THE COSMOLOGICAL TEST "MAGNITUDE-REDSHIFT" FOR SOME MODELS OF GRAVITATIONAL END PHYSICAL VACUUM

Yu.V. Aleksandrov, E.Yu. Bannikova
Kharkov State University, Ukraine

ABSTRACT. The cosmological test $m(z)$ has been calculated condition equation of state $p = -\varepsilon/3$ and $p = \varepsilon$. A case $p = \varepsilon$ doesn't contradict observational values of $m(z)$ for quasars.

Key words: equation of state, cosmological test, quasars

As far as we know (Veinberg, 1972) two independent Einshtein's equation contain three functions in standard cosmological model of homogeneous isotropic world : $a(t)$ - scaled factor, $\varepsilon(t)$ - power density and $p(t)$ - pressure:

$$\dot{a}^2 = \frac{8\pi G}{3c^2} a^2 \varepsilon - kc^2 \qquad (1)$$

$$\ddot{a} = -\frac{4\pi G}{c^2} a(\varepsilon + 3p). \qquad (2)$$

For system (1),(2) decision a matter state equation which looks like $p = \mu\varepsilon$ for ideal fluid is used and powerdominational condition (Stanyoukovich, 1972) asks for: $\mid \mu \mid \leq 1$. Most commonly the cases $\mu = 0$ and 1/3 describing the matter era and the radiation era in the evolution of our Universe are discussed. The value $\mu = -1$, describing hight - energy vacuum, makes a foundation of inflational models of early Universe. It should be noted that the value $\mu = 2/3$ has the classical ideal gas. It should be concentrated upon that all specified values of μ are the private cases of the equation $p = M\varepsilon/3$, where M is integer. Thou it is normaly to discuss the cases where $M = -1$ ($p = -\varepsilon/3$) and $M = 3$ ($p = \varepsilon$). The first case is discussed in (Kolb, 1989) where the suitable matter state is called K-matter. In (Stanyoukovich, 1972) equation of state appears under consideration of gravitational vacuum which is a medium consisting sting of supermassive particles -plankeons. The second case describes the limit stiff matter state when the sound velocity is equal to the light velocity. Such equation of state may have low-enegry vacuum [1].Under the hight density and pressure interaction between nucleons can also lead to the equation $p = \varepsilon$ (Zel'dovich, 1961).

When solving the system (1),(2) in conjunction with equation of state we receive the relation $a(t)$. After that from the interval equality 0 for photon it's non - dimensional rang can be find: $r = c\int_{a_0}^{a} dt/a(t)$. If we pass from time t to redshift z now (using the proportion $1 + z = a/a_0$),we shall receive (Gudmundsson and Rognvaldsson, 1990):

$$r = \frac{1}{\sqrt{\Omega - 1}} sin\left(\frac{2}{1+M}\left(arcsinA - arcsinB\right)\right), \qquad (3)$$

where

$$A = \sqrt{\frac{\Omega - 1}{\Omega}}, \quad B = \sqrt{\frac{\Omega - 1}{\Omega(1+z)^{1+M}}},$$

Ω is the relative density.

It is an interesting fact that (3) is formaly actually under any values of M and Ω. But when $M = -1$ or $\Omega = 1$ it is neccessary to make the proper limit passage in (3) and when $\Omega < 1$ it should be noted that trigonometric functions of imaginary argument pass to the proper hyperbolic functions of real argument.

Finalli, the fotometric distance to the square which is inversely proportional to the of radiation flow from object being located on cosmological distance is $d = (1 + z)r$. The magnitude of object is

$$m = M_0 + 5lg((1 + z)r) + const, \qquad (4)$$

accordingly,where M_0 is it's absolute magnitude. Some calculation results using the formulas (1),(2) and (3) are repsented on fig.1. The area which occupies by quasars on $m - z$ diagrame is shown schematically by a multangular (Khodjachikh, 1983).

One cen see thet the test $m(z)$ for K-matter and "dust" don't correlate with observations at least when $\Omega \simeq 1$ (the possible evolution effects for quazars don't take into account). The functions $m(z)$ for "stiff" matter ($p = \varepsilon$) occur into occupied quasars when densities are hight ($\Omega > 10$).

