# Gyrotropic Zener tunneling in $\nu = 0$ Landau Level of graphene

Antti Laitinen[a], **Manohar Kumar**[a], Edouard Sonin[b], and Pertti Hakonen[a]

[a]Low Temperature Laboratory, Department of Applied Physics, Aalto University, Espoo, Finland
[b]Racah Institute of Physics, Hebrew University, Jerusalem, Israel

Zener tunneling is a physical phenomenon, referring to tunneling of charge carriers across a forbidden gap between two bands. For a zero gap Dirac material such as graphene, this phenomenon was widely investigated theoretically and experimentally under the name Klein, or Klein-Zener tunneling. In the presence of a magnetic field, a cyclotron gap opens up between Landau levels, and Zener tunneling through this gap was qualitatively discussed as a possible source of magnetoresistance oscillations [1]. In a strong magnetic field the main force on an electron is the gyrotropic Lorentz force, while the inertia force proportional to the electron mass can be ignored. This makes electron dynamics similar to dynamics of superfluid vortices governed by the gyrotropic Magnus force. Here we present the first experimental evidence of gyrotropic Zener tunneling in suspended Corbino graphene between two sublevels of $\nu = 0$ the Landau level with the gap of Coulomb origin between them. By analogy with vortex dynamics we have developed a model for the gyrotropic Zener tunneling [2]. Observed exponential I-V characteristics at the breakdown of Hall states are reasonably well fitted by dependences predicted by the model.

References: [1] Yang et al. Phys. Rev. Lett. 89 076801 (2002), [2] Laitinen et al. (To be published)