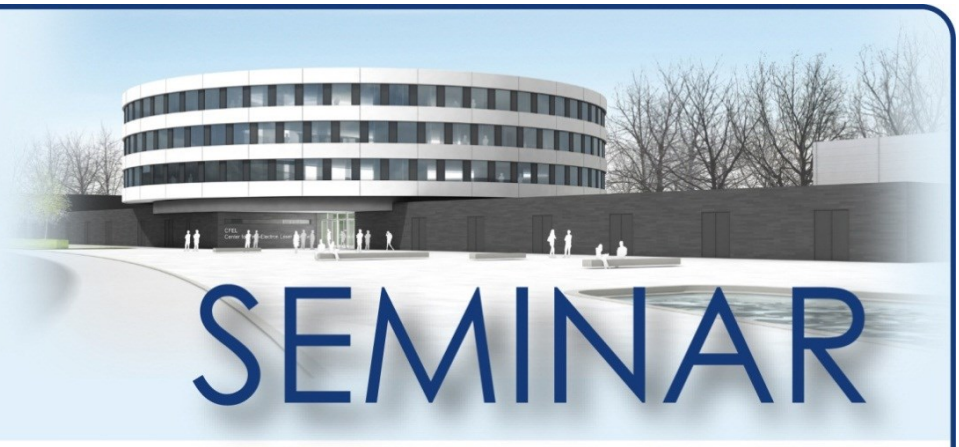
CFEL SCIENCE



SEMINAR

24th July 2014 - 3:00 p.m.

CFEL-bldg. 99, seminar room IV

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Spin-forbidden dipole-dipole interactions in strontium Rydberg atoms

Rydberg atoms are commonly used and investigated for their strong dipole-dipole interactions. For sufficiently dense samples, the dipole-dipole interactions lead to a Rydberg blockade effect, which has been proposed in many schemes ranging from the implementation of quantum gates to the possible observation of novel phases of matter. While alkali atoms are the most commonly used species of Rydberg atoms, new experiments at Durham University and Rice University are making use of cold strontium Rydberg atoms. As strontium Rydberg atom experiments have not been investigated as thoroughly as alkali metal atoms, the theoretical description of the Rydberg states is incomplete, and there is a need to develop new techniques for the theoretical prediction of bound state properties.

In this talk I will give an overview of how multichannel quantum defect theory (MQDT) can be used to describe the multichannel character of the Rydberg states of strontium. The multichannel nature of the bound states arises due to the possibility of both valence electrons being excited simultaneously; when these doubly excited states coincide in energy with singly excited Rydberg states, properties such as the lifetimes of the Rydberg states are greatly affected. By combining our MQDT models with the calculation of dipole-dipole interactions, we find that certain spin-forbidden transitions may contribute a surprisingly large amount to the total interaction strength, emphasizing the need to include two-electron effects when calculating Rydberg state properties of alkaline earth metal atoms. Finally, we explore the possible effects these spin-forbidden interactions may have on the dynamics of a chain of strontium Rydberg atoms.

Host: Nina Rohringer- MPIPKS