such as those used for these experiments. The relative sensitivity of these instruments is fairly well established, however. By use of the drift-scan technique, our upper limits to the flux are greater than the flux from *CP* 1133 reported by O'Mongain *et al.*[4], who used a similar technique. The latter flux was estimated to be 5×10^{-11} photons cm^{-2} s^{-1} at an energy threshold of about 3×10^{12} eV. But if the gamma ray source is pulsating, with a period equal to the radio pulsations, the upper limit of the flux measured in this experiment does not support the positive effect from *CP* 1133 reported by both O'Mongain *et al.*[4] and Charman *et al.*[5] Our results are summarized in Fig. 1.

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Cosmology and Electrodynamics

In a recent article[1] we discussed how the spontaneous transition of an atomic electron could be explained in the theory of direct interparticle action. It was shown how the entire transition rate could be explained in terms of the response of the universe. For the response to be appropriate the universe has to be a perfect absorber along its future light cone, a requirement met by the steady state theory but not by the open Friedmann cosmologies.

Recently Pegg[2] has argued that our work ignored the role of zero point oscillations of the electrodynamic field. He further points out that these oscillations contribute half the observed rate of spontaneous transition and that this effect, together with the response of the universe, would lead to one and a half times the observed rate.

The purpose of this letter is to clear up this misunderstanding, although we fail to see why it should have arisen at all. In our article[1] we emphasized clearly the fact that in the direct particle approach fields have no degrees of freedom of their own. Hence they cannot be quantized as in the case of electromagnetic field theory. The effect to which Pegg refers arises only in the field theory and is entirely absent from the direct particle theory. So the question of ignoring it does not arise.

It is perhaps advisable at this stage to comment further on the differences between the quantum aspects of field theory and the direct particle theory. The spontaneous transition is explained in quantum field theory by the rules of field quantization. These can be written in terms of a set of creation and annihilation operators a^*, a for photons (the carriers of field energy). The consequence of these rules is

$$a\,\psi(\ldots, n, \ldots) = \sqrt{\frac{2\pi\hbar c n}{k}}\,\psi(\cdots, n-1, \cdots) \qquad (1)$$

$$a^*\,\psi(\ldots, n, \ldots) = \sqrt{\frac{2\pi\hbar c(n+1)}{k}}\,\psi(\cdots, n+1, \cdots) \qquad (2)$$

where $\psi(\ldots, n, \ldots)$ describes a state with n photons and k is the wave number of these photons. The formula for the probability of an upward transition then turns out to be proportional to n, while that of downward transition turns out to be proportional to $n+1$. Because n is proportional to the external field intensity present we get a non-zero probability of downward transition even when $n=0$. This is the spontaneous transition probability. The asymmetry $(n, n+1)$ can also be related to Bose–Einstein statistics for photons (compare Feynman[3], p. 4).

In the direct particle theory this procedure is meaningless. There are no fields to quantize. The only observable electromagnetic effects must be related to the motion of charged particles. As demonstrated in our article, this approach leads to the correct answer.

The second major point of difference relates to self-action. It is present in the field theory and absent in the direct particle theory. We therefore fail to understand the latter part of Pegg's argument, especially its relevance to the absorber theory of radiation. If self action and vacuum oscillators are introduced into the absorber theory it is critically altered from the direct particle theory considered by various authors[1,4–7]. It is not surprising if such a modified theory agrees with the Einstein–de Sitter cosmology. In fact, the conventional field theory (which this modified theory resembles) is also consistent with any form of cosmology.

We end with the last, and in our view the most crucial, point of difference between the two theories. It is often argued that the direct particle theory follows from the field theory if all field oscillators are eliminated by integration. This is not a correct conclusion. Elimination of field oscillators leads to a formulation of electrodynamics which is different from that described by the direct particle theory. This difference has been pointed out by Feynman and Hibbs[8]. The direct particle theory involves advanced and retarded interactions on an equal footing. The elimination of advanced interaction is achieved only in certain models of the universe. Thus cosmology plays an important part in the direct particle formulation of electrodynamics.

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Sub-millimetre Wave Solar Observations

A sub-millimetre wave observation[1] of the Sun, obtained in December 1967 at an altitude of 3,580 m, indicated an unexpected absorption feature in the range 7–9 cm^{-1}, and thus confirmed an earlier unpublished result obtained as part of a study in March 1957 at the same site[2]. Because of the long atmospheric path during the more recent experiment, the spectral quality in the 20–30 cm^{-1} range was modest. In order to obtain better solar results over this range, further observations were made in April 1968