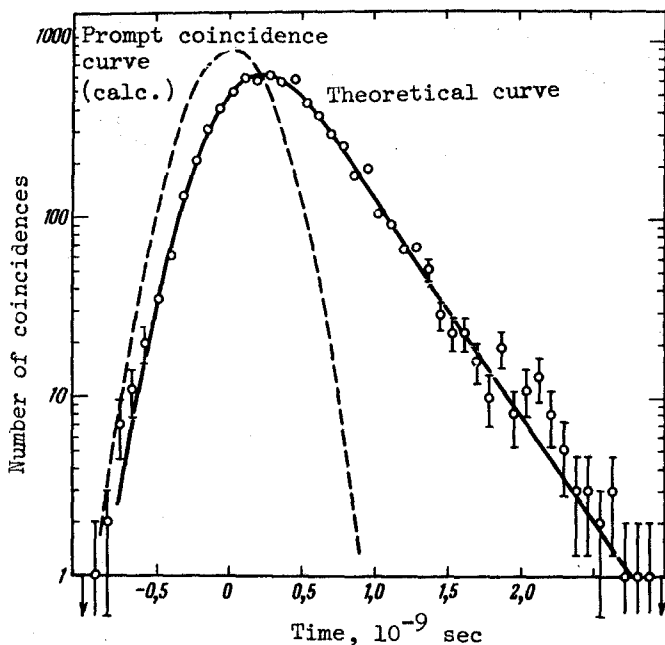


- [1] V.D. Kurnosov, V.I. Magalyas, A.A. Pleshkov, L.A. Rivlin, V.G. Trukhan, and V.V. Tsvetkov, *ZhETF Pis. Red.* 4, 449 (1966) [*JETP Lett.* 4, 303 (1966)].
- [2] Yu.A. Drozhbin, Yu.P. Zakharov, V.V. Nikitin, A.S. Semenov, and V.A. Yakovlev, *ibid.* 5, 180 (1967) [5, 143 (1967)].
- [3] V.A. Grekhnev, V.D. Kurnosov, A.A. Pleshkov, O.N. Prozorov, L.A. Rivlin, A.T. Semenov, V.V. Tsvetkov, and V.S. Shil'dyaev, *Phys. Tekh. Poluprov.* (Special Issue), *Physics of p-n Junctions in Semiconductor Devices*, p. 30, 1969.
- [4] V.I. Magalyas, A.A. Pleshkov, L.A. Rivlin, A.T. Semenov, and V.V. Tsvetkov, *ZhETF Pis. Red.* 6, 550 (1967) [*JETP Lett.* 6, 68 (1967)].
- [5] I.A. Poluektov, Yu.M. Popov, and N.N. Shuikin, *Ninth Internat. Conf. on Semiconductor Physics, Abstracts of Papers*, 193, 1968.
- [6] N.N. Shuikin, *Candidate's Dissertation*, 1970.
- [7] N.G. Basov and V.N. Morozov, *Zh. Eksp. Teor. Fiz.* 57, 617 (1969) [*Sov. Phys.-JETP* 30, 338 (1970)].
- [8] L.A. Rivlin, *Izv. Vuzov Radiofizika* 12, 1796 (1969).

LIFETIMES OF EXCITED STATES OF  $\text{At}^{217}$

G.D. Alkhazov, Yu.K. Zalite, M.L. Andersen<sup>1</sup>), and O.B. Nielsen<sup>1</sup>)  
 A.F. Ioffe Physico-technical Institute, USSR Academy of Sciences  
 Submitted 21 May 1970  
*ZhETF Pis. Red.* 12, No. 1, 7 - 9 (5 July 1970)

We measured the lifetimes of the 218 and 99 keV levels of  $\text{At}^{217}$ :  
 $T_{1/2}(218 \text{ keV}) = (2.7 \pm 0.2) \times 10^{-10} \text{ sec}$ ,  $T_{1/2}(99 \text{ keV}) > 5 \times 10^{-10} \text{ sec}$ .



Spectrum of delayed coincidences of  $\alpha$  particles ( $E_\alpha = 6.124 \text{ MeV}$ ;  $\text{Fr}^{221}$ ) and conversion electrons ( $E_\gamma = 218 \text{ keV}$ ;  $\text{At}^{217}$ ). The solid curve was calculated from the formula for the delayed-coincidence spectrum, with parameters chosen by least squares.

