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SOME QUANTUM-MECHANICAL RELATIONS IN CASE OF SINGULAR OPERATORS

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Elaboration of some fundamental relations in 3-dimensional quantum mechanics is considered taking into account the restricted character of areas in radial distance. In such cases the boundary behavior of the radial wave function and singularity of operators at the origin of coordinates contribute to these relations. We derive the relation between the average value of the operator's time derivative and the time derivative of the mean value of this operator, which is usually considered to be the same by definition. The deviation from the known result is deduced and manifested by extra term, which depends on the boundary behavior mentioned above. The general form for this extra term takes place in the hypervirial-like theorems. As a particular case, the virial theorem for Coulomb and oscillator potentials is considered and correction to the Kramers' sum rule is derived. Moreover the corrected Ehrenfest theorem is deduced and its consistency with real physical picture is demonstrated.

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