Is it necessary to involve the ether and its analogues to explain dark energy and dark matter?

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Abstract

The article considers a model in which the initial elements are metric constraints imposed on an initially rotating and radially reacting vacuum.
It is assumed that the Hubble constant H and the acceleration parameter q can be derived without using energy densities, pressure, or a cosmological constant, but only through the internal dynamics of the metric, which depends on the angular velocity, radial response, and their derivatives.

It was shown earlier [9] that the rotation of the sphere around the Z axis leads to the movement of the metric along this axis with the velocity Vz. Since this direction coincides with the tangent direction to the XZ and YZ planes, the movement of the metric can be interpreted as the result of the rotation of the sphere around the X and Y axes (see Fig. 1):

$$\omega_{x,y}=\frac{V_z}{r}=\frac{\alpha}{r}\left(\frac{\sqrt{3}}{2\omega_z^2}\ln(1-r^2\omega_z^2)+\frac{\sqrt{3}r_z^2}{1-r^2\omega_z^2}\right) \qquad (1)$$

where $\omega_z=\omega_{z0}+\alpha*t$, α is the angular velocity, c=1.

Thus, the rotation of the sphere around the main axis creates a movement of the metric not only parallel to the Z axis, but also drags it along orthogonal directions. Then the deformation of the metric in all orthogonal planes [7] is determined by the expression:

$$S_k=-\frac{\sqrt{3}}{2\omega_k}\ln(1-r^2\omega_k{}^2) \quad k = x,y,z \qquad (2)$$

In this case, the absolute values of the angular velocities are equal $\omega_x=\omega_y=f(\omega_z)$ and are determined by formula (1).
Next, we will consider rotation around the main axis - Z. Rotation around other axes is not taken into account.

Connection with the parameters of the expansion of the Universe.

Within the framework of the proposed model, the Hubble constant is defined as:

$$H=\frac{\dot{S}_z}{S_z} \qquad (3)$$

Substituting the expression (2) and the derivative into (3), we obtain:

$$H=\frac{-2r\frac{dr}{dt}\omega_z^2-2r^2\omega_z\alpha}{(1-r^2\omega_z^2)\ln(1-r^2\omega_z^2)}-\frac{\alpha}{\omega_z} \qquad (4)$$

At $V_\pi=r^2\omega_z^2$ <<1 :

$$H\approx 2\frac{\dot{r}}{r}+\frac{\alpha}{\omega_z} \qquad (5)$$

Acceleration of the Universe:

$$q(t)=-1-\frac{\dot{H}}{H^2} \qquad (6)$$

For $\ddot{r}=0$ and small angular acceleration we obtain: q ≈ - 0.5, which agrees with the observed accelerated expansion of the Universe. But we are interested in the exact result. Let us use formula (4), for angular acceleration α =0 (if the angular velocity does not depend on time, then the derivative H is relatively easy to find) we obtain:

$$H=-\frac{2r\frac{dr}{dt}\omega_z^2}{(1-r^2\omega_z^2)\ln(1-r^2\omega_z^2)} \qquad (7)$$

$$v_r=\frac{dr}{dt}$$

After substituting into formula (6) we obtain:

$$q(t)=\frac{(1+V_\pi)\ln(1-V_\pi)}{2V_\pi} \qquad (8)$$

Where $V_\pi=r^2\omega_z^2$

As we see, the Hubble constant depends on the tangential and radial velocity, acceleration depends only on the tangential velocity.

Results table

Options	Radius, r	Angular velocity, ω	Coordinate velocity, v_r	Hubble constant, H	Acceleration, q
1	1.000e+16	9.7712e-18	0.011	2.210e-18	-0.5038
2	1.000e+16	2.55e-17	0.0106	2.20e-18	-0.550
3	1.036e+16	2.46e-17	0.011	2.20e-18	-0.550
4	7.58e+18	6.34e-20	7.27	2.184e−18	-0.7

As can be seen from the table, the proposed model is in good agreement with the actual observation data, which is known to be equal to: H= 2.22e-18 (H0=(2.20×10−18)×(3.0857×1019)≈67.9 km/s/Mpc), q= 0.55-0.7.

