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TRR 142 Seminar

Coherent Spectroscopy for Quantum Control of Matter

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-TRR 142 Guest Scientist-
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Morgantown, WV

Date: **Wednesday, 21.05.2014**
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Location: **TU-Dortmund,**
Seminarbuilding II,
Lecture Room 2

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Title

Coherent Spectroscopy for Quantum Control of Matter

Prof. Alan D. Bristow
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Abstract

Quantum control can be achieved in many atomic and chemical settings, for example
to enhance product / byproduct branching ratios, direct photocurrent / photoionization channels
and enhance mechanisms in photocatalysis. Quantum control primarily uses constructive
and destructive interference of quantum pathways between initial and final states to select and
controlled the desired process with the amplitude and phase of incoming light. In this talk, a
simple quantum control scheme based on two harmonically related pulses is demonstrated to
drive and direct photocurrents in bulk silicon and in topological insulator materials.
In practice, quantum control is often hindered by insufficient information about the target
states. Calculation of the system's Hamiltonian can even be impossible. In this talk, multidimensional
coherent spectroscopy is used to acquire the Hamiltonian for potassium vapor. This
method yields line centers and line widths for all the quantum pathways for a three-level atomic
system, such that the full Hamiltonian can be modeled empirically. This result paves the way for
multidimensional coherent spectroscopy to measure all the desired properties of any system in
situ, prior to the implementation of a deterministic quantum control scheme.