TENSOR AND THE FULL SYSTEM OF ELECTROMAGNETIC FORCES

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This report presents a consistent four-dimensional approach to the construction of the full system of electromagnetic forces, including dynamic forces, designed to simulate the kinetics of charges under short and ultrashort pulses of the field in purposes of inertial plasma confinement. On the basis of a four-dimensional representation of electromagnetic field (EMF) and its sources through electromagnetic potential  and 4-current density , obtained the second rank density tensor of energy-momentum interaction EMF – 4-current density . From the external four-dimensional tensor obtained by differentiation of the third rank density tensor of the electromagnetic forces ,which includes 64 components. Components are grouped in 16 types of three-dimensional electromagnetic forces, including the forces of Coulomb and Ampere. Forces are linked into a single system by continuity, conservation and equilibrium equations, which follow from the tensor of energy-momentum and electromagnetic forces density. The system of electromagnetic forces is presented in the table:

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| Dynamic forces | | Static and stationary forces | |
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where S1 - S16 - density of electromagnetic forces; φ and A - scalar and vector potentials of electromagnetic field; ρ and J=ρV - electric charge and electric current density; с - light speed; V - velocity of the charges; t - time; k(x, y, z) - coordinates of the three-dimensional space; - symbol of tensor product; ∂ - symbol of partial derivative. Forces S4 and S6 respectively describe the density of static and dynamic Coulomb force. The Ampere force density is a part of the tensor force S15. The other forces are new. Dynamic electromagnetic forces must be considered in the performance of the tasks of inertial thermonuclear fusion, the study of Z - and X-pinches and other processes of plasma dynamics. Static and stationary forces must be considered when solving problems of magnetic plasma confinement and the consideration of MHD instabilities. Dynamic forces S1 and S2, depending on the rate of change in time of the scalar potential and charge density are of a particular interest. When they increase in time volumetric compression forces directed against Coulomb force action appear. At a sufficiently high increase rate these forces may exceed repulsive force of similar charges, and the process of matter collapse begins. It is possible that this process explains the formation of hot spots Z - and X-pinches and their further explosions. Equilibrium equations , ,  follow from tensor  . If we express the current density and vector potential in terms of velocity of charges, these equations can be considered as the deterministic kinetic equations of self-consistent motion of charges and can be used in modeling of kinetics of plasma. The system of electromagnetic forces can be used for the improvement and development of plasma confinement devices.