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Nota di contenuto	Introduction -- Strong Laser Fields and Ultrashort Laser Pulses -- Ionization in Strong, Ultrashort Laser Pulses -- The Reaction Microscope -- Tunnel Ionization from a Coherent Superposition in Ar+ -- Population of Doubly Excited States in Strong Laser Pulses -- Channel-selective Electron Spectra for H2 at Different Wavelengths -- Conclusion and Outlook.
Sommario/riassunto	In this thesis, the ionization of atoms and small molecules in strong laser fields is experimentally studied using a reaction microscope. The population of autoionizing doubly excited states in the laser fields is proven and a possible connection to the well-known dielectronic recombination processes is discussed. The fundamental process of tunnel ionization in strong laser fields is subject of investigation in a pump-probe experiment with ultrashort laser pulses. A coherent superposition of electronic states in singly charged argon ions is created within the first, and subsequently tunnel-ionized with the

second pulse. This gives access to state-selective information about the tunneling process and allows to test common models. Moreover, the ionization of krypton and argon at different wavelengths is studied, from the multiphoton to the tunneling regime. The wavelength-dependent investigations are furthermore extended to molecular hydrogen. In addition to ionization, this system might undergo different dissociative processes. Channel-selective electron momentum distributions are presented and compared to each other.