Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Topological states and quantized current in helical organic molecules AI-MIN GUO, Harbin Institute of Technology, QING-FENG SUN, Peking University — Topological quantum states have been attracting intense interest in condensed matter and materials physics. Here, we report a theoretical study of electron transport along helical organic molecules subject to an external electric field, which is perpendicular to molecular helix axis. Our results reveal that topological states can appear in single-helical molecules as well as double-stranded DNA under the perpendicular electric field. In particular, a topological charge pumping can be realized by rotating the electric field in the transverse plane. During each pumping cycle, an integer number of electrons can transport across the helical molecules at zero bias voltage, with pumped current being quantized. This quantized current is associated with the Chern number of occupied energy bands, and constitutes multiple plateaus by scanning either the Fermi energy or the bias voltage. Besides, the plateaus of quantized current persist in a very wide range of model parameters, since the edge states are topologically protected. These results could pave the way to explore topological states and quantized current in the biological systems and the helical molecules, and help in designing stable molecular devices.

Ai-Min Guo
Harbin Institute of Technology

Date submitted: 11 Nov 2016 Electronic form version 1.4