

## Behavior of Vacuum Polarization of Gauge-Boson and Wavefunction Renormalization Factor of Fermion in Different Phases of QED<sub>3</sub>

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**Abstract:** We investigate the behavior of the vacuum polarization of the gauge-boson  $\Pi$  and the wave-function renormalization factor of the fermion  $A$  in QED<sub>3</sub>, using the coupled Dyson-Schwinger equations for the gauge-boson and fermion propagator. Using several different ansätze for the fermion-gauge-boson vertex, we find that the wave-function renormalization factor  $A$  and especially the vacuum polarization  $\Pi$  have different behaviors in the dynamical chiral symmetry breaking phase and in the chiral symmetric phase and hence in the phenomenological applications of QED<sub>3</sub> one should choose different forms of gauge-boson propagator for these two phases. We also find that when adopting a specific ansätze of the fermion-gauge-boson vertex (ansätze (3)) the vacuum polarization function equals its one-loop perturbative result in the chiral symmetric phase. This fact suggests that in QED<sub>3</sub> the Wigner vacuum corresponds to the perturbative vacuum.

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Key words: Dyson-Schwinger equations, vacuum polarization of gauge-boson, DCSB phase, symmetric phase

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