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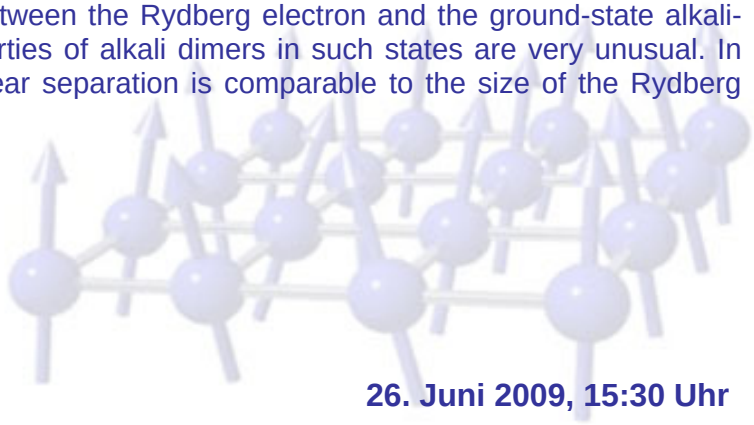
Green's functions in atomic and molecular physics: From strong-field ionization to molecular Rydberg states

Many problems in atomic and molecular physics require propagation of an electron wave function between two regions of space with different symmetries of the Hamiltonian. This propagation can be accomplished by the Green's function method combined with the Kirchhoff integral approach similar to that used in diffraction theory. Sometimes, because of the complexity of the quantum-mechanical Green's function, semiclassical propagation methods are used. We illustrate these methods by applying them to tunneling ionization of atoms and molecules in a strong electric field and to the description of a special class of molecular Rydberg states which are possible in heavy alkali dimers due to strong interaction between the Rydberg electron and the ground-state alkali-metal atom. The properties of alkali dimers in such states are very unusual. In particular the internuclear separation is comparable to the size of the Rydberg orbit.



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