HIDDEN MASS BOSON MEDIUM AS REAL DARK MATTER WITH THEORETICAL BACKGROUND AND PRACTICAL APPLICATIONS

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Hidden Mass Boson (HMB) medium as real Dark Matter (DM) is considered. This DM model bases on the Newtonian approach of gaseous compressible substance. For confirmation of our simulation we present the special experimental results on the temperature dependence for propagation velocity of electromagnetic fronts, additional detail explanation of the Hooke law, the Dulong–Petit law, the thermal expansion law, the Stephan-Boltzmann radiation low and some astrophysics problems (cosmic jets, gamma-ray bursts with their afterglows and oth.). Theoretical part of our study contains some main physical principles, the dimensional analysis, thermodynamically compatible conservation laws, nonlinear thermal radiation modeling and exact solutions.

Coming back from the positions of modern experimental data to fundamental ideas of early XX century theoretical physics (first of all, works by M. Planck, A. Einstein and L. de Broglie) allows us to indicate rather motivated solution of some mysterious problems of the present-day physics. A typical example here can serve a correlation linking energy E with mass value m, frequency ν and temperature T

$$E = mc^2 = h\nu \approx kT, \qquad (1)$$

where c - light velocity, h and k - the Planck and Boltzmann constants. The last approximate equality in (1) follows from Planck's distribution in vicinities of maximum radiation density distribution of absolutely black body and presents itself Wien's displacement law.

In the first half of XX century the temperature in cosmic vacuum was considered equal zero ($T=0$) that due to relation (1) matched mass value $m=0$ (mass absence in free space of cosmos). However finding in the second half of XX century of a final not zero temperature in cosmic vacuum (cosmic microwave background radiation - CMBR) $T=2.725\ K$ allows us by means of relation (1) to define vacuum particle mass $m \approx kT/c^2$. The presence of these massive particles in physical vacuum was specified in [1,2], and [3-5] it was identified with massive particles of Dark Matter (DM). Subsequently, in [6-8] this particle was named Hidden Mass Boson - HMB (in analogy with the known of Higgs Boson). To be short, we change the virtual Planck resonators in his derivation of the formula for absolutely black body radiation density by real (massive) particles.

Another important effect of correlation (1) under $m = const$ is the presence for typical velocity c the dependency on temperature $c \approx \sqrt{kT/m}$. Thereby, electromagnetic waves velocity in vacuum should not be a universal constant. This conclusion requires more detailed explanation.

Validity of fundamental correlation (1) brings about the necessity to introduce for physical vacuum a classical elastic medium model, which should consider the existence of two typical distortion propagation velocities c_0 and c_1: velocity c_0 - for longitudinal (potential) distortions - waves of compression - depression (without particles rotation) and velocity c_1 - for transverse (solenoid) distortions - waves of shift (without volume change). Herewith, using the classical Poisson approach for elastic medium we should write down intensities of electric field $\overline{E}$ and magnetic field $\overline{H}$ in linear approach as sums of potential and solenoid components

$$\overline{E} = grad\,\varphi + rot\overline{A}, \quad \overline{H} = grad\,\psi + rot\overline{B}. \qquad (2)$$

A further effect of correlations (1) and (2) for electromagnetic distortions is an extended writing of the Maxwell system of electrodynamics equations [7-9] providing for presence of longitudinal waves (for free space without concentrated charges and currents)

$$\frac{\partial \overline{E}}{\partial t} - c_1 rot\overline{H} + c_0 gradp = 0; \ \frac{\partial p}{\partial t} + c_0 div\overline{E} = 0,$$
$$\frac{\partial \overline{H}}{\partial t} + c_1 rot\overline{E} + c_0 gradq = 0; \ \frac{\partial q}{\partial t} + c_0 div\overline{H} = 0. \qquad (3)$$

Relations (3) incorporate scalar fields p and q presenting fields of "force lines density" (Faraday field lines) of electric and magnetic fields. One can easily show [7] that scalar potentials φ and ψ in (2) and scalar fields p and q in (3) satisfy the d'Alembert wave equations with typical velocity c_0 for longitudinal (potential) distortions and vector potentials A and B satisfy the d'Alembert wave equations with typical velocity c_1 for transverse (solenoid) distortions. Thereby, finding the final temperature in physical vacuum should result in a finite mass of vacuum particle and existence of longitudinal components of electromagnetic field.

Hereinafter the report justifies the equation of physical vacuum state $p = nkT$ (n - DM particles concentration) and HMB structure in the form of classical dipole with characteristic charge value of the $q \approx 10^{-28}$ C. The presence of characteristic charge under the given particles concentration allows us to define the Debye screening radius and build a unified theory of chemical linkages, electromagnetic, weak and strong interactions [9]. By that the main role plays the Debye screen radius of electron and proton charges.

As confirmation of our DM modeling we present the special experimental results on the temperature dependence for electromagnetic front and disturbances velocities [8-10], additional detail explanations of the Hooke, the Dulong – Petit, the thermal expansion and the Stephan – Boltzmann radiation laws and astrophysics problems (cosmic jets, gamma-ray bursts with their afterglows) [9]. The theoretical part of our study contains the dimensional analysis [6-8], thermodynamically compatible conservation laws [5], nonlinear thermal radiation modeling and exact solutions [11]. We demonstrate also practical application of this simulation for air breathing engines design. The talk shows typical results for turbojet engines and their components [5-9].

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