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NUCLEAR STRUCTURE SNAPSHOTS. A PERSONAL SELECTION

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Abstract. *Several nuclear structure research directions are illustrated with results of different experiments from author's activity, and possible future developments are emphasized.*

Keywords: Nuclear structure, nuclear level lifetimes, nuclear deformation, high-spin states, direct transfer reactions

1. Introduction

The atomic nucleus is a complicated system of many nucleons (neutrons and protons) which interact through the so-called strong (nuclear) interactions. The experimental nuclear spectroscopy has as purpose to determine the characteristics of the different quantum states of this system: energy, spin, parity, lifetime, electromagnetic static moments (magnetic dipole, electric quadrupole), other quantum numbers, as well as the different decay modes of these states and their characteristics. The study of the electromagnetic (gamma) decay, which is the main decay mode of the excited states with energy below the particle emission threshold represents one of the most common means of deducing the properties of the excited nuclear states.

In order to study the excited states of a nucleus, they are populated by different nuclear reactions, or by decays. Each particular decay or reaction mechanism has specific features, therefore they will populate the final states preferentially; for example, the beta decay process will populate states in the daughter nucleus within a certain spin window, depending on the spin of the mother nucleus, whereas in fusion-evaporation reactions induced by heavy-ion beams one preferentially populates high spin states. It is therefore rather difficult to achieve a *complete* knowledge of the excited states, even at low excitation energies, in a certain nucleus, because one would have to combine many different methods of population and study.

There are a number of about 3000 nuclei for which spectroscopic measurements could be performed in different degrees of detail. Theoretical nuclear structure models predict the "existence" of other about 3000 nuclei, that is, nuclei within

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