Abstract

Three different aspects of low-lying electric dipole excitations in light and medium-mass spherical nuclei have been investigated in this thesis using complementary experimental methods. One focus was on the isospin character of dipole excitations in the doubly-magic nucleus ^{48}Ca probed in an $(\alpha, \alpha'\gamma)$ experiment at 34 MeV/u performed at the Kernfysisch Versneller Instituut (KVI) in Groningen, The Netherlands, along with a parity measurement performed at the High Intensity γ-ray Source (HIγS) facility in Durham, USA, and a comparison with theoretical results from microscopic calculations. The coexistence of isoscalar, isovector, and isospin-mixed electric dipole excitations of diverse underlying structure, including a strong almost pure isoscalar oscillation, was revealed.

In addition, protons at intermediate energies (80 MeV/u) were used for the first time at KVI Groningen in a $(\mathrm{p}, \mathrm{p}'\gamma)$ coincidence experiment on ^{140}Ce. In this way, access to the dipole response to a complementary hadronic probe with a dominant isoscalar character, but a higher penetration depth due to a higher energy per nucleon, is given. The deduced excitation pattern complements the picture previously obtained from $(\alpha, \alpha'\gamma)$ and (γ, γ') experiments.

The last part of this thesis deals with the investigation of candidates for the two-phonon $(2_1^+ \otimes 3_1^-)_{1^-}$ state in ^{40}Ca and ^{140}Ce. For this purpose, the γ-decay behavior of the candidates was studied using the newly installed and commissioned high-efficiency γ-γ coincidence setup γ^3 for $(\vec{\gamma}, \gamma')$ experiments at HIγS. Besides the ground-state decay, a decay of the 1_1^- state to the 3_1^- state was observed for ^{40}Ca, whereas for ^{140}Ce decays to the 2_1^+ and to the 0_2^+ state were detected.