Prof. Dr. S. Hollands
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UNIVERSITÄT LEIPZIG

Fakultät für Physik und Geowissenschaften

Physik-Kolloquium

Dienstag, den 13.12.2016, 17.00 Uhr

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Supercooled Liquids and the Glassy State of Matter

Glasses are ubiquitious in daily life and technology. However, microscopic mechanisms generating this state of matter remain a subject of debate and the glass transition continues to be one of the most puzzling riddles in condensed matter physics. Glasses are rigid like crystals, but lack any long-range order. Some theories describe glasses simply as kinetically constrained liquids, while other theories are built on the existence of an underlying thermodynamic phase transition. In this talk we will document that dielectric spectroscopy can help to solve this long-standing controversy. Broadband dielectric spectroscopy is an unsurpassed method to investigate the dramatic slowing down of molecular motion in supercooled liquids and glasses. In these experiments, the linear response of the investigated glass formers to an applied external field is detected in a frequency range of up to 20 decades.[1] However, theory and experiments on spin glasses,[2] and orientational glasses[3,4] have shown that linear response is blind to hidden order in amorphous matter and that only nonlinear susceptibilities provide insight into critical dynamics on approaching the freezing transition. Consequently, in recent years the investigation of the nonlinear dielectric response of glass forming matter is attracting increasing interest (see, e.g., 5,6,7). After a general introduction into glassy dynamics and into the importance of the glassy state of matter in daily life and technology, we focus on broadband dielectric spectra of supercooled liquids. We provide a detailed discussion of the microscopic processes that govern glassy dynamics, including the structural relaxation,[8] excess wing[9] and Johari-Goldstein relaxation,[10] fast ß-processes[11] and Boson peak.[12] We also touch aging[13] and early hole-burning experiments,[14] the latter providing evidence of dynamic heterogeneity, which governs the glass transition. Finally, we show that non-linear dielectric experiments provide experimental evidence on diverging length scales at the glass transition, supporting theories based on thermodynamic amorphous order.[7]

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Ort: Hörsaal für Theoretische Physik, Linnéstraße 5

Alle Teilnehmer sind ab 16.30 Uhr zu Kaffee vor dem Hörsaal eingeladen.