The properties of odd nuclei in the region between the doubly-magic lead  $\text{Pb}^{208}$  and nuclei having a stable deformation have not yet been thoroughly studied. The measurement of the lifetime of the excited states of such nuclei is of independent interest. In addition, knowledge of the lifetime of nuclear levels is essential for the interpretation of the experimental data of the angular  $\alpha$ - $\gamma$  ( $\alpha$ -e) correlations<sup>2</sup>). We report here the results of the measurement of the lifetime of the excited states of  $\text{At}^{217}$ . The measurements were performed by the delayed-coincidence method. The  $\alpha$  particles produced in the decay of  $\text{Fr}^{221}$  were registered with a semiconductor surface-barrier silicon detector. The energy resolution of the (FWHM) detector was 25 keV. The conversion electrons were registered with

<sup>1</sup>) Niels Bohr Institute, Copenhagen, Denmark.

<sup>2</sup>) In particular, we have measured the angular  $\alpha$ - $\gamma$  correlations in the decay of  $\text{Fr}^{221}$  [1].

the aid of a plastic scintillator and a photomultiplier. The time spectra of the delayed  $\alpha$ -e coincidences were plotted at fixed  $\alpha$ -particle energies corresponding to the decays of  $\text{Fr}^{221}$  to a definite level of  $\text{At}^{217}$ . The half-width of the (FWHM) curve of the prompt coincidences was 0.7 nsec. The experimental data were analyzed by three methods: 1) by comparing the theoretical curve of the delayed coincidences with the experimental points by the method of least squares; 2) by the method of the third central moment; 3) by the slope method<sup>3)</sup>. To verify the procedure, we first measured the lifetime of the 241-keV level of the excited state of the  $\text{Rn}^{220}$  nucleus. The obtained time  $T_{1/2} = (1.4 \pm 0.1) \times 10^{-10}$  sec is in good agreement with the results of other authors [3, 4]. The figure shows the spectrum of the delayed coincidences of decays from the 218-keV level of the  $\text{At}^{217}$  nucleus. All three methods of mathematical analysis, applied to the experimental data, gave practically identical results:  $T_{1/2} = (2.7 \pm 0.2) \times 10^{-10}$  sec. The result is typical of weakly deformed nuclei. The reduced probability of the E2 transition (the 218-keV transition is 99% E2 [5]) is enhanced here by approximately 40 times relative to the single-particle estimate after Weisskopf, thus indicating that this transition has a collective nature.

We have also measured the lifetime of the 99-keV level of  $\text{At}^{217}$ . The mathematical reduction of the measurement results, carried out under the assumption that all the registered coincidences correspond to decays from the 99-keV level of  $\text{At}^{217}$ , yielded the following value:  $T_{1/2} = (1.4 \pm 0.8) \times 10^{-10}$  sec. In fact, however, there was observed in this case a contribution of coincidences from extraneous impurities present in the source (from  $\text{Bi}^{212}$ ), and of coincidences of decays from the 218-keV level of  $\text{At}^{217}$ . Therefore, the total error of the obtained value of  $T_{1/2}$  is possibly larger than the statistical error indicated above. Nonetheless, we can state reliably on the basis of the analysis of the experimental data that the lifetime  $T_{1/2}$  of the 99-keV level of  $\text{At}^{217}$  is less than  $5 \times 10^{-10}$  sec.

The authors are grateful to A.A. Vorob'ev for useful discussions.

- [1] O.B. Nielsen, M.L. Andersen, A.A. Vorob'ev, V.A. Korolev, G.D. Alkhazov, and Yu.K. Zalite. Program and Abstracts of 20th Annual Conference on Nuclear Spectroscopy and Atomic Structure, Part I, p. 169, Leningrad, 1970.
- [2] G.D. Alkhazov, Yu.K. Zalite, M.L. Andersen, and O.B. Nielsen, Preprint FTI-243, Leningrad, 1970.
- [3] R.E. Bell, S. Bjornholm, and J.C. Severiens, Kgl. Danske Videnskab, Mat. Fys. Medd. 32, No. 12 (1960).
- [4] W.R. Neal and H.W. Kraner, Phys. Rev. 137 B1164 (1965).
- [5] B.S. Szhelepov, A.V. Zolotavin, R.B. Ivanov, M.A. Mikhailova, and V.O. Sergeev, Izv. AN SSSR ser. fiz. 33, 1607 (1969).

#### EXPERIMENTAL OBSERVATION OF KINETIC DIAMAGNETISM AND PARAMAGNETISM

Yu.L. Ivanov  
 A.F. Ioffe Physico-technical Institute, USSR Academy of Sciences  
 Submitted 25 May 1970  
 ZhETF Pis. Red. 12, No. 1, 9 - 11 (5 July 1970)

In [1], Gurevich considered a new effect, called kinetic dia- and paramagnetism. It turns out that the Nernst or Hall azimuthal current in a cylinder having a radial temperature gradient or an electric field can lead to a noticeable decrease or increase, in the interior of the cylinder, of an external magnetic field directed along the cylinder axis. A more complete theory of this

<sup>3)</sup>The methods of reducing the experimental data and details of the experiments were reported in [2].