$$\Delta E_p \approx 2\sqrt{\ln 2}\, Q_{2p}\left[\frac{\hbar\sqrt{Q_{2p}}}{6\pi Ze^2\sqrt{m}}\right]^{1/2}$$

and the half-width of the distribution with respect to the angles between the directions of the two protons is $\Delta\theta \approx 2\sqrt{3/Q_{2p}}$ (MeV). If a centrifugal barrier is also present, for the single protons emitted from the shell with orbital angular momentum ℓ, the unpairing of the biprotons occurs either under the barrier, at a distance $r_0 = \hbar(m\epsilon_0)^{-1/2}[\ell(\ell+1)]^{1/2}$ from the center of the nucleus, where $\epsilon_0 \approx 70$ keV is the energy of the virtual singlet level of the nucleon-nucleon system, or else on the outer boundary of the potential barrier R_{max}, if $r_0 > R_{max}$.

As a result, the half-width of the energy distribution is $\Delta E_p \approx \sqrt{\epsilon_0 Q_{2p}}$ and the half-width of the angular distribution is $\Delta\theta \approx \sqrt{\epsilon_0/Q_{2p}}$, which corresponds to $\Delta E_p \approx 0.38$ - 0.60 MeV and $\Delta\theta \approx 0.19$ - 0.12 in the region $Z > 50$, when $E_{pair} \approx 2$ MeV $< Q_{2p} < 5$ MeV, as would be the case for a barrierless emission of a virtual singlet diproton or dineutron.

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CONCERNING THE OBSERVATION OF TRANSITIONS BETWEEN HYPERFINE SUBLEVELS OF PARAMAGNETIC ATOMS

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A detailed study of the parameters of hyperfine splitting of the energy sublevels of atoms yields data on electron-nuclear interactions, on the state of the electron shell of the investigated atom, on the character of intermolecular interactions, etc.

Many papers have been published recently on electron paramagnetic resonance (EPR) in atoms introduced into various matrices, as a rule inert [1 - 3]. In such experiments, the electron-nuclear interactions lead to the presence of a hyperfine structure of the absorption curve. The energy of the electron-nuclear interaction is determined from the distance between the absorption lines in terms of the magnetic field.

For the purpose of accurately determining the hyperfine interaction in the hydrogen atom, Wittke and Dicke [4] described the results of observations of transitions with $\Delta M = 0$ in a longitudinal magnetic field of 0.006 Oe.

There are no published reports of transitions between hyperfine sublevels with $\Delta M = \pm 1$.

In this report we present the results of observation of such transitions in atomic hydrogen. We used a videospectroscope with synchronous detection, covering the frequency range 1500 - 1000 Mcs. The passage through the line was by varying the magnetic field. The atomic hydrogen, obtained with the aid of high-frequency discharge, was condensed in an argon matrix at a temperature 10 - 15°K.

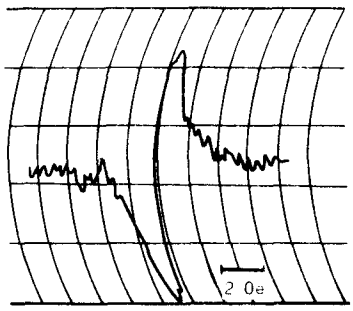

Figure: Derivative of the absorption line of transitions between hyperfine sublevels of atomic hydrogen.

The figure shows a record of the derivative of the absorption line, corresponding to the transitions $F = 1$, $M = -1 \rightarrow F = 0$, $M = 0$ in atomic hydrogen at 1377.5 Mcs in a field of 27 Oe (the hyperfine splitting of hydrogen is 1420 Mcs).

The table lists the values of the resonant frequencies for different external fields, obtained experimentally and calculated from the Breit-Rabi formula.

H, Oe.	27	34	34.4	37.2	110.2	111.3	112.8
ν_{meas}, Mcs	1377.5	1372.5	1368.9	1367.2	1277.2	1276.3	1275
ν_{calc}, Mcs	1384	1376	1375	1371	1284	1283	1281

We note that the described type of resonance makes it possible to determine the hyperfine splitting with greater accuracy than from the distance between the components of the hyperfine structure of the EPR line. It becomes possible and of interest to study the dependence of the width of the hyperfine-transition line on the temperature of the sample, on the external magnetic field, on the nature of the matrix, etc. We plan to carry out such investigations, including those of paramagnetic atoms of metals.

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