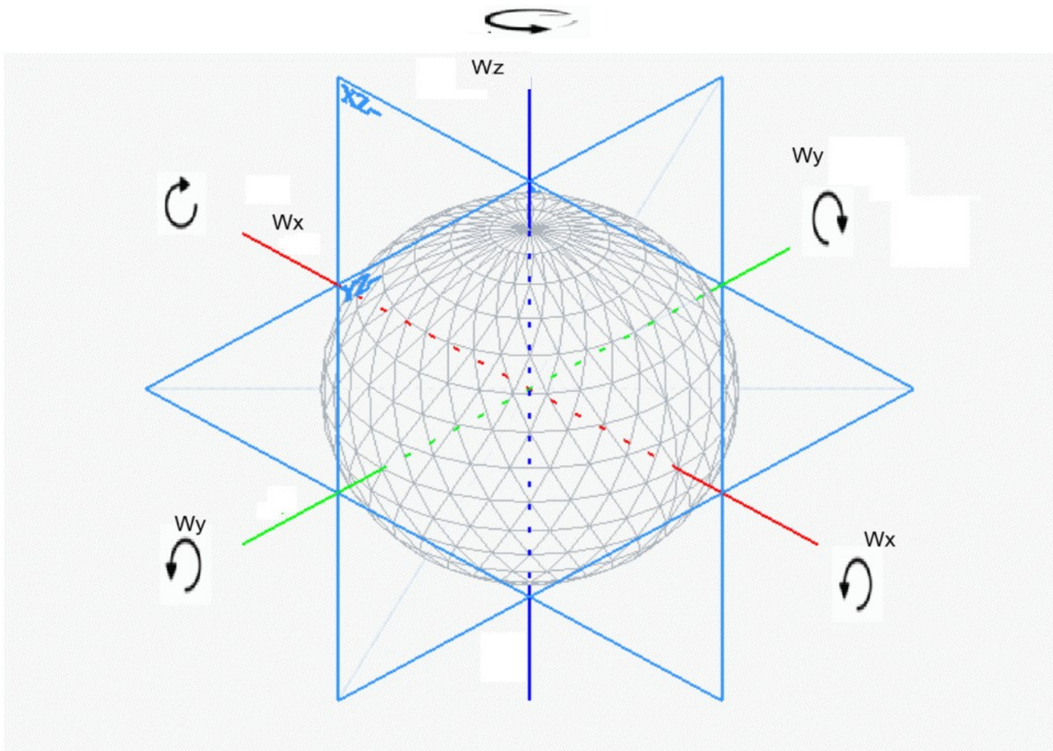
Wz
Wy
Wx
XZ
YZ
Wy
Wx

Fig. 1

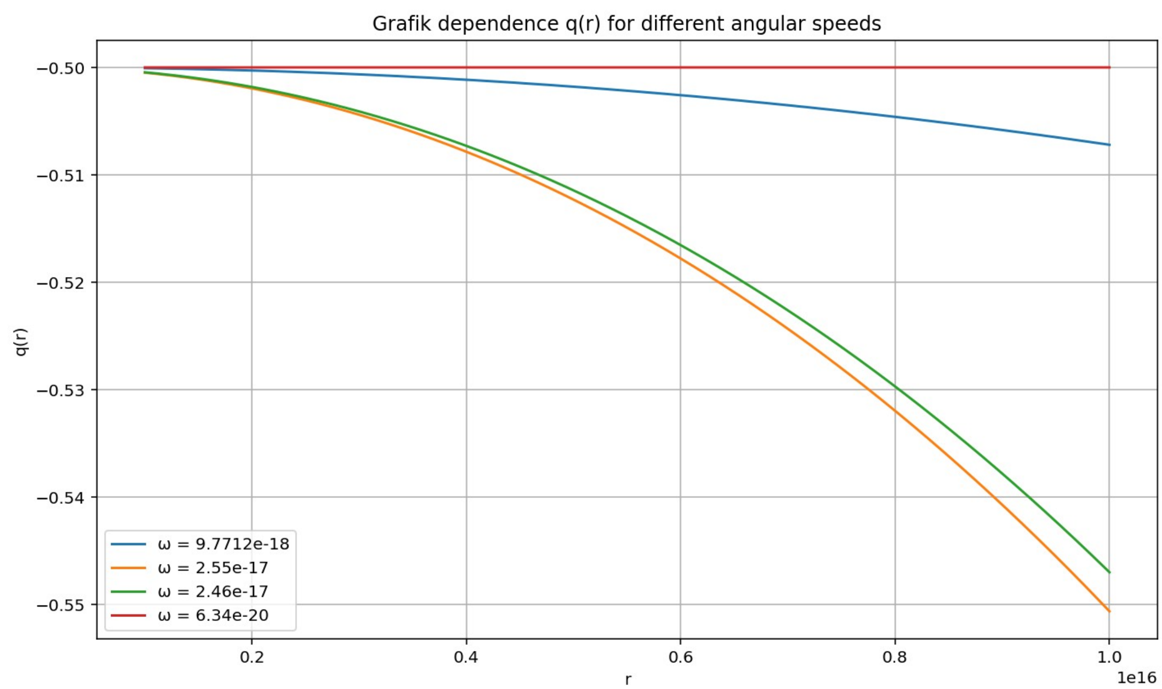
Grafik dependence q(r) for different angular speeds
−0.50
−0.51
−0.52
−0.53
−0.54
−0.55
q(r)
0.2
0.4
0.6
0.8
1.0
1e16
r
ω = 9.7712e-18
ω = 2.55e-17
ω = 2.46e-17
ω = 6.34e-20

