VII. MAGNET LABORATORY RESEARCH

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A. THE HYPERFINE STRUCTURE OF THE RESONANCE RADIATION OF MERCURY

After our first successful observations almost a year ago, we experienced a variety of difficulties which have only recently been completely overcome.

The main points that must be watched are: preventing excessive gaseous impurities in the resonance lamp, avoiding the deposition of mercury near the windows of the resonance lamp, and providing for the cooling of the arc lamp if a broad or reversed line is radiated. When proper precautions were taken regarding these points, good results were consistently obtained.

An automatic recording device was developed by connecting the horizontal deflecting terminals of a dc oscilloscope to the terminals of a shunt through which the magnet current passes, and connecting the vertical deflecting terminals to the output of the photomultiplier. A curve obtained with a sample containing natural and radioactive mercury is shown in Fig. VII-1.

A first attempt to produce sufficient Hg^{195} for magnetic scanning was unsuccessful.

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B. QUADRUPOLE MOMENT OF Na^{23}

We have computed the sign of the nuclear electric quadrupole moment to be expected for the sodium nucleus on the basis of the following assumptions: (a) zeroth-order central-field approximation and (b) three protons in a $(d_{5/2})^3$ configuration with total resultant angular momentum equal to 3/2. The result was identically zero. This is in disagreement with our rather large experimental value of $(+ 0.12 \pm .07) \times 10^{-24}$ cm^2.

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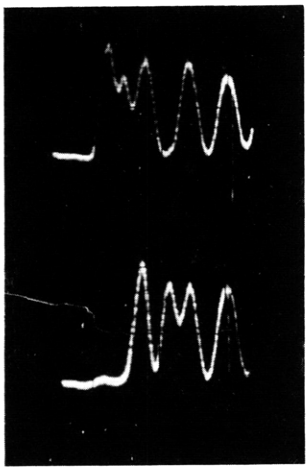

Fig. VII-1

Automatically recorded curve showing the hyperfine structure of a sample of mercury.