Plasmon-polaritons in magnetized charge-neutral graphene

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Graphene plasmon-polaritons (GPPs) - electromagnetic fields coupled to oscillating Dirac charge carriers in graphene - exhibit nanoscale confinement allowing for an active control via gating, and are thus highly interesting for nanophotonics and optoelectronics. Up to now, the GPPs have been known to be formed by either free charge carriers in doped graphene or thermal charge fluctuations in charge-neutral (CN) graphene at non-zero temperature [1-4]. Here, we find that magnetically biased CN graphene can support GPPs of both transverse magnetic (TM) and transverse electric (TE) polarizations even at zero temperature. These GPPs exist in the narrow absorption bands originating from the electronic transitions between Landau levels [5]. The wavelength and the propagation lengths of both TM and TE GPPs can be controlled by varying the applied magnetic field. Remarkably, the interband TE GPPs have two orders of magnitude stronger confinements than TE GPPs in doped graphene, favoring their excitation via grating. Our findings open the door for novel magnetic-field controllable graphene-based optoelectronic devices, such as waveguides, photodetectors and sensors among others.

References

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