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Energy dependent chirality effects in graphene

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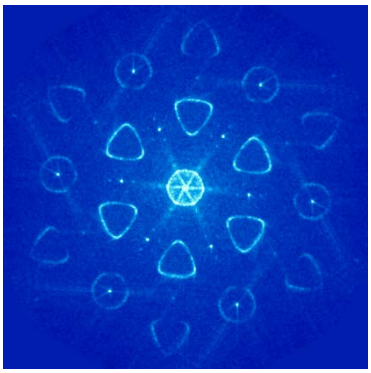

The chiral nature of the low energy quasiparticles of graphene play a key role in many interesting phenomena such as Klein tunneling and chiral quantum Hall effects, and could even affect graphene based devices. By imaging quasiparticle interference (QPI) with Fourier-transform scanning tunneling spectroscopy (FT-STS), the effects of chirality can be directly visualized. However, detailed studies are only available for the low energy region near the Dirac point.

We highly n-doped our graphene by intercalation of Cs and analyze the QPI at energies ranging from the linear (Dirac-like) to the strongly trigonally warped region near the Van Hove singularity. At their crossover, we observe a drastic change in the QPI, indicating a state with broken chirality. Two effects are driving this transition: First, the trigonal warping of the constant energy contour opens up a new scattering channel. Second, higher order electron hopping pushes the Van Hove singularity down to lower energies.