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Narrow-gap Luttinger liquid in carbon nanotubes

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Single-walled carbon nanotubes are the thinnest and the cleanest among the currently available nanoscale quantum wires. Transport properties of nanotubes depend on the presence of a gap in electron spectrum, defining two main nanotube types, metallic and semiconducting. Semiconducting tubes attract interest in particular because of the sensitivity of their properties to external fields and doping. Among semiconducting tubes there is an interesting class of narrow-gap tubes, or so-called chiral metallic tubes, which exhibit a narrow semiconducting gap arising due to curvature [1]. The Luttinger liquid effects, which are strong in all nanotubes, are particularly interesting in the narrow-gap tubes. Interaction strongly affects the energy gap, reinforcing it and making it sensitive to the long-wavelength charge mode dynamics [2]. We discuss new types of charge carriers possible in the gapped states and their relation to recent experimental work [3].

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