state and the first excited state of such systems. An occasional inversion of the two levels (spin 7/2 or 9/2 in the ground state) is not unlikely and would not prejudice the occurrence of isomerism.

1 W. Elsasser, J. de phys. et rad. 5, 625 (1934).
2 E. P. Wigner, Phys. Rev. 51, 947 (1937).
3 W. H. Barkas, Phys. Rev. 55, 691 (1939).
4 M. G. Mayer, Phys. Rev. 74, 235 (1948).
5 E. Feenberg and K. C. Hammack, Bull. Am. Phys. Soc. 23, No. 7, 10 (1948).

Comparison of Atmospheric Methane Content above Flagstaff, Arizona, and Columbus, Ohio

ARTHUR ADEL
Arizona State College, Flagstaff, Arizona
November 29, 1948

A CONTINUOUS, high resolution map of the infra-red solar spectrum, 2 microns to 14 microns, was obtained by the author in 1940, at the Lowell Observatory. The experiment was performed with a 2400-line-per-inch grating in a Pfund type, automatically recording spectrometer of aperture $f{:}5$ and focal length of 30 inches. That portion of the map between 7 microns and 14 microns has been published, with a reference to the unpublished segment between 2 microns and 7 microns.[1]

Early in 1948, M. Migeotte[2] identified absorption lines of the methane fundamentals ν_3 (3.3 microns) and ν_4 (7.7 microns) in the solar spectrum map recorded at Flagstaff.
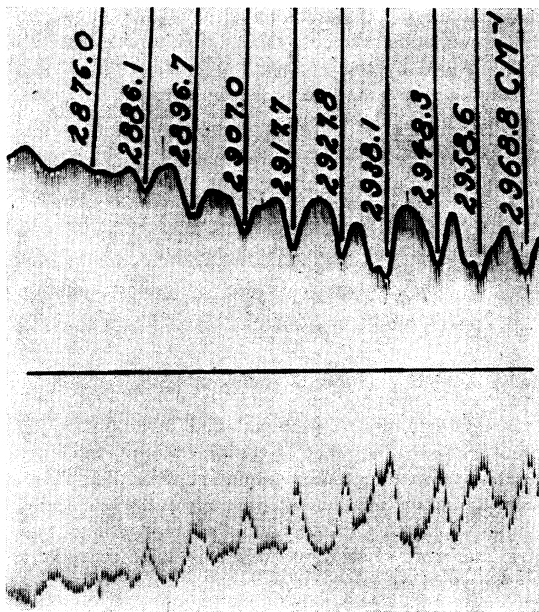

FIG. 1. The grating solar spectrum near 3.4 microns, observed at Flagstaff, Arizona, on the morning of October 28, 1940. It shows ten lines in the P-branch of ν, of methane (CH_4). Reproduction of the original record of galvanometer deflection versus grating position.

The fundamental ν_3 (3.3 microns) is clearly resolved in the unpublished portion of the Flagstaff map and it serves importantly in drawing a comparison between the amounts of methane above Flagstaff and Columbus. ν_3 is far superior to ν_4 for the purposes of such a comparison, because of the much heavier absorption by water vapor at 7.7 microns and the far greater water vapor content of the atmosphere over Columbus relative to Flagstaff.

Figure 1 shows ten lines in the P-branch of ν_3 of methane as observed in the solar spectrum at Flagstaff on the morning of October 28, 1940. The detailed agreement between this curve and the one obtained by Migeotte[2] is remarkable. The central intensities of the latter do not exceed those of the former by as much as one might have expected in view of the fact that the work at Columbus was done with a 7200-line-per-inch grating. It is significant that the fractional energy absorption is closely the same for the two spectra, thus indicating a widespread and uniform distribution of methane above the earth.

1 Arthur Adel, Astrophys. J. 94, 451 (1941).
2 Marcel Migeotte, Phys. Rev. 73, 519 (1948); Astrophys. J. 107, 400 (1948); Phys. Rev. 74, 112 (1948).

The Isotopic Constitution of Ytterbium

RICHARD J. HAYDEN, DAVID C. HESS, JR., AND MARK G. INGHRAM
Argonne National Laboratory, Chicago, Illinois
December 8, 1948

THE isotopic constitution of ytterbium was first investigated by Aston.[1] Using anode rays from ytterbium bromide, he observed isotopes at masses 171, 172, 173, 174, and 176 and estimated their abundances photometrically. Later Dempster[2] using his Tesla spark ion source found isotopes at masses 168 and 170. He gave estimates for the abundances of these two isotopes but not for the abundances of the other isotopes. Dempster's figures for 168 and 170 and Aston's values for the other isotopes, corrected for the presence of the lighter isotopes, are given in the first row of Table I. In 1941 Wahl[3] investigated ytterbium using careful photometric mass spectrographic methods. His results are given in the second row of Table I. He did not observe the 168 isotope and so he assumed Dempster's value in his calculation of percentages. He did not quote limits of error but he did give his mean mass, uncorrected for packing fraction, as 173.068±0.006. This would indicate that he believed his abundance ratios good to 1 percent.

Because of the historical unreliability of photometrically measured isotopic abundances, an electrometric determination seemed desirable. The ion source used was a tungsten surface ionization filament similar to that pre-

TABLE I. Isotopic abundances (percent) of the ytterbium isotopes.

Investigator	168	170	171	172	173	174	176
Aston and Dempster	0.06	2	9	23	17	37	12
Wahl		4.21	14.26	21.49	17.02	29.58	13.38
Authors	0.140	3.034	14.34	21.88	16.18	31.77	12.65
	±0.002	±0.030	±0.14	±0.22	±0.16	±0.32	±0.13

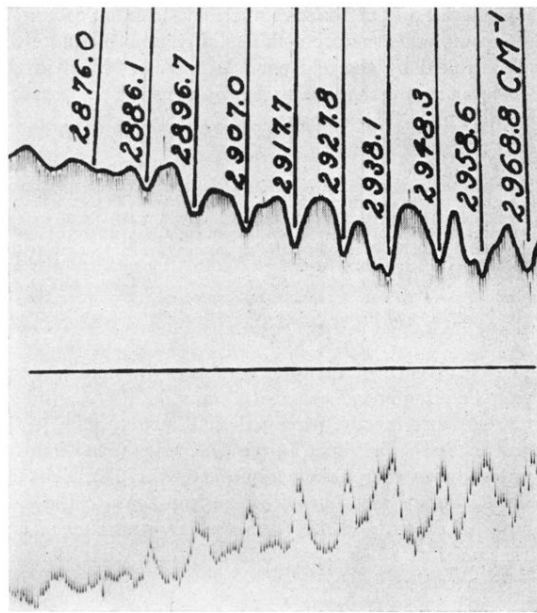Fig. 1. The grating solar spectrum near 3.4 microns, observed at Flagstaff, Arizona, on the morning of October 28, 1940. It shows ten lines in the P-branch of ν, of methane (CH₄). Reproduction of the original record of galvanometer deflection *versus* grating position.