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A remark on "Cosmic gravitational background radiation as a basis of Karolyhazy hazy space-time" by G.-W. Ma

Lajos Diósi [1]

KFKI Research Institute for Particle and Nuclear Physics, POB 49, H-1525 Budapest 114, Hungary

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Abstract

The calculations of Ma [Phys. Lett. A 239 (1998) 209] contain an easily detectable error which makes his conclusions irrelevant. © 1999 Published by Elsevier Science B.V.

Ma [1] has recently claimed that, starting with a reasonable gravitational background radiation, he can deduce the spectrum of space-time fluctuations of a certain model [2], and he claims that this spectrum is cosmologically sensible. However, the spectrum he has deduced differs from the true spectrum of this model which I and Lukács [3] criticized as being cosmologically untenable.

Unfortunately, there is a crucial error in Ma's deduction, which can easily be detected.

Ma's calculations start with a certain [2] plain wave expansion of the gravitational radiation, see Eqs. (10)–(21). The amplitudes of the two independent polarizations of the plane wave are denoted by δ and C, respectively. The gravitational energy W, i.e. the volume integral of the r.h.s. of Eq. (19), is then expressed in terms of the author's amplitudes δ and C. I note here that the energy of plane waves should always be positive. However, Ma's energy expression (21) is indefinite: the terms proportional to C^2 have been left out.

I have calculated the term missing from Eq. (21),

$$W_{(\beta)}(\text{missing}) = \frac{c^4 V}{32\pi G}\sum_k k^2 C_{(\beta)}^2 .$$

This term is absolutely relevant for what Ma is going to do later in his Letter. The author's claim is based on the extreme smallness of a certain function D^2 which governs the intensity of fluctuations. It is bounded by $D_{\rm up}^2 \sim 10^{-12}$ as the Letter states. Now, the missing term above, when added to Ma's incomplete expression (21), amounts to the change $D^2 \to 1 + D^2$, as may be seen from Eq. (24). The smallness of D^2 disappears in the correct plane wave expansion of the energy. This, in itself, invalidates the Letter's claim.

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[1] E-mail: diosi@rmki.kfki.hu.

[2] Ma chooses a gauge which violates the spatial rotation invariance, see Eq. (17b). This leads to the awkward forms $\sum(1/k)\prod k$ instead of 3-covariant expressions.

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