Int. Workshop "Shapes and Dynamics of Atomic Nuclei: Contemporary Aspects" ed. Nikolay Minkov, Heron Press, Sofia 2015

## Importance of Lifetime Measurements for the Nuclear Structure and Current Experimental Techniques

## S. Pascu

National Institute for Physics and Nuclear Engineering, R-77125, Bucharest-Magurele, Romania

## Abstract

One of the most important topics in nuclear spectroscopy is measuring the lifetimes of excited states. These quantities are strongly related to the determination of reduced transition probabilities, which are rather sensitive to details of the intrinsic structure of the states. Therefore, such measurements represent a crucial test for different theoretical models which address different regions of the nuclear chart. Lifetimes of excited states are well known to cover many orders of magnitude, but typically they are in the range below nanosecond. Consequently, several methods that are able to perform measurements in these regions have been developed. The ROmanian array for SPectroscopy in HEavy ion REactions (ROSPHERE) is a spectrometer which allows for sensitive lifetime measurements down to the picosecond range. ROSPHERE is a new  $4\pi$ high-resolution  $\gamma$ -ray detector array which was installed at the Bucharest 9 MV tandem accelerator. The setup consists of up to 25 detectors and it is typically used in a mixed combination of high-purity Ge detectors and fast LaBr<sub>3</sub>:Ce scintillation detectors. The multi-detector setup can be coupled with a state of the art plunger device allowing for lifetime measurements by employing the Recoil Distance Doppler Shift (RDDS) [1] or in-beam Fast Electronic Scintillation Timing (FEST) technique [2]. Recent experiments illustrating the methods and how this helps our understanding of the complex nuclear phenomena including nuclear deformation will be presented.

## References

- [1] A. Dewald, S. Harissopulos, and P. von Brentano, Z. Phys. A, 334, 163 (1989).
- [2] N. Mărginean et al., Eur. Phys. J A 46, 329 (2010).