10,603 A the scale is determined with interferometers, beyond that point with gratings by coincidence of orders. The wave lengths show excellent consistency when tested by the combination principle. Eye estimates of intensity are given for disk and spot; striking differences often appear between these. One-quarter of the lines are known to be solar, one-third telluric, and of the remainder, all very weak lines, probably more than half are telluric but difficult to classify. Four criteria, singly or in combination, are used for this classification. Through structural analysis of laboratory spectra, nearly two-thirds of the known solar lines are identified, with numerous further identifications in sight. Faint lines not yet observed in the laboratory are often clearly recognized in the sun through such analysis. Aside from lines of *Ca* II and *H,* multiplets of *Si* and *C* are the most conspicuous solar features in the infrared. Excitation potentials are given for identified lines. Vibrational transition and isotopic constitution are assigned for all lines of atmospheric oxygen. A list of chromospheric lines is appended. An explanatory text will accompany the table.

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THE PROBLEM OF POSSIBLE MOLECULAR IDENTIFICATION FOR INTERSTELLAR LINES

By Andrew McKellar

(*Abstract*)

Recent spectrographic observations by W. S. Adams at the Mount Wilson Observatory combined with identifications proposed by the writer have shown that several sharp lines of interstellar origin in the spectra of distant stars are due to transitions from the lowest energy states of the diatomic molecules *CH* and *CN*. Thus not only has it been shown that diatomic molecules

exist in interstellar space but also the presence there of the hitherto undetected elements hydrogen, carbon, and nitrogen has been demonstrated.

Eleven spectral lines which are due to absorption by material in interstellar space still remain unidentified. All these lines were discovered by the Mount Wilson observers. Four are very sharp, having the same characteristics as the interstellar lines so far identified as being due to atoms and diatomic molecules. The other seven are much more diffuse features. While the writer has made a careful study of the available data on over thirty of the more common diatomic molecules, no significant coincidences with the above eleven lines have appeared. However, several interesting points have been noted and they are enumerated below.

The four as yet unidentified sharp lines (λλ4232.58, 3957.74, 3745.33, and 3579.04) happen to be so spaced in wave-length (or wave-number) units that it is plausible that they may all be due to the same diatomic molecule. This possibility is further enhanced by the observation of Adams that they apparently behave similarly from star to star. If we assume that the four lines are the "ultimate" lines of four bands of a hypothetical molecule, forming a v',0 progression, particularly a progression beginning with the 0,0 band, the vibrational constants of the upper electronic state of this molecule concerned in the absorption can be immediately calculated. The result is:

$$\omega_e = 1863 \text{ cm}^{-1}$$
$$x_e\omega_e = 115 \text{ cm}^{-1}$$
$$y_e\omega_e = 2.6 \text{ cm}^{-1}$$

These do not correspond exactly to any molecular state as yet studied. However, on examining lists of molecular constants, it is found that these constants more closely approximate those of diatomic hydride molecules than of any others. In view of this and of the well-known excessive cosmical abundance of hydrogen, it appears that if the four sharp lines are due to a diatomic molecule it is probably a hydride molecule.

The diffuse interstellar lines discovered by Merrill and his co-workers are several angstrom units in width. Also from Adams' results on the interstellar *CN* lines, it can be calculated that the "Rotational" temperature of interstellar space is about 2° K. Taking these facts into consideration it is found that if the diffuse lines are caused by interstellar diatomic molecules, they must be neither very heavy nor very light ones but molecules with intermediate moments of inertia (of the order of that of *SiN*). If light diatomic molecules were responsible the features would be somewhat wider than those observed and would likely have been resolved into individual lines. If the molecules were much heavier than *SiN*, the absorption features caused by them would be considerably narrower than the observed lines.

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THE STRUCTURE OF THE λ 3883 *CN* BAND IN THE SPECTRUM OF COMET CUNNINGHAM (1940*c*)

By Andrew McKellar

(*Abstract*)

During the months of December 1940 and January 1941, nine spectrograms of the nucleus of Cunningham's Comet were obtained at Victoria. These were secured with an instrument which gave considerably greater spectral purity than it has been usually possible to use for cometary spectra, the dispersion at λ 3880 being 57 A/mm and the projected monochromatic image of the slit being 0.8 A.

Both micrometer measurements and intensity measurements on several of the plates have revealed definite structure in the λ 3883 sequence of *CN* bands. While evidence of some such structure has been found previously for seven other comets from Daniel (1907) to Achmaroff-Jurloff-Hassel (1939), it is thought that for none of these have so many maxima and minima