The dimension of the Ecosphere

M. Kozlowski, J. Marciak-Kozlowska

In this project we investigate the possibility of the calculation of the planet orbit radii as the function of the fine structure constant α. We argue that the Ecosphere is defined as the part of space rounded the star which can be calculated assuming the present day value of the electromagnetic fine structure constant $\alpha = 137^{-1}$. As was shown in paper [1] the planet orbit radius R is described by the formula

$$R^{\frac{3}{2}} = \frac{\hbar c}{m_p \alpha^2} \frac{1}{m_e c^2} \left(\frac{M_P}{m_p} \right)^{\frac{1}{2}} \left(\frac{\hbar c}{m_p c^2} \right)^{\frac{1}{2}}. \tag{1}$$

In formula (1) m_p and M_P are the masses of the proton and Planck particle respectively $M_P = \left(\frac{\hbar c}{G} \right)^{\frac{1}{2}}$. The possibility of the doing the physics on the background space time at the unification energy and the existence of stars made of protons and neutrons endorse α in the niche [2]

$$\frac{1}{180} \leq \alpha \leq \frac{1}{85} \tag{2}$$

or [3]

$$\frac{1}{195} \leq \alpha \leq \frac{1}{114}. \tag{3}$$

It is interesting to observe that one obtains the niche for planet radii – the Ecosphere which is the result of formulae (2) and (3). The Ecosphere radius spans

$$0.5\,\text{AU} \leq R_{\text{Ecosphere}} \leq 1.5\,\text{AU}. \tag{4}$$

In the case of the Solar system in the niche we find only the orbits of Venus, Earth and on the border Ecosphere: Mars.

It will be very interesting to apply the formula (1) to the other "worlds" – the extraterrestrial planets (for example for planets newly discovered by OGLE collaboration).

References

[1] M. Kozlowski and J. Marciak-Kozlowska, http://lanl/arxiv/astro-ph/0305533.

[2] J. D. Barrow, F. J. Tipler, *The anthropic cosmological principle*, Oxford University Press, 1986.

[3] M. Kozlowski, *Physics Essays*, **7**, (1994), p. 261.