Effective Tomonaga-Luttinger liquid theory for multi-wall nanotubes

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This study develops a formalism based on Tomonaga-Luttinger liquid (TLL) theory, which effectively describes one-dimensional (1D) systems through collective modes that account for electron-electron interactions. One of the most promising 1D materials are carbon nanotubes, which come in two types single- and multi-wall. Specifically, we present here a TLL model for multi-wall nanotubes (MWNTs) which include the valley degree of freedom alongside spin and charge. We address the complexity introduced by inter-shell interactions and hybridization in MWNTs, considering that conducting paths are randomly distributed among coaxial shells.

Our findings indicate a universal value of compressibility for the holon mode, while neutral mode parameters vary with inter-shell coupling details.

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