Mesic forces in quantum mechanics

Čestmír Šimáně

Nuclear Physics Institute, Academy of Sciences of the Czech Republic, Řež 130, 250 68 Řež, Czech Republic

The equations of motion and the continuity equation have been derived from the relativistic Lagrangean density, corresponding to the motion of the electrically charged continuous substance with the flow velocity $\boldsymbol{v}$ in an external electrical field, diffusing simultaneously with osmotic velocity $\boldsymbol{u}$, the last obeying the diffusion law $\vec{u} = -D\nabla\mu/\mu$. The dependence of the osmotic velocity on the gradient of the mass density results in the appearance of mesic type forces and in a continuity equation with the right side, different from zero, expressing the density of internal rest mass sources. If identical continuity equation holds true at all points of the continuum, what is possible but for the flow velocity equal zero, than the equation of continuity represents the condition for steady, time independent states of the whole continuum volume. It has been proved, that the flow velocity – at least in the spherically symmetrical states – turns to zero automatically, owing to the fact, that the internal force densities in the electrically charge continuum compensate fully the external electrical force density. The equation of continuity, with $D = \hbar/2m$ and with the total electrical charge of the electron continuum around the proton e^-, represents the condition for steady bound states of the electron substance, equivalent to the Schrödinger equation, giving the same eigenfunctions and eigenvalues. A perturbation of a steady state by some additional external potential, either throughout the whole volume or in a part of it, leads to transient, time dependent states of short duration, during which the flow velocity as well as the mesic type forces, which are products of the velocity and the total time derivative of the mass density, differ from zero. The Newton law for volume elements situated at different points changes to $\vec{F} = \mathrm{d}(\mu\vec{v})/\mathrm{d}t = \mu\mathrm{d}\vec{v}/\mathrm{d}t + \vec{v}\mathrm{d}\mu/\mathrm{d}t$, where the second member represents the non zero mesic type forces between the establishment of next steady states. The duration of the transient periods are very short so that one may characterize them as jumps. Alas, the present experimental techniques do not permit to observe and to study the mesic forces directly. At the time being, their supposed existence may be supported only by the fact, that introducing them in the theory one gets a classical explanation of the observed steady states. At the end, it has been shown, that one obtains the continuity equation, from which the steady states may be derived, by simple algebraic operations from the Bohm equations, if one replaces his point electron by a charged electron continuum. Consequently, than also the quantum potential acquires a new interpretation.