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SOME ASPECTS OF CHARGE STATIC FIELD POTENTIAL IN THREE-DIMENSIONAL ELECTRODYNAMICS

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Purpose. Obtaining the expicit expression for a point charge field potential in three-dimensional electrodynamics when the vacuum polarization is taken into account; comparison of the results obtained by the different methods of calculation. The present work is a continuation of Ref. [1]. It is of interest from the point of view of further studying the chiral symmetry dynamic breaking in QED_3 [2-11] and the properties of planar structures in solid physics [12-15].

Methodology. The numerical calculation of the integral representing the desired potential and the integrand approximation by the fractional-linear function are used. The numerical evaluations are performed with the Wolfram Mathematica 9.

Findings. When calculating the potential of the static charge field in QED_3 in N^{-1} approximation, the possibility of using a fractional-linear approximation for a function associated with a polarization operator is investigated. When comparing the application of different variants of fractional-linear approximation for the considered function with the result of numerical integration, it turns out that the three-point approximation is the best one. On the basis of this approximation, an analytical expression is obtained for the required potential and it is shown that when the mass of loop fermions vanishes, this expression does not turn into the known exact expression; the reason for this discrepancy is analyzed. On the basis of the expression for the potential obtained with the help of the three-point approximation, the possibility of weakening the condition for the disappearance of confinement is investigated and it is shown that under the considered approximation this possibility is absent.

The work was carried out according to the plan of the state budget subjects of the Physics Department.

Key words: three-dimensional electrodynamics, static potential, polarization of vacuum, chiral symmetry breaking, confinement.

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