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G. V. Gadiyak, D. A. Kirzhnits and Yu. E. Lozovik. Collective Excited States in Atoms. The paper argues in favor of the existence of special, collective excited states (CES) of the electron shells of heavy atoms (atomic numbers $Z \gg 1$). CES resemble vibrations of a charged liquid drop or plasma oscillations of the electron fluid in a metal. They have specific quantum numbers that do not reduce to the electron-hole numbers that correspond to ordinary single-frequency excitations in the atom.

Two difficulties stood in the way of solution of the problem of the existence of CES in the atom, which was posed more than 40 years ago. First, the CES had to lie within the continuous single-frequency spectrum corresponding to excitations of outer electrons of the atom, and separation of the CES from the corresponding background is an independent problem. The authors proposed that the CES proper are localized at the center of the atom and make the transition to background excitations only as a result of decay. This was confirmed by the appearance of distinct plateaus on the curves of CES frequency and damping as functions of the localization radius; it is to these plateaus that realistic values of the above quantities correspond. The second difficulty was that the damping of CES in the atom does not have literal smallness with respect to the frequency, in contrast to the case of a homogeneous medium. Therefore only a numerical calculation based on the theory of inhomogeneous systems could lead to smallness of the corresponding ratio and hence to the conclusion that the CES actually exist.

A calculation of this kind made on the BÉSM-6 computer of the USSR Academy of Sciences Siberian Division Computer Center was used as a basis for the theory of dielectric response for inhomogeneous systems proposed earlier by the authors, which was based on a combination of the random-phase approximation and the quasiclassical description of the single-frequency states. The accuracy of this theory as applied to the heavy atom is determined by the parameter $Z^{-2/3}$. A search for weakly damped CES of the dipolar optically active type (which correspond in first approximation to vibrations of the shell as a whole with respect to the nucleus) resulted in detection of two such excitations with the respective frequencies 13.7Z eV and 36.0Z eV and damping ratios of $3 \times 10^{-3}Z$ eV and $10^{-4}Z$ eV. The oscillator strength for the lower level is of the order of 0.1Z, while that for the upper level is three orders smaller. The observed CES lie in the soft x-ray range (vacuum ultraviolet). They could have been manifested in experiments as narrow peaks in the photoabsorption cross section or as the cause of the appearance of atomic-reaction features typical for the Bohr picture.

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The two-level system in a strong light field

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The section on Atomic Collisions (Chairman V. V. Afrosimov) of the USSR Academy of Sciences Council on Plasma Physics has recently shown excellent initiative in organizing conferences on specific problems that are of immediate importance for practice and new from the standpoint of basic research. Two excursion sessions were held in 1974. A conference on the topic "Coherence of Laser Radiation and Multiquantum Processes" (Chairman of Program Committee S. I. Anisimov) was held in February at the USSR Academy of Sciences Institutes of Theoretical Physics and Solid-State Physics (Chernogolovka, Moscow Oblast'). Another on the subject "The Two-Level System in a Strong Light Field" (Program Committee Chairman V. A. Kovarskiĭ) was held at the Moldavian Academy of Sciences Institute of Applied Physics (Kishinev) in December. The narrow specialization of the conferees who are working actively in this area, the use of invited papers in the basic format of the conferences, the original scientific communications presented by most of those in attendance, and the planned free discussions all combine to make such conferences highly productive.

The conference at Kishinev is a good example. At first glance, the two-level system is one of the most thoroughly studied models that have come into extensive use in quantum radiophysics. However, various new