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Comment on BRIEF HISTORY OF QUANTUM MECHANICAL METHODS IN ATOMIC THEORY AND HIDDEN SYMMETRIES

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The aforementioned paper contains two parts. In the first one the author briefly discusses some popular methods for calculating atomic spectra, such as the variational method and those by Hartree—Fock and Latter. However, the most interesting problem is considered in the second part of the paper and concerns the origin of the so-called hidden symmetries of the effective Hamiltonian. Fock [1] was the first who attracted the attention of physicists to the problem of revealing hidden symmetries of atomic Hamiltonians. The second step was made by Demkov and Ostrovsky [2] who suggested the reasonable explanation of the famous $(n + l)$–rule by Klechkowsky giving the order of filling the electronic shells in atoms.

In the paper by Yu.P. Rybakov three possibilities of revealing the hidden symmetries are mentioned. The first one concerns the standard group extension method, where the Hamiltonian commutes with the generators of the larger group. In the second approach one searches for the so-called dynamical group, for which the Hamiltonian serves as one of the generators. At last, the third possibility appears as the most appealing one: it concerns searching for the intertwinning transform between the old and the new Hamiltonians. As an example the author considers the Wiener—Della Riccia intertwinning transform [3] that sends the Hamiltonian operator from the coordinate space to the phase one, the latter property giving new opportunities for revealing additional symmetries.

References

[1] V.A. Fock. "Naherungsmethode zur Lösung des quantenmechanischen Mehrkorperproblem" *Z. Phys.* 1930. Bd. **61**. S. 126 - 148.

[2] Yu.N. Demkov and V.N. Ostrovsky. "$(n + l)$ Filling Rule in Periodic Mendeleev System and Focusing Potentials" *JETP*. 1972. Vol. **62**. Pp. 125 - 132.

[3] G. Della Riccia and N. Wiener. "Wave Mechanics in Classical Phase Space, Brownian Motion, and Quantum Theory " *J. Math. Phys.*. 1966. Vol. **7**. P. 1372.