In this thesis, the metastable states are studied. The work focuses on a theoretical model of one or two metastable states decaying into a continuum of states which is bounded from below. We examine the time evolution of such systems and how it is affected by the energy of the metastable state(s) and by the position of the poles of the scattering matrix in the complex plane. We also look closely at the spectral line shape. Numerical integration of a system of differential equations is used for solving the problem of the time evolution and spectral line shape while Freshbach-Fano projection operator formalism is used for finding the position of the poles. The results are compared with first order perturbation theory and with semi-analytical formula obtained from adiabatic elimination of the continuum. The last part of the thesis is dedicated to an application of the model on neon–helium–neon cluster.