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Enhancement of Electromagnetic Properties of Conducting Nanostructures Using Controlled Patterns

[1]Madhulata Kumari* and [2]Nabin Kumar

Author's Affiliations:
[1]Research Scholar, University Department of Physics, B.N. Mandal University, Madhepura, North Campus, Singheshwar, 852128, Bihar, India.
E-mail: madhulatayadav1997@gmail.com
[2]University Department of Physics, B.N. Mandal University, Madhepura, North Campus, Singheshwar, 852128, Bihar, India.
E-mail: naveen.dr9689@gmail.com

***Corresponding author:**
Madhulata Kumari
Research Scholar, University Department of Physics, B.N. Mandal University, Madhepura, North Campus, Singheshwar, 852128, Bihar, India.
E-mail: madhulatayadav1997@gmail.com

ABSTRACT

We have studied the enhancement of electromagnetic properties of conducting nano structures. For this purpose the controlling method was used. The electronic properties of low dimensional semiconductor and met al.lic structure were studied. The plasmonic devices are useful in this study. The study of persistent currents using microscopic materials were studied. The electric and magnetic susceptibilities having nanostructures were studied. In this case shape, size and temperatures were taken into accounts. The properties of met al.lic nanoparticles were presented. The study of diamagnetic-paramagnetic transitions were studied at different temperatures. It was found that susceptibility decreased exponentially when temperatures were increased. At high temperatures susceptibility turned into weak paramagnetic nature. The paramagnetic-diamagnetic transitions were demonstrated and it was found that there were multiple flips at intermediate temperatures.

KEYWORDS

Enhancement, electromagnetic properties, nano structures, plasmonic, low dimensional, persistent current, microscopic, susceptibility.

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INTRODUCTION

Buttiker et al.[1] studied the growth of persistent currents in conducting rings. Several investigators studied electronic properties of conducting materials using nano fabrication methods[2-5]. The properties of low dimensional metal and semiconductor nano structures was studied by different authors[6-7]. Monticone et al.[8], Kante et al.[9] and McEnery et al.[10] studied the applications of quantum rings using plasmonic devices and considering metamaterials. Kreibig and Vollmer[11], Quinten[12] and Blackman et al.[13] studied the quantum effects in response to electronic properties of met al.lic nanoparticles. Gomez et al.[14] studied spin braking by magnetic impurities and due to electron interaction. Rickhaus et al.[15] studied the diamagnetic behavior of conducting materials and characteristics of susceptibility for different temperatures. Loss and Goldbart[16] studied the electronic properties of one dimensional rings and double parity effect was presented and followed by Weiz et al.[17] to show the same results. Deblock et al.[18] studied the properties' of conducting materials such as silver rings. Fuhrer et al.[19] studied the energy spectra of quantum rings. Kleemans et al.[20] studied the oscillatory persistent currents in self assembled quantum rings to present the electronic properties of met al.lic and conducting materials.

