Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

IRTG-Seminar

Prof. Thomas Allison

Stony Brook University

"Cavity-enhanced ultrafast spectroscopy"

Ultrafast optical spectroscopy methods, such as transient absorption spectroscopy and 2D spectroscopy, are widely used across many disciplines. However, these techniques are typically restricted to optically thick samples, such as solids and liquid solutions. Using a frequency comb laser and optical cavities, we present a technique for performing ultrafast optical spectroscopy with high sensitivity, enabling work in dilute gas-phase molecular beams. Resonantly enhancing the probe pulses, we demonstrate transient absorption measurements with a detection limit of Δ OD = $2{\cdot}10^{-10}$ ($1{\cdot}10^{-9}$ / $\sqrt{\text{Hz}}$). Resonantly enhancing the pump pulses allows us to produce a high excitation fraction at a high repetition rate, so that signals can be recorded from samples with optical densities as low as OD ≈ 10^{-8}, or column densities $<10^{10}$ molecules cm^2. In this talk, I will discuss initial demonstration experiments, methods for cavity-enhancing multidimensional spectroscopy signals using multiple frequency combs, and progress towards widely tunable cavity-enhanced ultrafast spectrometers operating from the ultraviolet to the infrared.

Friday, July 20, 2018; 10:00 a.m.,
Seminar Room AG Stienkemeier, 5th Floor,
Physics high rise, Hermann-Herder-Str. 3

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