

Low-energy resonant processes in collisions of electrons, atoms, ions and molecules significantly contributed to the evolution of the early Universe. Much attention has not yet been paid to processes involving lithium atoms and ions. In this thesis, we present the theoretical description of two associative detachment processes of Li with H^- and H with Li^- within the nonlocal resonant theory. The nonlocal resonant models were constructed from potential energy curves computed by the MOLPRO package of *ab initio* programs and from electron-molecule scattering data obtained from R -matrix calculations by the UK molecular R -matrix suite of codes. The Lippman-Schwinger equation describing the nuclear motion was solved by the Schwinger-Lanczos algorithm. We developed a new method, which is based on the singular value decomposition method and separates the coupling potential. We predict several orders of magnitude difference between the temperature-dependent rate constants of the studied collisions at temperatures below 1000 K.