METHOD

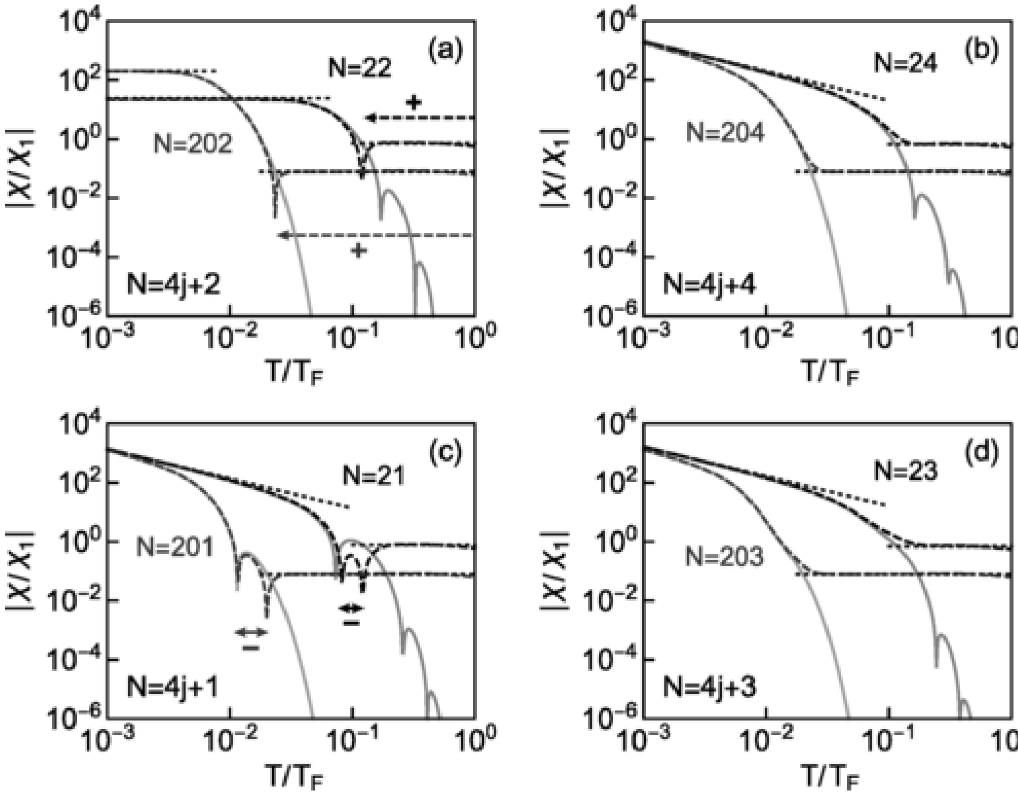
We have used quantum ring having fixed number of non interacting electrons dipped in external magnetic field. The properties of metal. and conducting material were calculated applying grand canonical potential. The chemical potential was calculated. The energy levels were obtained by using Schrodinger Pauli equation. The interactions between magnetic field and electron spin were find out. The eigen states and energies were calculated using the relation

$$\psi_{m,\sigma_z} = \frac{1}{\sqrt{2\pi R}} \chi_{\sigma_z} e^{im\phi}$$

Where χ_{σ_z} is the spin part of wave function. The persistent canonical potential was used for finding the magnetic susceptibility for the ring.

RESULTS AND DISCUSSION

We have studied the enhancement of electromagnetic properties of conducting nano structures using controlled patterns. Graph (1) shows the plot of magnetic susceptibility versus electron spin for different temperatures. It shows that susceptibility decreases exponentially at high temperature without electron spin. Graph (2) shows the plot of transitions for different temperatures. The Graph (2) shows the utility of one dimensional model and also show transitions for paramagnetic diamagnetic state. Graph (3) shows the plot of dependence fo susceptibility on temperatures. It was found that susceptibility was increased when temperatures were decreased. It was found that when the ring was Huckel type then it followed the Lagevin susceptibility. At low temperature the Curie point was observed with the help of (1) (a) Weiss type of paramagnetism was found. Graph (1) is size dependent transition which presented the paramagnetic diamagnetic transition for certain range of temperatures.



