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# On quantum uncertainty relation features at subatomic distances and the possibility of nonrelativistic and relativistic solutions in the problem of the electron motion in the Coulomb field of a proton

**Vladimir Murzin, Ljudmila Shchurova** and **Sergei Savinov**
Lebedev Physical Institute, Russian Academy of Sciences, Russia

The present paper is based on the results of our recent work [V.N. Murzin, Physics Letters A 381 , p. 233–238, 2017] in which the invariance of uncertainty relations with respect to the parameters of virtual photons as carriers of electromagnetic interaction is established. It is shown that Heisenberg's uncertainty relations can change at subatomic distances, become less constraining and allow smaller values for the uncertainty of the momentum. In the case of the problem of the electron motion in the Coulomb field of a proton, it leads to appearance of two fundamentional solutions. The first is nonrelativistic Bohr solution with electron orbit radius ~ 5•10-$^{9}$ cm, and the second - relativistic solution (RS) with electron orbit radius $r^{RS}$ ~ 0.4 10 $^{13}$ cm that is characterized by nuclear scales of energies and distances. As shown the relativistic solution well match to parameters and features of a neutron: size characteristics ( $r_N$ 0.8 10 $^{13}$ cm ); regularities of the spatial charge distribution, namely, a positively charged nucleus in the center and a negatively charged cloud in peripheral part; the magnitude and sign of the magnetic moment $M_{RS}$ $M_{e\ RS}$ $M_P$ $1.5_N$ , where N is the nuclear magneton ( $M_N$ 1.9 $_N$ ); the mass of the relativistic atom $m_{RS}$ $m_p$ 3 4 me comparable with $m_N$ $m_p$ 2.5me; typical energies 0 2MeV of electrons, emitted in the beta neutron decay. The spin features of RS and the possibilities of RS are discussed when compared with quantum quark-gluon theory results for protons and neutrons within the concepts of strong and weak fundamental interactions. The presented results may be of interest and can be considered in more correct way in quantum electrodynamics.

## Biography

Vladimir Murzin graduated from the Moscow Institute of Physics and Technology (1957) In 1964 he received the Ph.D degree. In 1978 he received the degree of Doctor of Science. He is Professor from 1992 and the Head of Laboratory in Department of Solid State Physics in Lebedev Physical Institute of Russian Academy of Sciences, Moscow. He is the project coordinator (FP7 No. 912100) within the 7th Framework Programme of the European Union. He was awarded with the State Prize of Russian Federation. He published about 200 papers, two books and several monographs.

murzin@lebedev.ru

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