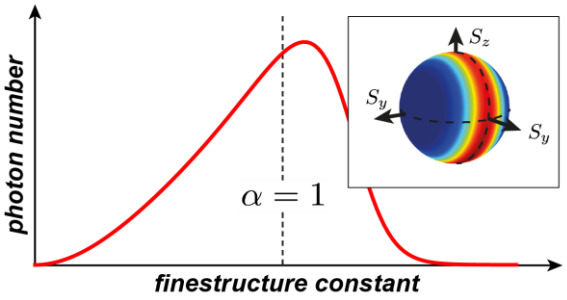
Physikalisches Kolloquium

Universität Konstanz

Di 18.07.23
15:15 Uhr
P 603
im Anschluss Getränke und Snacks

Prof. Dr. Peter Rabl
Walther-Meißner-Institut, Bayerische Akademie d. Wissenschaften, Technische Universität München

Non-perturbative (cavity) QED



The structure of atoms, molecules and solids is mainly determined by static Coulomb forces, while the coupling to the quantized degrees of freedom of the electromagnetic field plays only a secondary role. Recently, it has been speculated that this general rule can be overcome in the context of cavity quantum electrodynamics (QED) [1,2], where the coupling of dipoles to a single field mode can exceed the bare energy of the photon itself. Under these conditions, light-matter interactions become non-perturbative [3], as characterized by an effective finestructure constant of order unity. In this seminar I will give a basic introduction to this extreme coupling regime of cavity QED and explain how vacuum-induced many-body effects can lead to novel ground state phases in QED [3-5], which are the opposite of what has been assumed so far. Beyond a purely fundamental interest, these general mechanisms can be important for potential applications, ranging from cavity-assisted chemistry to quantum technologies based on ultrastrongly coupled circuit QED systems.

•[1] F. Schlawin, D. M. Kennes, M. A. Sentef, Applied Physics Reviews 9, 011312 (2022).
•[2] P. Forn-Diaz, L. Lamata, E. Rico, J. Kono, and E. Solano, Rev. Mod. Phys. 91, 025005 (2019).
•[3] D. De Bernardis, T. Jaako, and P. Rabl, Phys. Rev. A 97, 043820 (2018).
•[4] F. Armata, G. Calajo, T. Jaako, M. S. Kim, and P. Rabl, Phys. Rev. Lett. 119, 183602 (2017).
•[5] M. Schuler, D. De Bernardis, A. M. Läuchli, and P. Rabl, SciPost Phys. 9, 066 (2020).

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