Fig. 2

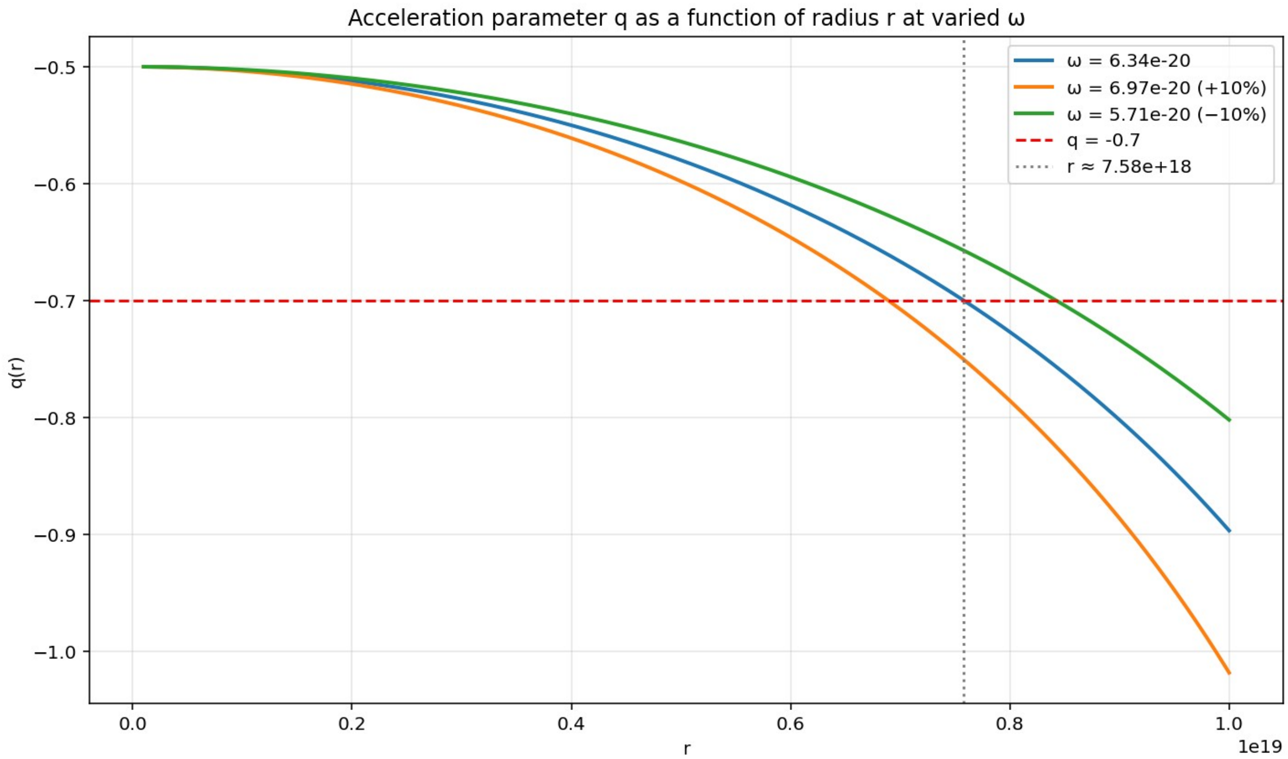

Fig. 3

Conclusion

In the current model based on Friedmann's formulas, the cosmological constant associated with dark energy creates a dimensionless negative pressure of approximately -0.7. The remaining pressure, slightly less than -0.22, is due to dark matter. Rotations around axes orthogonal to the Z axis may provide the missing negative pressure. Therefore, the problem seems to be reduced to solving the following metric:

$$ds^2 = -c^2(t)^2 + d(x+s_x)^2 + d(y+s_y)^2 + d(z+s_z)^2$$

The deformations Sk are determined by formula (2). It can be shown that when $\omega \to 0$, sk $\to$ 0.

Literature

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