Abstract

This thesis presents a study of octupole vibrations in even-even rare-earth nuclei with prolate deformed shape by means of different experimental probes and it introduces the method of $(\mathrm{p}, \mathrm{p}'\gamma)$ coincidence experiments. In order to perform such experiments, a new scattering chamber housing silicon detectors has been designed and constructed at Wright Nuclear Structure Laboratory, Yale University. Using this method, the nucleus ^{150}Nd was investigated showing a high selectivity for low lying negative-parity states. In a second experiment, the nucleus ^{168}Yb was excited by the fusion-evaporation reaction $^{166}\mathrm{Er}(\alpha, 2\mathrm{n})$ at the HORUS spectrometer, Institut für Kernphysik (IKP), Universität zu Köln. Both experiments provide a deeper insight into the structure of the respective octupole-vibrational states and their K quantum numbers and mixing with other bands was deduced. In ^{168}Yb, an octupole-band structure was established for the first time. Using the results from the experiments and investigating data obtained in previous experiments, the systematics were extended and new properties such as the mixing of the $J^\pi = 1^-$ states were derived.

The second part deals with the new sorting code *SOCO* which is optimised to create two-dimensional coincidence matrices. It was implemented and tested within the scope of this thesis. The code provides a highly flexible and modularised architecture and is capable of reading various listmode formats. Unlike the sorting code used at IKP up to now, the sorting code *SOCO* makes use of multithreading resulting in an evaluation speed more than three times faster compared to the previous code.