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Synthesis of 2D and 1D graphene structures and their magnetic and plasmonic properties[1]

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The synthesis of 2D and 1D graphene structures is critical to explore their unique physical properties, including Dirac plasmonics in 2D graphene and spin-polarized edge states in zigzag graphene nanoribbons. We have developed a universal new method to synthesize 2D and 1D graphene structures, and further revealed the exotic magnetic and plasmonic properties of graphene at the quantum level. Our central findings include: 1) Self-assembled synthesis of monolayer graphene from aromatic molecules at low temperatures; 2) One-dimensional self-assembled synthesis of the narrowest zigzag graphene nanoribbons, with the pentacene segments connected by carbon tetragons, which are predicted to serve as definitive spin switches to reverse the spin orientations of the two edge channels; 3) Quantum control of the plasmon excitation and propagation in graphene; 4) Substantial enhancement of quantum coherence in graphene by plasmon coupling. Collectively, these findings help to shed new light on the synthesis of graphene structures with designed patterns and exploration of their emergent quantum properties.

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