On Estimating the Electromagnetic Pollution

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The problem of artificial electromagnetic background in cities is of the same importance as problems of chemical, acoustic, thermal etc. pollutions. Known field methods of the electromagnetic pollution evaluating are not quite adequate if the electromagnetic influences onto biological objects are analyzed, because those are essentially quantum systems (e.g., field formalism cannot take into account the Aharonov-Bohm effect). A self-sufficient potential formalism [1] is more promising. This theory predicts the existence of so-called Zero Magnetic (ZM) or Potential (P) electromagnetic potential oscillations. However, there are no experimental confirmations of those yet.

A mental experiment is proposed in this paper to observe the ZM waves (Fig. 1). A short planar electron wavepacket $W_1$ falls with velocity $v_{ex}$ on the diaphragm $D$ having two slots. Two charged sheets $C_1$ and $C_2$ with surface densities of charge $-\sigma$ and $+\sigma$ are placed behind the diaphragm transversely to one. The sizes of the sheets in both dimensions ($\Delta X, \Delta Y$) are much greater than length of the wavepacket $\Delta x$. The sheets are surrounded with an impenetrable for electrons potential barrier $B$ of $2\Delta Z < \Delta X, \Delta Y$ in width. Initially, the sheets are placed almost together, so electromagnetic potentials the left and the right of ones are practically zero. When parts of the wavepacket passed through the slots move close to the middle of the sheets length $X$, the sheets are drawn apart for a time of $\Delta t < \Delta X / v_{ex}$; then ones are returned to their initial positions. After an interval of order $\Delta Z / c$ ($c$ is the light velocity), components $A_t$ and $A_z$ of the potential four-vector become non-zero for the wavepacket part locations. Component $A_z$ does not vary the electron wave phase, while component $A_t$ gives the phase shift about $-eA_t\Delta t / \hbar$. Both parts of the wavepacket passed the sheets full length $\Delta X$ ($W_2$) are deflected with the biprism $BP$ producing interference figure ($W_4$) on the screen $S$. The $z$ coordinates of the interference fringes have to vary depending on were the sheets moved during the wavepacket passing or no. Known experimental results of the Aharonov-Bohm effect examinations give a good chance that outcome of the described above mental experiment would be successful.

The fact that the variation of the potential from the relocated sheets $C_1$ and $C_2$ reaches the parts of the electron wavepacket $W_2$ only after the time of order $\Delta Z / c$ (not instantaneously) means that some wave process occurs between the sheets and the wavepacket parts. This cannot be described from the position of the field formalism, because electromagnetic field of the charged sheets does not affect the electron wavepacket at all. This is the ZM wave of electromagnetic potential.

The experimental validating the one of basic consequences of the potential formalism enables way to more realistic estimating the electromagnetic pollution after-effects.

References