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Large-Area Intercalated Two-Dimensional Pb/Graphene Heterostructure as a Platform for Generating Spin–Orbit Torque

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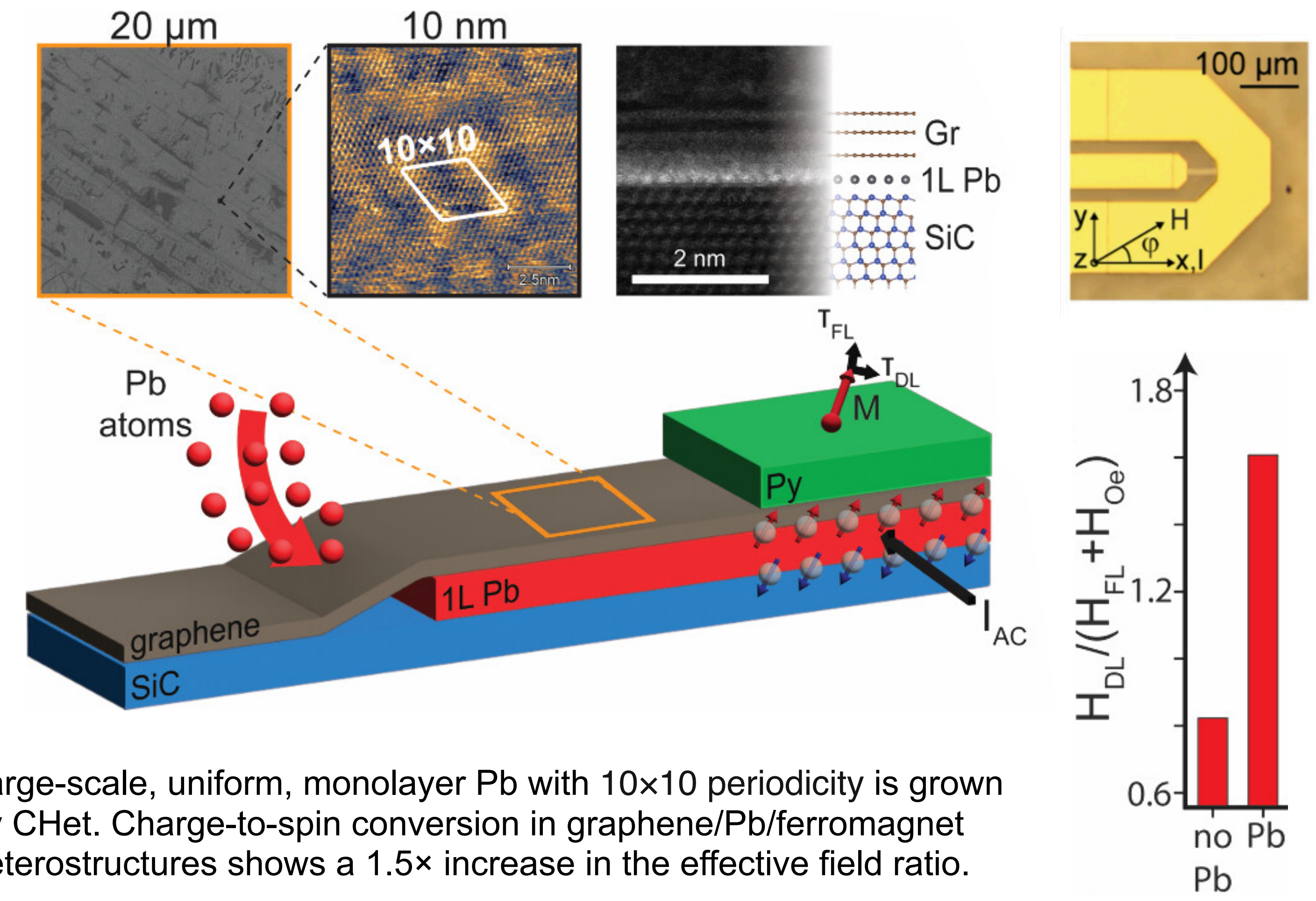
Intercalation of air-stable monolayer Pb into EG/SiC by confinement heteroepitaxy (CHet) enables study of heavy metal films at the extreme limit of thinness with complementary microscopy and spectroscopy. Pb coverages up to 90% can be achieved at elevated temperatures beyond those of conventional ultrahigh vacuum methods. CHet-based Pb exhibits a Frenkel-Kontorova domain boundary network due to lateral compressive stress relief within a (1 × 1) Pb/SiC model, which can be seen experimentally as a (10 × 10) superstructure. Anticipating a large spin polarizability, we leverage uniformly intercalated Gr/Pb/SiC as a basal layer for a ST-FMR measurement, discovering a 1.5× increase in the effective field ratio over a hydrogenated sample and consistency with C_{3v} symmetry. Intercalation of Pb in EG/SiC is thus a promising material platform for *ex situ* spin transport phenomena.



Large-scale, uniform, monolayer Pb with 10×10 periodicity is grown by CHet. Charge-to-spin conversion in graphene/Pb/ferromagnet heterostructures shows a 1.5× increase in the effective field ratio.