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Can we understand time through scattering in low dimensions?

Time is a very poorly understood entity in physics. Newton's laws of motion or the equations of special relativity are invariant under time reversal. Yet in the classical world time always increases in the forward direction. One can only understand this at a statistical level using the concept of entropy but a microscopic understanding in terms of the equations of motion is absent. One may thus resort to quantum mechanics for an answer as one may expect classicality to emerge from that. Time irreversibility does have a role to play in the standard model. However, there is no self-ad joint time operator defined in quantum mechanics with time playing the role of a parameter in the time reversible Schrodinger equation. In quantum mechanics time intervals can be defined in several ways and can also be probed experimentally. Different definitions correspond to different situations besides in quantum mechanics what is measured always depends on the way it is measured. Our interest is traversal time and signal propagation time which is the quantum analogue of a classical time interval. This study will provide a clear view of the interpretation of the two times. According to Copenhagen interpretation of quantum mechanics the two should be the same but the issue is not settled yet in regimes where they can be negative. We use Argand-diagram and Burgers-circuit to show that the correct traversal time and the correct signal propagation time can be identically negative implying signal can be propagated in negative time. We will show that nano-scale semiconductor or metallic systems can become an excellent testing ground to reveal propagation in backward time and can give us a very neat understanding on the nature of time.

Biography

P Singha Deo completed his PhD in 1996 and has remained associated with research and teaching in physics in premier institutions and universities abroad and in India. He has published more than 60 papers in international journals. He is currently a professor at S.N. Bose Centre, Kolkata since 1999 and successfully guided several PhD theses. He has worked on various issues and problems in mesoscopic physics and correlated systems. Some of his current research topics include quantum devices, quantum capacitance, bosonization in higher dimensions, quantum mechanical scattering phase shift in low dimensions, etc.

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