TABLE I. Emulsion characteristics.

Designation	Old type*	New type**
Emulsion thickness	40 μ	24 μ
Emulsion weight	5.4 mg/cm²	7.2 mg/cm²
Percentage gelatin	56	27
Percentage silver halide	44	73

* Characteristic of Eastman Emulsion No. 276,296.
** Characteristic of Eastman Emulsion No. 329,489.

emulsion. The photographic density of the images produced by delayed development, D_t, and of the control developed immediately after the exposure, D_0, were measured on a recording densitometer. The fractional loss of photographic density as a function of the period of delayed development is exhibited in Fig. 1. The data shows that fading takes place in both emulsions, but is less pronounced in the newer type of high silver halide content.

Since the density is an integration of the blackening produced by the individual alpha-particles, variations in either the length, grain size, or grain spacing of the individual tracks can be anticipated after prolonged delay in their development. Photo-micrographs of the tracks (Fig. 2) show that alterations of this character are produced, the deterioration depending on the emulsion type and the extent of delayed development. It is noteworthy that the tracks are completely obliterated in the emulsions of low silver content if development of the latent image is delayed beyond 5 days, whereas in the improved plates the track is still recognizable after a delay period of 20 days.

These studies indicate that the abundance of stars in emulsions exposed at high elevations may have been underestimated as a result of the fading of the latent image of the multiple tracks in disintegrations produced during the initial stages of the cosmic-ray exposure. In the new type emulsion the exposure can probably be prolonged for 20 days without appreciable loss in the total track count. Further experiments are in progress on the rate of fading as a function of the energy and the relative flux of the alpha-particles.

[1] H. Yagoda, Am. Mineralogist **31**, 87 (1946).
[2] M. Blau, Sitz. Akad. Wien, Math.-Naturw. Klasse, Abt. 2A **140**, 623 (1931).
[3] J. Lauda, *ibid.*, Abt. 2A **145**, 707 (1936).
[4] G. P. S. Occhialini and C. F. Powell, Nature **159**, 186 (1947).

Hyperfine Structure and the Nuclear Spin of U^{235}*

O. E. ANDERSON AND H. E. WHITE
University of California, Berkeley, California

May 22, 1947

THE hyperfine structure and isotope shift in the arc lines of uranium have been studied using Fabry-Perot etalons with a resolving power of 500,000. The source was a liquid-air cooled hollow cathode tube into which was placed a 50-mg piece of metallic uranium with the isotope 235 considerably enriched. While many of the arc lines in the visible region show isotope shift, only λ5915 and λ6926, throughout the range of 4000 to 8500A, show resolvable and measurable hyperfine structure. λ5027

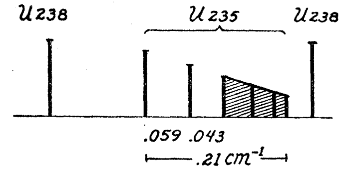

FIG. 1. Flag pattern in the hyperfine structure of U^{235}.

shows a very large isotope shift of 0.426 cm^{-1} or 0.108A. Since this line showed no hyperfine splitting of any kind, it was used to check the relative intensities of the two components due to the two isotopes 235 and 238 of the enriched sample.

Using 6-mm etalon spacers, the two components of λ5027 are so sharp and well separated that this line lends itself quite well to relative abundance measurements by either photographic or direct reading photo-voltmeter methods. The photographic method was used in this experiment to compare relative intensities with relative abundance. Agreement to within one percent of the values known from other reliable data is well within the accuracy expected by the photographic method.

Using J-values supplied to us from other sources,[1] as 6 and 7 for λ5915, the relative intensities of the components were studied. The flag pattern in the photographs shows three clearly resolved components as indicated in Fig. 1. Knowing the relative abundance of the two isotopes, and hence the relative energies falling into the two isotope patterns, a reasonably good determination of the nuclear spin I can be made by comparing the 238 sharp component with the first component of the flag pattern. This turned out to be more reliable than a comparison of the relative intensities of the lines within the hyperfine structure pattern or a comparison of their relative intervals.

Assuming the J-values of 6 and 7, intensity measurements indicate $I=5/2$, or $7/2$. The over-all width and the relative intensity of the tail of the pattern favor the lower value of $I=5/2$.

* This report is based on work performed under Contract No. W-7405-eng-36 with the Manhattan Project at the Los Alamos Scientific Laboratory of the University of California.
[1] C. C. Kiess, C. J. Humphreys, and D. D. Laun, J. Opt. Soc. Am. **36**, 357 (1946).

The Concentration of He^3 in the Liquid and Vapor Phases of He^4*

HENRY A. FAIRBANK AND C. T. LANE
Sloane Physics Laboratory, Yale University, New Haven, Connecticut

AND

L. T. ALDRICH AND ALFRED O. NIER
Department of Physics, University of Minnesota, Minneapolis, Minnesota

May 21, 1947

IT is known[1] that helium contains a stable isotope of mass 3 and that this isotope has an abundance ratio of approximately 1.3×10^{-6} in atmospheric helium and 1.6×10^{-7} in helium derived from natural gas.[2] In order to obtain information on the possibility of separating this isotope with the use of liquid helium, we have studied the