Anthony Leggett and Foundations of Quantum Mechanics

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Abstract:

Sir Anthony Leggett is one of the most important physicists of the second half of the Twentieth Century. In 2003, he was awarded the Nobel Prize on behalf of his theoretical explanation of the superfluidity of the Helium 3, solved in 1973. What is not so well known about him, and not yet subjected to historical investigation, is how much effort he has dedicated to research on foundations of Quantum Mechanics (QM). In fact, as early as 1960's, he had already quite a strong interest on such topics and, in 1972, he took the decision, according his words, that he would no longer do the kind of physics that is published on Physical Review B (condensed matter and material physics) and would devote itself full time to research on foundational issues. It is important to note that he was aware of the implications this kind of decision could have, since he could only take this step because he had a permanent position, as he recognized it later. It was this spirit, to look to QM on its basics, looking for such extreme situations that could eventually led QM to a breakdown that took him to face the problem of the Helium 3 superfluidity. Yet, even being able to solve it within QM (and paradoxically extending QM validity to new domains), his interests remained close to challenge QM on different grounds, and he began facing what we now call Macroscopical Quantum Mechanics Effects, and also Decoherence. With the help of a doctoral student, Amir Caldeira, he developed testable models for the interaction of a quantum system with the environment through the use of master equations on the early 80's and since then he remained quite active inside the community of research of foundations of QM, arguing in favor of the realization of experiments that would eventually test QM on extreme situations, specially directed on testing QM on macroscopical systems, a project he calls "building Schrödringer's cat in the laboratory", always hoping to identify some kind of breakdown in the quantum mechanics description of the world.

In this project, we examine his career and works on foundations of QM, specially those connected to what we now call Decoherence, and try to understand why his name is usually forgotten when this story of foundational issues is told, despite the importance his theoretical work has had on the last 30 years. In this talk, we will focus on explaining the earlier theoretical problems he and Caldeira faced and his contributions to the field, linking his approach to explain why latter his name was "forgotten" from the field of foundations of QM.