MODEL OF DARK NONBARYON MATTER AND GRAVITATIONAL WAVES

ABRASHKIN ANATOLY
Institute of Applied Physics, Nizhny Novgorod, Russia
abrash@hydro.appl.sci-nnov.ru

1. Dark matter consists of the virtual particles with Plank's scales (etherons):

$$l_p=\sqrt{\frac{\hbar G}{c^3}}\approx 1{,}7\cdot 10^{-33}\,см;\quad t_p=\sqrt{\frac{\hbar G}{c^5}}\approx 6\cdot 10^{-44}\,c;\quad m_p=\sqrt{\frac{\hbar c}{G}}\approx 2\cdot 10^{-5}\,г.$$

Suppose they don't interact with each other and form Boze-condensate:

$$i\hbar\frac{\partial\psi}{\partial t}=-\frac{\hbar^2}{2m}\Delta\psi;$$

Potential motion of compressible fluid with quantum pressure:

$$\psi(\mathbf{r},t)=\sqrt{\rho}\exp i\theta;\quad \vec{v}=\frac{\hbar}{m}\nabla\theta\quad (Madelung,1926).$$

$$\begin{aligned}&\frac{\partial\rho}{\partial t}+div\,\rho\mathbf{v}=0;\\ &\frac{\partial\mathbf{v}}{\partial t}+\frac{1}{2}\nabla v^2-\frac{\hbar^2}{2m_p^2}\nabla\left(\frac{\nabla^2\sqrt{\rho}}{\sqrt{\rho}}\right)=0.\end{aligned}\qquad (1)$$

Linear oscillations $\tilde{\rho},\tilde{v}$ **relatively homogeneous state:** $\rho=\rho_0=const;\quad v=v_0=0$:

$$\frac{\partial^2\tilde{\rho}}{\partial t^2}+\frac{\hbar^2}{4m_p^2}\frac{\partial^4\tilde{\rho}}{\partial x^4}=0;$$

$\omega=\pm\dfrac{\hbar}{2m_p}k^2$ **- dispersion relation for gravitational waves;**

$$k\le k_{\max}=l_p=\frac{m_pc}{\hbar}\quad\Rightarrow\quad V_g=\left|\frac{\partial\omega}{\partial k}\right|=\frac{\hbar}{m_p}k\le c\,.$$

- We reject the idea of absolutely empty space and assume that gravitational waves are the oscillations of the density of ether stipulated by the action of quantum pressure. As a result, our equation differs from the usual wave equation. It is of fourth order and describes longitudinal waves. Their dispersing relation contains the spatial dispersion, but group velocity is always less then velocity of light.

- The etherons play a part of hypothetical gravitons which are introduced in quantum theory of gravitation. But the rest-mass of graviton is supposed to be zero as for photon. Mass of etheron is equaled to m_p.

2. MODEL OF ELEMENTARY PARTICLES

- Etheron is interpreted as simplest elementary particle. His mass m_p is great but lifetime t_p is extremely small. So we can suppose that elementary particles consist of virtual etherons.

Consider localized, stationary structure. Let this particle has spherical shape with radius $R = R_0$. Outside of it the density of etherons ρ is equaled to ρ_0. Inside the structure (see (1)):

$$\Delta\sqrt{\rho} + \alpha^2\sqrt{\rho} = 0; \quad \alpha = const > 0,$$

Distribution of the density inside the particle and it's mass:

$$\sqrt{\frac{\rho}{\rho_0}} = \sqrt{\frac{R_0}{R}}\frac{J_0(\alpha R)}{J_0(\alpha R_0)}; \quad M = \frac{4\pi\rho_0 R_0}{J_0^2(\alpha R_0)}\int_0^{R_0} R\cdot J_0^2(\alpha R)\,dR$$

Mass M doesn't depend on value of m_p!

CONCLUSIONS

- **Dark matter is initial state of matter**
- **Cosmic vacuum is Boze-condensate of etherons**
- **Etheron is carrier of gravitational interaction**