# Advances in Precision Graphene Nanoribbons

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Graphene nanoribbons (GNRs) – quasi-one-dimensional graphene strips, are garnering increasing attention as promising candidates for next-generation electronic and spintronic materials. The intriguing electronic and magnetic properties of GNRs are intricately related to their edge structure, width, dopant, nonplanarity, and termination. Bottom-up synthesis of GNRs, which can be achieved through both in-solution and on-surface methods, stands out as a robust approach to access precision GNRs with customizable structures/topologies and electronic structures, which holds significant promise for advancing nanoelectronics and spintronics in the coming era. Over the last decade, general design principles and synthetic methodologies have been established for synthesizing precision GNRs. In the first part of my talk, we will introduce the general types and structures of GNRs, elucidating their unique electronic structures and intrinsic properties. In the second part, we will present the precision GNRs obtained by on-surface synthesis, showcasing their intrinsic electronic properties, topological phases, and spin-related properties. In the third part, we will delve into the in-solution synthesis of both nonplanar GNRs and GNR heterostructures via step-growth or chain-growth polymerization. Special emphasis will be placed on cove-edged GNRs, renowned for their unique and highly tunable electronic structures, alongside the design strategy aimed at achieving high intrinsic charge carrier mobilities. In the final part, we will outline strategies geared towards improving the solution processability of GNRs and further demonstrate their integration in nanoelectronic devices