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Non Equilibrium Dynamics in “Electron Glasses”

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Abstract:

"Electron glasses" are disordered systems in which electronic states are localized due to the underlying atomic disorder, and where electron-electron interactions play an important role owing to the fact that screening is reduced. In this definition "glass" generally refers to the disordered structure of the electronic states imposed by the quenched disorder. However in other types of glasses (spin glasses, structural glasses) one also observes special dynamical properties: ultra-slow relaxations, memory and ageing effects. In the eighties it was conjectured that charge carriers in electron glasses should also exhibit a glassy dynamics, which should be observable in conductivity and field effect measurements. Since the pioneer experiments performed two decades ago on insulating amorphous indium oxide in Jerusalem, glassy dynamics has been observed in a number of systems. We will give an overview of the field from the experimentalist point of view. We will first focus on granular aluminium, a system that has been extensively studied in Grenoble, where slow dynamics, as well as memory and ageing effects were evidenced. A point will be made about the interplay between glassy effects and reproducible conductance fluctuations observed in mesoscopic samples. Until recently all the macroscopic systems studied displayed a rather universal behaviour (universal field effect anomaly, activation-less dynamics). However during the past two years the picture has been evolving. I will show recent experiments performed in Grenoble on new systems, showing thermal activation and indications of a cross-over from quantum (tunneling) to classical (activated) glasses.