# CONTROLLING OPTICAL ACTIVITY IN TWO -ATOM-THICK GRAPHENE

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Recently, the experimental realization of thin films with full control of the structural handedness down to the atomic scale was possible by stacking two graphene layers whose chiral properties are designed by an interlayer rotation angle [1]. The precise handedness can be controlled over several millimeters. This kind of uniform chiral metamaterial with two-atom-thick would provide a powerful tool for exploring and controlling chirality-dependent phenomena, including circular dichroism, templated enantioselective growth in stereochemistry, electronic spin filters in spintronics, among other fields.

In this work, we report theoretical results of the circular dichroism of a chiral stacking of two-dimensional materials are positioned layer-by-layer with precise control of the interlayer rotation. Using a time-perturbed first-principles theory [2], we show that these chiral properties originate from the large in-plane magnetic moment associated with the interlayer optical transition. Furthermore, we show that we can program the chiral properties of atomically thin films layer-by-layer graphene left-handed or right-handed films with structurally controlled CD spectra. The first-principles calculation show that the multipole polarizability, an intrinsic and structure-dependent quantity induced by the chiral nature of the interlayer optical transition, is the origin of the giant optical activity that is comparable to the highest known values for other materials.

*Keywords:* chiral graphene, 2D-materials, first-principles circular dichroism

**References**

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[2] F. Hidalgo, A. Sanchez-Castillo, C. Noguez, Physical Review B 79, (2009) 075438