GOETHE UNIVERSITÄT FRANKFURT AM MAIN

Fachbereich Physik
Institut für Theoretische Physik

SPECIAL CONDENSED MATTER THEORY SEMINAR

Subject: **Capacitance and Compressibility of Correlated Electron Systems**

Speaker: **Prof. Dr. Thilo Kopp (Universität Augsburg)**

Date & time: **Monday, 12thth of February 2024 at 15 p.m.**

Venue: **Room 01.114**

Abstract:

Classically, the capacitance of a two-plate capacitor does not depend on the electronic properties of the metallic state of the plates. However, quantum effects may strikingly reduce or enhance the capacitance with respect to the school book formula. In fact, it is the compressibility of electronic systems on the plates which can be measured by a capacitance device. It is of great technological interest to identify schemes how to enchance capacitances in nanoscale devices. I present two schemes for such a sizable enhancement where both depend on the observation that the compressibility of the considered correlated electron system becomes negative. One scenario depends on electronic exchange interactions in dilute electron liquids and it has been established in devices with nanometer distances between the plates [1]. The second part of my talk is the negative compressibility of a two-band Hubbard model. There the role of Hund's coupling is essential for the interpretation of the transition to negative compressibility close to half-filling [2].

[1] J.P. Eisenstein, L.N. Pfeiffer, and K.W. West, Phys. Rev. Lett. 68, 674 (1992);
L. Li, C. Richter, S. Paetel, TK, J. Mannhart, and R.C. Ashoori, Science 322, 825 (2011).
[2] R. Frésard and M. Lamboley, J. Low Temp. Phys. 126, 1091 (2002);
R. Frésard, K. Steffen, and TK, Phys. Rev. B 105, 245118 (2022).