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## Vacuum and in-medium polarization phenomena in strong magnetic fields

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We discuss the fermion-antifermion polarization phenomena in strong magnetic fields that can be realized in heavy-ion collisions, laser fields, and neutron stars. We elaborate on its effects on birefringence when a photon is traversing the magnetic-field region [1].

The medium effects can drastically change the vacuum birefringence due to the Pauli blocking effect and the medium-specific contribution known as the Landau damping. We also discuss the axial charge generation when a perturbative electric field is applied on top of the strong magnetic fields, leading to a non-zero divergence of the axial-vector current [2]. For massive fermions, the medium contribution can be as large as the vacuum contribution known as the chiral anomaly.

[1] Koichi Hattori and Kazunori Itakura, “In-medium polarization tensor in strong magnetic fields (I): Magneto-birefringence at finite temperature and density,” 2205.04312 [hep-ph].

[2] Koichi Hattori and Kazunori Itakura, “In-medium polarization tensor in strong magnetic fields (II): Axial Ward identity at finite temperature and density,” 2205.06411 [hep-ph].

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