



# Breaking Paradigms in Atomic and Molecular Physics

*Eugene Oks*

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## **Breaking Paradigms in Atomic and Molecular Physics** Eugene Oks

The book presents counterintuitive theoretical results, which were published in reputable refereed journals by the book's author and by others. These fundamental results break several paradigms of quantum mechanics and provide alternative interpretations of some important phenomena in atomic and molecular physics. First, it is shown that singular solutions of the Schrödinger and Dirac equations should not have been always rejected: they can be legitimate and necessary for explaining some experimental results, e.g., the high-energy tail of the linear momentum distribution in the ground state of hydrogenic atoms. Second, it is demonstrated that charge exchange is not really an inherently quantal phenomenon, but rather has classical roots. This result is applied to the problem of continuum lowering in plasmas. Third, it is shown that the most challenging problem of classical physics that led to the development of quantum mechanics the failure to explain the stability of atoms can be actually solved within a classical formalism from first principles: the fall of atomic electrons on the nucleus due to the radiative loss of the energy, which seemed to be classically unavoidable, does not occur within Dirac's generalized Hamiltonian dynamics applied to atomic physics. The underlying physics can be interpreted as a non-Einsteinian time dilation. Fourth, it is demonstrated that in two-electron atoms or ions, the spin spin interaction, which was usually considered as an unimportant correction to the binding energy, actually makes a significant contribution to the binding energy if the singular nature of this interaction is properly taken into account.

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