LETTERS AND COMMENTS

Comment on 'The vacuum field energy in a constant volume cavity'

B Jancovici

Laboratoire de Physique Théorique et Hautes Energies (Laboratoire Associé au Centre National de la Recherche Scientifique - URA D0063) Université de Paris-Sud, Bâtiment 210, F-91405 Orsay Cedex, France

Abstract. The argument in a paper, published in this journal, is shown to be incorrect.

As a member of the Editorial Board of this journal, I have been urged to respond to an article I have found to be wrong. This is the paper 'The vacuum field energy in a constant volume cavity' by Weigand and Guerra [1].

These authors have investigated the Casimir effect (i.e. the force due to the zero-point energy of the electromagnetic radiation) for a prismatic cavity with perfectly conducting walls. Unfortunately the authors do not seem to have been aware of previous work on this subject, in particular by Lukosz [2] and by Balian and Duplantier [3]. It had been found that in the case of a cavity with wedges, such as a prismatic one, infinite Casimir forces are obtained if the walls are assumed to remain ideal conductors up to arbitrarily high frequencies; for obtaining physically relevant results, it is necessary to take into account that any material becomes transparent to electromagnetic radiations at high enough frequency. The correct Casimir energy has, as its leading term, a contribution proportional to the total length of the wedges. Thus, contrary to the claim in [1], there is no phase transition when the shape of the prismatic cavity is varied.

The calculations and results in [1] are not valid because the starting point is incorrect. In a cavity of finite volume V the density of modes *cannot* be approximated by $8\pi V \nu^2 / c^3$, even cut at the minimum eigenfrequency. The actual density of modes has corrections which are the very source of the Casimir effect. Furthermore, it is necessary to take into account the forces on *both* sides of the cavity walls.

References

[1] Weigand R and Guerra J M 1997 *Eur. J. Phys.* **18** 40
[2] Lukosz W 1973 *Z. Phys.* **262** 327
[3] Balian R and Duplantier B 1978 *Ann. Phys.* **112** 165

Footnote

After having been shown a draft of this Comment, the authors wrote to the Managing Editor that 'the aim of [their] paper is not the calculation of the true Casimir forces'.