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EXACT MULTIELECTRONIC GROUND STATES FOR PERIODIC POLYMER CHAINS

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Abstract

For the first time exact multielectronic ground states have been deduced for periodic polymer chains containing Hubbard interaction and square cells, representing non-integrable itinerant many-body systems under the action of external fields. The variety of arising unusual physical properties place such systems close to technological application possibilities in nanotechnology and spintronics.

I. Introduction

Polymers and molecular chains are genuine objects for nanotechnology. Based on them, molecular electronics devices can be constructed as field effect transistors, diode rectifiers, light-emitting diodes, etc. On this line, organic polymers are studied in order to open possibilities for the use of special ordering effects in molecular devices as superconductivity, organic ferromagnetism or spin polarized conductivity. Since in such systems peculiar properties arise which can be altered by approximations, non-approximated methods are also in view to be used in their analysis.

II. Results

Recently [1], we have for the first time applied such methods in deducing the first multielectronic, particle number dependent and exact ground states for such systems with square unit cell, in presence of external electric and magnetic fields. The method uses the positive semidefinite operator technique [2, 3], and provides quite interesting physical properties as insulators on a continuous and finite concentration region of carriers, spin-polarized conduction, correlated half-metal, fully and partially saturated ferromagnetic states in an insulating phase, which by the action of external fields become metallic and non-magnetic, etc. Based on these results, even the design of spin valve devices has been suggested for applications in spintronics [1]. Taking into account itinerant linear chains with spin-spin type of interactions, metal-insulator transitions provided by correlation effects have been also deduced [4].

References

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