Cyclotron resonance in bilayer graphene

ERIK HENRIKSEN, Columbia University, ZHIGANG JIANG, LI-CHUN TUNG, NHMFL, MOLLIE SCHWARTZ, Columbia University, MAIKA TAKITA, Barnard College, YONG-JIE WANG, NHMFL, PHILIP KIM, HORST STORMER, Columbia University — The hyperbolic dispersion of bilayer graphene leads to a Landau level (LL) spectrum that is linear in the magnetic field, \( B \), at low energies but shifts to a \( \sqrt{B} \) dependence with increasing energy. Here we present the first infrared transmission measurements of the unique \( B \)-field dependence of LL transitions in bilayer graphene, in a gated \( 400 \mu m^2 \) sample in fields up to \( B = 18 \) T. Eight intraband transitions are observed among LL indices \( |n| \leq 4 \), including the unusual zero-energy \( n = 0 \) level, and are found to follow a selection rule of \( \Delta n = +1 \). We find the change in field dependence is plainly visible between the behavior of the transition energies for \( n = -1 \to 0 \) and \( n = 0 \to +1 \), which are close to linear in \( B \), as compared with all other transitions which display a clear \( \sqrt{B} \) behavior. However, the shift in field dependence occurs at energies well below where it is expected based on nearest-neighbor tight-binding calculations, and a single set of fitting parameters within this theory fails to describe our results.

Erik Henriksen
Columbia University