 2) a solar spectrum in absorption resulting from reflection of sunlight by the dust is superposed on the cometary spectrum; 3) spectral features are imposed on the other two parts from the Earth's atmosphere (telluric features) .

Most of the cometary emissions are the result of transitions from molecules. In the optical region of the spectrum, most of these molecules are fragment species (OH, NH, CN, $C_3$, $C_2$, $NH_2$, CH, etc.) and not parents. Some of the parents are not yet well determined. In the IR and radio, mixtures of fragments and parents can be observed (see [3]).

The molecular spectrum is quite dense. Thus, at low spectral resolving power only whole bands can be observed. In the past few decades, both optical (e.g. [1]) and IR spectrographs (e.g. [2], [4]) working at high spectral resolution have been developed, allowing studies of individual lines. This allows for studies of isotopes ratios ([5]), rotational temperatures and formation mechanisms.

Comets generally cover large areas on the sky with very low surface brightness. Thus, one of the challenges for optical and IR spectra is the small amount of light that is imaged down the slit of a typical spectrograph. As modern spectrographs and detectors have improved, ever fainter comets have become observable and higher spectral resolution can be used. This has allowed for observations of comets over a wider range of heliocentric and geocentric distances.

In this talk, I will review some of the advances in cometary spectroscopy and will show examples from several instruments.

## References

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