Speaker: **Caroline Stier (University of Freiburg)**

Title: **Quantum Dynamics of Two Composite Particles on a One-Dimensional Lattice**

Date: **Thursday, July 27th, 2:30 pm**

Place: **Seminar room 915**

Quantum Dynamics of Two Composite Particles on a One-Dimensional Lattice

We study the dynamics of two composite bosons on a one-dimensional lattice. We investigate how the dynamics are affected by their constituents' quantum statistics as well as their initial state. Starting from the full Hamiltonian of four elementary particles, we formulate an effective Hamiltonian assuming that the two composites – consisting either of two elementary fermions or two elementary bosons – are tightly bound objects. Thus, instead of treating the tunneling of each constituent individually, we consider the tunneling of the whole composite with an effective tunnel coupling. We choose the contact interactions between the elementary constituents such that the resulting composite particles are non-interacting. However, due to the possibility of the exchange of identical constituents, the composites experience an effective nearest-neighbor interaction if they are located on adjacent sites. Furthermore, working with the relative and center-of-mass coordinates of the two composite particles allows us to consider only their relative motion. Therefore, we can reduce the original problem of four elementary particles forming two composites on a one-dimensional lattice to an effective one-particle problem on a semi-infinite lattice with a potential barrier. We solve the Schrödinger equation generated by the Hamiltonian of the relative motion analytically, and compare our result to a numerical solution. Additionally, we simulate the time evolution of two composites starting in four different initial configurations. Since there are bound and scattering solutions for their relative motion, the two composites propagate either together or individually. We find that the probabilities for the two types of motion strongly depend on the initial state. Furthermore, the center-of-mass group velocity for the bound state of two composites with bosonic constituents is higher than in the fermionic case, and thus, two bound composites with bosonic constituents propagate faster in the direction of their center-of-mass coordinate than two bound composites with fermionic constituents.