The metrical evolution velocity of the Universe increases with the growth of density Ω. When $\Omega > 1$ such dependences of value Ω on evolution parameter η (defining by the proportion $cdt = ad\eta$) (Monin et al.,

1989) take place:

$$\Omega_1 = \frac{1}{\cos^2(2\eta)}; M = 3 \tag{5}$$

Taking into account that $\Omega_1 = 30$, we shall receive that $\Omega_0 = 1.13$ i.e. near to 1. The suitable estimations of evolution time will give us: $t_1 = 0.7c/a_0$ and $t_0 = 0.03c/a$. Though, evolution velocity increase by means of hight values Ω_1 is compensated,when order of value is considered, by arrest of evolution development under the passage from "dust" world to "limit stiff". Under the passage to K-matter the evolution rate rises and this rules out the possibility of great values Ω in that case.

So assumption that quasars can contain matter with limit stiff equation of state is not contrary to visible for them values $m(z)$ and can be the object of next treatment.

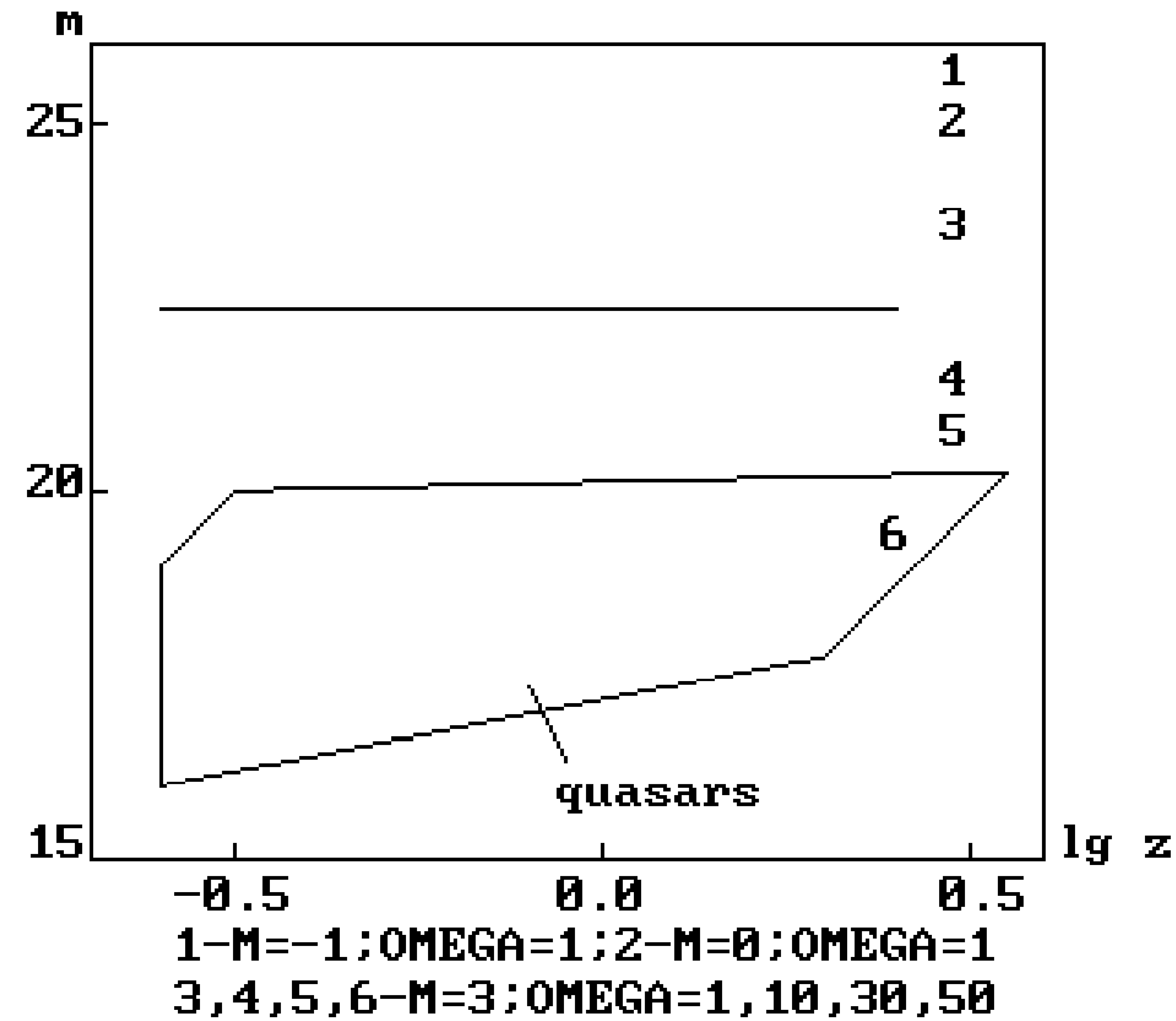

Figure 1. The dependence $m(z)$ for $p = -\varepsilon/3$, $p = \varepsilon$ and quasars.

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