

I.S. Nurgaliev

Nonsingular Universe

It is shown that taking into consideration a vorticity-related component of cosmological motion averts singularity and explains acceleration of the expansion.

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The cosmologic singularity is a consequence of using simplistic expansion law instead of the realistic $V_{\alpha} = H_{\alpha\beta} R^{\beta}$. Here $H_{\alpha\beta}$ is distortion tensor (affinor), R^{β} is radius-vector of galaxies. Excessive symmetric character of the Hubble's law is nothing but oversimplification of the cosmological principles of homogeneity and isotropy. The law given above includes distributed rotation which is imperative attribute of cosmological kinematics and has been ignored in the Hubble's law. (Was not the intuitive feeling of the oversimplification of the expansion law the reason for the contradictory attitude to expansion interpretation of redshift-distance correlation by Hubble?) Historically, looking a few centuries back, lack of given tensor (affinor) law might be considered the reason for the idea of the Cartesian vortexes to be less popular in comparison to the ideas of Newtonian potential forces. But if to look a few thousands years, emerging cosmological model was and still is in harmony with oldest world religions. But new world religions standing on the "beginning" conception (creation) supported singularizm and won tender for cooperation with Science on the European scene.

The centrifugal forces acting between particles rotating randomly around each other are shown below to be able to reverse gravitational collapse. It is shown in this report that contribution from vortex ω (anti-symmetric part of $H_{\alpha\beta}$) provides stabilization of cosmological collapse and induces rotational structure formation. It makes natural to interpret increasing redshift for larger distances as the transverse redshift effect.

$$\frac{v}{v_0} = \frac{\left[1 - \frac{R^2 (\omega^2 - H^2)}{c^2} \right]^{1/2}}{1 - \frac{RH}{c}}, \quad \frac{v}{v_0} = 1 - RH/c + \frac{3}{2}(RH/c)^2 - \frac{1}{2}(R\omega/c)^2,$$

The exact expression and one for small RH/c and $R\omega/c$, respectively, hold therefore, the most natural candidate for acceleration cause is "local rotation" $\omega > 3H$ which is homogeneous and isotropic.

Cosmological Expansion Started from the Big Bounce upon Local Rotation

Local rotations (vortexes) play the role of radical stabilization of cosmological singularity via radical negative **nonlinearity** in the retrospective extrapolation and making static or steady in-the average state of the universe or a local region possible. Therefore Einstein could "permit" the galaxies to rotate instead of postulating lambda-term ad hoc in the case of general relativistic consideration of static in average Universe [1]. Though, as we know, it dose not mean necessarily that the lambda-term is not needed because of other arguments.

Let us consider local imaginary spherical region of the homogeneous and isotropic infinite distribution of gravitating "dust". As Milne and McCrea did, we can ignore the surrounding matter (Birkhoff theorem). But in contrary to Milne and McCrea [2], we do not demand the test particle rest at the contracting sphere marking the boundary of the ball of the constant mass but let it move with the typical peculiar cosmological velocity $\vec{v}_{peculiar}$ on the sphere because rotation is a typical motion in the Universe along with well measured expansion, and the galaxies do have peculiar components of their motion. In other words we rehabilitate vorticity, and thereby long

time ignored centrifugal cosmological forces as well. $\vec{v}_{peculiar}$ is perpendicular to pure Hubble expansion. It is ignored component of the cosmological motion, in particular, in the standard general relativistic Friedman-Lemaitre models as well [3]. In Newtonian cosmology we derive in traditional notations:

$$\dot{H} + H^2 = K_1^2 \rho^{4/3} - (4\pi G/3)\rho. \quad (2)$$

Here we have got good surprise. The same functional dependence of ω^2 on R as of energy density and pressure of ultra-relativistic matter (electromagnetic radiation, photons gas), all of them while isotropic, are proportional to $1/R^4$, and the very same law of conservation of the averaged shear squared σ^2 (the latter causes black “matter” effect along with “black energy” effect of ω^2) remain the functional character of (2) unchanged causing only the re-defining the constant $K^2 = \Omega^2 - \Gamma^2 - \Sigma^2$, where constants Ω, Γ, Σ stand for vortex, radiation (energy density and pressure) and shear constants in corresponding conservation laws.

Here is the first integral of (2): $H^2/2 = -K^2/2R^4 + GM/R^3 + A/R^2$, where A is a constant of integration. A final integral of the cosmologic equations holds:

For $A \geq 0$ we have:

$$t + t_0 = -(2A)^{-1}(2AR^2K + 2GMR - K^2)^{1/2} - GM(2A)^{3/2} \ln(2^{3/2}A^{1/2}(2AR^2 + 2MGR - K^2) + 4AR + 2GM); \text{ for } A \leq 0 \text{ we have } t + t_0 = (2A)^{-1}(2AR^2K + 2GMR - K^2)^{1/2} - GM(-2A)^{3/2} \arcsin[(2AR + GM)/(2A^2K^2 + GM^2)^{1/2}].$$

What is exact value of ω^2 in the radiation-dominated Einstein static Universe? We have

$$\omega^2 = \frac{4\pi G}{3} \rho_{radiation} = \frac{4\pi G}{3c^2} aT^4, \text{ where } a = \frac{\pi^2 k^4}{15h^3 c^3} = 7.56 \times 10^{-16} J/m^3 K^4. \text{ Therefore, } \omega^2 = \frac{4\pi^3 Gk^4}{45h^3 c^5} T^4.$$

Or, compactly, $\omega^2 = a\chi T^4$, and $\omega^2 = \aleph T^4$, where $\chi = \frac{4\pi G}{3c^2} = 3.1 \times 10^{-27} m/kg$.

$$\aleph = \frac{4\pi^3 Gk^4}{45h^3 c^5} = 2.11 \times 10^{-41} c^{-2} K^{-4}$$

is a new universal constants combination. The illegally trampled right to rotate is returned to point of matter. For $T=2.7K$ we get that even such a small value as $\omega^2 \approx 1.12 \times 10^{-40} \text{ rad}^2/c^2$ could be enough to compensate the radiation contribution to the cosmological contraction preceded to the observed expansion, i.e. less than, supposedly, existing value. We have given an answer “Thanks, no.” to the following hypothesis. In the Universe somebody somehow with the some unknown purpose, at the some mysterious previous stage of its evolution had fine tuned with 100%-precisness zero scattering of each particle around each another. This Entity provided by this fantastic job the delivery all of them to the very same point at the very same time. Sorry, not in this Universe [3, 5, 6].

References

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