

Coulomb pulsars are sources of cosmic rays with energies greater than 10 TeV

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In a new capacity, Einstein's idea of the equivalence of mass and energy is confirmed. The equivalence manifests itself in similar functionality in the processes of pulsations (focusing and bounce) of "excess" energy in the generalized 2D Kepler problem and "excess" mass in the 3D Vysikaylo-Chandrasekhar problem of cumulation and dissipation of de Broglie waves in quantum stars (pulsating accretion of quantum stars) with a mass greater than Chandrasekhar's (~ 1.46 solar masses). Such pulsations of quantum stars are due to differences in the de Broglie wavelengths of electrons and ions. This difference leads to quantum separation of charge during the collapse of a quantum star and the formation of an electric field shock wave. A new mechanism (type) of a thermonuclear reactor near the surface of charged quantum stars and dense cores of ordinary stars and planets is proposed. Acceleration of protons and electrons up to energies above 10 TeV in electric field shock waves in the nuclei of giant plasmoids – quantum stars – and their transmutation into neutrons in reactions with each other are the basis of such a mechanism. Rotation, which reveals cumulation and dissipation and structurally promotes the transfer of energy from all degrees of freedom into rotation and pulsations during cumulation, is not the only true sign of cumulation and structural spiral turbulence with hierarchical cascades of structures with energy-mass-momentum flows. The same sign of cumulation is the violation of electrical neutrality. We prove that, just as in the case of rotation, it is possible under certain conditions to form space charge jumps (shock waves of the electric field discovered by Rutherford in atomic nuclei, Gunn in semiconductors and Vysikaylo in gas-discharge plasma, see [1] for more details) and the transformation of all types of energy into electrical energy (electric field). In this case, the violation of electrical neutrality is very small, but its role in the organization of the structure of the Coulomb quantum pulsar is enormous. It is a weak violation of electrical neutrality at a level of 10^{-36} **that stops the gravitational cumulation of protons into stars (and even into black holes) and leads to the generation of proton or ion winds from stars [2] and even from black holes [1]. The violation of electrical neutrality at the level of 10^{-18} leads to the suppression of gravitational forces, and at the level of 10^{-12} - to the formation of Cosmic rays with energies up to $3 \cdot 10^{20}$ eV [1]. Simultaneous excitation in complex hierarchical dynamical systems of rotation, pulsations and violation of electrical neutrality leads to the generation of the third degree of freedom - a magnetic field. There is no need to invent a "mysterious" magnetic dynamo, but one should involve the interference of rotation and violation of electrical neutrality. The author argues that the presence of a magnetic field is an indirect, convincing sign of a violation of electrical neutrality and rotation, and, consequently, cumulation.**

[1] Vysikaylo P.I. Detailed Elaboration and General Model of the Electron Treatment of Surfaces of Charged Plasmoids (from Atomic Nuclei to White Dwarves, Neutron Stars, and Galactic Cores): Self_Condensation (Self_Constriction) and Classification of Charged Plasma Structures–Plasmoids. Part I-3. General Analysis of the Convective Cumulative–Dissipative Processes Caused by the Violation of Neutrality: Metastable Charged Plasmoids and Plasma Lenses. Surface Engineering and Applied Electrochemistry. 2012, 48(1), 11–21.

[2] Vysikaylo P.I. Quantitative Investigation Nonequilibrium Inhomogeneous Plasma of the Heliosphere with Runaway Electrons IEEE Transactions on Plasma Science 2022, V.50, Issue 4, pp. 810–816. DOI: 10.1109/TPS.2022.3160189

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