AUCTORES
Globalize your Research
Journal of Mechanical and Aerospace Engineering
Chur Chin*
Open Access
Short Communication

Quantum Fluctuations Evoked by Gold Nanoparticles (AuNPs) and Normal Saline with KCl Solution

Chur Chin

Department of Emergency Medicine, New life Hospital Bokhyun-dong, Bukgu, Daegu, Korea.

***Corresponding Author:** Chur Chin, Department of Emergency Medicine, New life Hospital Bokhyun-dong, Bukgu, Daegu, Korea.

Received Date: April 16, 2025 | **Accepted Date:** April 22, 2025 | **Published Date:** April 29, 2025

Citation: Chur Chin, (2025), Quantum Fluctuations Evoked by Gold Nanoparticles (AuNPs) and Normal Saline with KCl Solution, *J Mechanical and Aerospace Engineering*, 3(1); **DOI:** 10.31579/jmae-2025/006

Abstract:

Previously, we had identified that graphene exfoliator, NaCl + KCl solution can use to make a pair annihilation of boson particles. Fermion needs lesser Fermi energy to make a pair production or a pair annihilation by dopped colloid gold [1]. In this report, we show the mechanistic aspect of the quantum fluctuation which evoke the atomic collapse.

Key words: quantum fluctuation; gold nanoparticles; Normal Saline with KCl solution

Introduction

When gold nanoparticles are attached to graphene, there's often charge redistribution at the interface [2]. This can locally dope the graphene (either p-type or n-type, depending on how the AuNPs are functionalized). Gold nanoparticles exhibit localized surface plasmon resonance (LSPR) — collective oscillations of electrons that can strongly interact with graphene's π-electron system. This interaction can lead to hybrid states that are sensitive to quantum confinement and electromagnetic fluctuations. Quantum fluctuations are temporary changes in the energy of a point in space, due to Heisenberg's uncertainty principle. In materials, vacuum fluctuations affecting electron behavior at the graphene-AuNP interface. Casimir-like effects between graphene sheets or particles in close proximity. shot noise or current fluctuations in quantum transport measurements and quantum plasmonic behavior due to coupling of plasmons (from AuNPs) with Dirac fermions in graphene.When the graphene's 2D Dirac fermions and AuNPs' plasmonic fields together at the nanoscale, the system becomes susceptible to quantum fluctuations, especially under low temperatures,ultrafast optical excitation,nano-confinement, and high-sensitivity measurements.

Discussion

The alkali halides like NaCl and KCl (especially in molten or solid form) have been used in mechanical or thermally-assisted exfoliation of graphite to get few-layer or monolayer graphene. The mechanism is mostly mechanical intercalation and salt-assisted exfoliation [3,4], not chemical. They help create graphene by wedging themselves between layers of graphite when heated or ground, making exfoliation easier. Both are wide-bandgap insulators with no free electrons at room temperature.They don't exhibit quantum fluctuation behavior in the same way metals, superconductors, or low-dimensional materials do. Quantum fluctuations, in the physical sense (e.g., vacuum fluctuations, quantum noise, Casimir forces), typically require delocalized or mobile quantum particles (like electrons or photons),low-dimensional systems and strong field confinement or coherence.If you combine NaCl + KCl with graphene or gold nanoparticles, under specific quantum-confined conditions as in nano-cavities formed between exfoliated graphene flakes with trapped salt crystals — Casimir or van der Waals forces could play a role.During ultrafast laser excitation of a graphene/salt system, transient quantum fluctuations in local fields might emerge. If the salt mixture is used as a solid electrolyte in a confined space, ion tunneling and charge noise could introduce quantum stochasticity.

An ionic aqueous solution, highly conductive (electrically), and biologically relevant.It's a classical system: mobile ions in water, governed by thermal motion, electrostatics, diffusion, etc. Quantum fluctuations as in vacuum energy, Casimir forces, tunneling, etc. usually occur in non-thermal, confined, or low-dimensional systems. However,If we place this solution in contact with graphene or 2D materials, we can create electrical double layers at the interface, quantum capacitance effects and possibly observe charge density fluctuations or noise in graphene's conductance measurable at high sensitivity. These edge conditions can amplify the detection of quantum fluctuations, even in ionic environments.Putting normal saline + KCl inside carbon nanotubes, graphene capillaries, or nanopores can create quantum-confined ionic transport (ion tunneling, ion Coulomb blockade) Water and ions in this confined geometry do not behave classically anymore and quantum effects dominate.

Conclusion

The graphene-AuNP composites can indeed evoke or enhance quantum fluctuations, especially through plasmonic interactions, charge transfer, and quantum confinement at the nanoscale. This is an active area of quantum material research.If this ionic solution integrate with quantum sensors (like nitrogen-vacancy centers in diamond or graphene-based quantum dots), the fluctuations in ion motion and their electromagnetic fields could influence quantum coherence. In that case, ionic motion coupling to quantum state interplay where quantum fluctuations could be observed or modulated.

References

1. Chin C. (2024) . Case reports of bosonic pair annihilation on graphene by NaCl+KCl solution, J Clin Images Med Case Rep. 5(11) .3322.
2. Chuang MK, Chen FC, Hsu CS. (2014).Gold nanoparticle-graphene oxide nanocomposites that enhance the device performance of polymer solar cells. J Nanomaterials;179:1-12.
3. Wang S, Wang C, Ji X. (2017). Towards understanding the salt-intercalation exfoliation of graphite into graphene. RSC Adv;7(82):52252-52260.
4. Moosa A, Abed M. (2021). Graphene preparation and graphite exfoliation. Turk J Chem;45(3):493-519.

DOI: 10.31579/jmae-2025/006