SPECTROSCOPY LETTERS, 6(1), 73-75 (1973)

EMISSION THEORY AND SYNCHROTRON RADIATION

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Abstract: The angular distribution of synchrotron radiation gives no evidence against the Ritz emission theory.

It has recently been put forward that the angular distribution of the radiation emitted by fast accelerated electrons in a synchrotron contradicts the Ritz emission theory.[1] This new attempt against emission theory is based on the conclusion that it predicts isotropical angular distribution of the emitted radiation relative to accelerated electrons (and nonisotropical angular distribution over the entire solid angle 2π of the forward hemisphere relative to the laboratory). It can be shown that this conclusion is reached by the incorrect application of the basic concepts of emission theory and an inadequate interpretation of the phenomenon considered, and therefore probably wrong. It is sufficient to note the following three arguments to refute the recent criticism against emission theory.

1) The two distinct concepts of emission theory are confused: virtual quantum and real photon. It should be pointed out that virtual quanta (or the so-called "partucules fictives infiniment petites") were introduced by Ritz only as an aid to represent the field of an electric charge.[2] These virtual quanta were assumed to be emitted by the electric charge continually in all directions with the relative velocity c. Using streams of such fictitious "bullets", a qualitative interpretation of various electromagnetic phenomena can be actually given, but in a more sophisticated manner.[3]

2) Synchrotron electrons are treated as free particles in uniform rectilinear motion. This is not justified since electrons are neither free (due to the electromagnetic field in synchrotron), nor in uniform rectilinear motion (due to their acceleration which is just the physical reason for the radiation).

3) Synchrotron electrons are treated as ordinary sources of light. This is not right since the radiation originates as a result of the interaction between an electron and the outer electromagnetic field, and it is not emitted by the electron itself as an ordinary source. The electron can be taken as a source of virtual quanta, but not as a source of real photons.

It should be emphasised that such incorrect procedure[1] would give erroneous results not only in the scope of emission theory. Following the same logic it could be easily deduced that special relativity predicts isotropical angular distribution of the radiation in all inertial frames - and so to "disprove" special relativity.

It is well-known that the angular distribution of radiation due to an accelerated charge can be obtained in the scope of special relativity (as well as according to classical Maxwell-Lorentz electrodynamics) using only the Liénard-Wiechert potentials (which result from retarded potentials) for a point charge.[4]

According to the Ritz emission theory, the expressions for retarded potentials are somewhat more complicated since c is replaced by $c + v_r$. Therefore, the analogues of the Liénard-Wiechert potentials are surely not simpler than the original ones. It is quite impossible to predict intuitively the angular distribution of radiation starting from complicated mathematical expressions. The problem is more intricate since the old Ritz's version of emission theory is not the only one possible.[5] Only a rigorous theoretical derivation could give satisfactory results for comparison with experimental data and predictions of other theories.

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Received December 4, 1972

Accepted December 20, 1972