"I WANNA KNOW TUNNELING"
A One-day Discussion Meeting On Tunneling
Venue : Institute Lecture Hall
Date : 12. 09. 2002

ABSTRACTS

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Speaker : D. Sahoo

Title : Tunneling : An Overview

The presentation will include following topics:

1. Stationary state one-dimensional tunneling description.
2. Tunneling of a wave-packet through a barrier and the Wigner phase time.
3. Splitting of energy levels due to tunneling; application to molecular spectroscopy; Spin tunneling.
4. Dynamical tunneling.
5. Conceptual problems arising in defining tunneling times; non-uniqueness of tunneling time in conventional quantum mechanics; Tunneling time in Bohmian quantum mechanics.
6. Tunneling in relativistic quantum mechanics.
7. Many-body tunneling.
8. Tunneling in phase space.
9. Light-controlled single photon tunneling.

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Speaker : S. Varma

Title: Scanning Tunneling Microscopy

Invented in 1982 by Binnig and Rohrer, the scanning tunneling microscope (STM) was the first instrument to perform real space atomic resolution imaging of the surface of a material. The talk will discuss the tunneling microscopy and its applications.

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Spaeker : V. Venkatesh Shenoi

Title : Electron tunneling in superconductors

We start with Giaever's discovery of electron tunneling (NIS) in superconductor. The phenomenological model for NIS and SIS tunneling due to Giaver will be discussed. From tunneling Hamiltonian formalism, we show that the tunneling current is a direct measure of the density of states by tunneling expt. We will discuss NIN, SIN, SIS tunneling as well as Josephson tunneling within this formalism. We shall end with a brief discussion of simple approach to obtain Josephson equations due to Feynman.

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Speaker : L. Satpathy

Title: Tunneling in Nuclear Phenomena

Nuclear matter which constitutes about 99.9 % of the universe exists in many conditions in nature characterised by density, neutron-proton ratio and temperature. In the form of nucleus, it is the fundamental building block of matter. The question of the existence or nonexistence of various nuclear specises and their abundances has been of fundamental importance ever since the discovery of the nucleus in 1932. Apart from beta-decay the study of the instability of the nucleus manifested in its decay processes like nucleon, alpha,cluster and fission and the constructive process of fusion has largly answered the above question. The underlying role of quantum mechanical tunneling phenomena in all these processes will be reviewed.

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Speaker : A. M. Jayannavar

Title: Quantum Clocks

The subject of time in quantum mechanics is beset with problems since it's inception. There is a long history of debate in regard to a time taken by a particle to tunnel through a barrier. Tunneling is one of the most mysterious phenomena of quantum mechanics. This problem is not only of academic interest but also of practical importance in future semiconductor technology. This determines the maximum attainable speed (bandwidth for signal transmission) in nano-scale devices. Numerous theories (based on various interpretations of quantum mechanics) contradict each other in their predictions. Some predictions being, tunneling time is zero, superluminal, complex, real, ill-defined, probability distribution is not positive definite, etc. To obtain real (positive/negative) value for this time, several quantum clocks have been proposed but each one comes with it's own peculiar unphysical problem (inherent in it's definition). An overview of this subject will be given and a plausible way out of this controversy would be touched upon.

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Speaker : P. Agrawal

Title: Instanton and Tunneling : A Glimpse

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