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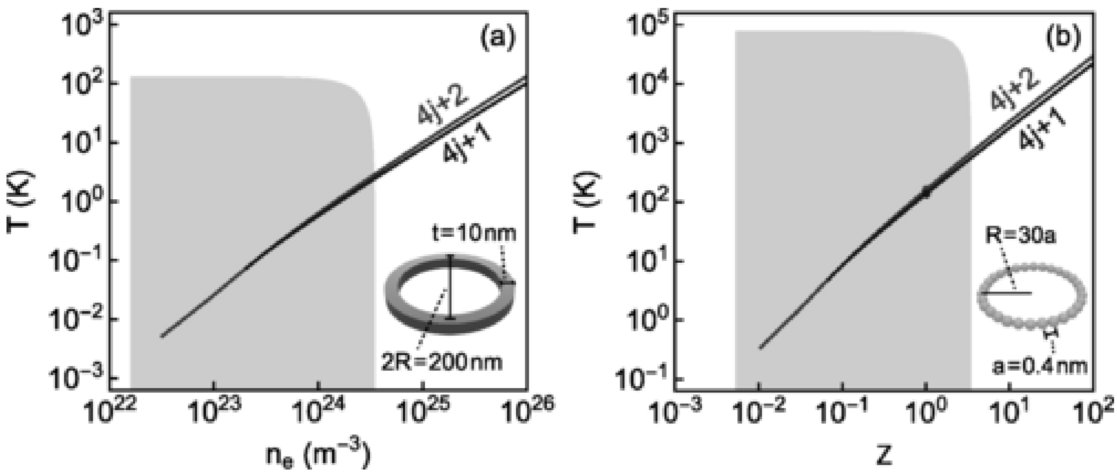
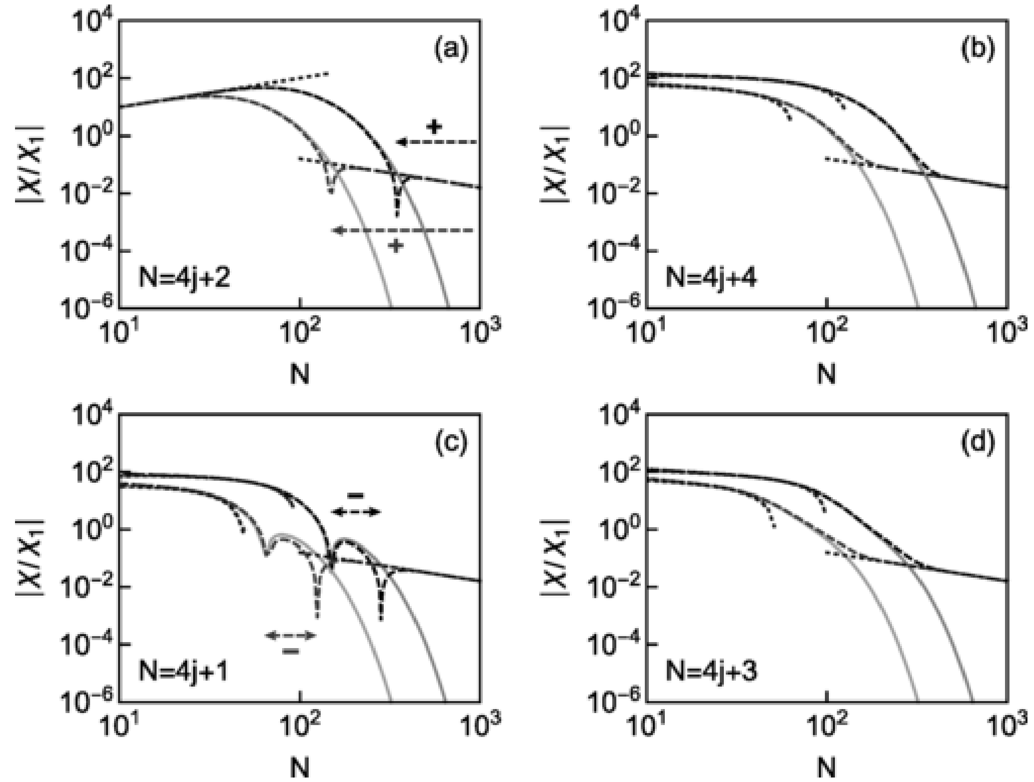
Graph 1: Plot of magnetic susceptibility versus spin-electron.



Graph 2: Plot of transition for different temperatures.



Graph 3: Plot of dependence of susceptibility on temperatures

CONCLUSION

We have studied the enhancement of electromagnetic properties of conducting nano structured material using controlled patterns. The electrical properties and magnetic properties of metallic and semiconductors were also studied. The calculations of magnetic susceptibilities of different conducting materials were made. The persistent current was obtained. It was found that diamagnetic-paramagnetic transition was possible above critical temperature. The results found were in good agreement with previously obtained results.

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