A guide on how to travel around the world with the Coulomb excitation tools in the suitcase

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Nuclear research aims to investigate the fundamental laws ruling our world on the micro-scale, as well as the forces confining the building blocks of the matter. An atomic nucleus can form a structure of a given shape, which is one of the most fundamental features of nuclear matter. It is related to the charge/mass distribution of the nucleus in its ground state and the energetic excited states.

Coulomb excitation is one of the fundamental experimental techniques based on the inelastic scattering of the projectile particle on the target nucleus. Such experiments are performed typically at beam energies below the Coulomb barrier, yet still corresponding to 8% of the speed of light to allow sufficient physical separation between the projectile and target nuclei to exclude possible nuclear contributions to the excitation mechanism. In the Coulomb excitation experiments, transitions de-populating excited states are measured in the γ-ray spectrometers, while the scattered projectiles are registered simultaneously in an array of heavy-ion detectors. This method allows for determining the nuclear electromagnetic structure. It provides the set of matrix elements coupling excited states related to various spectroscopic data describing the charge distribution in the nucleus. The results of experiments performed with this nuclear microscope allow for measuring the shape in each energetic state independently.

In this talk, I will attempt to map the places I worked as a nomadic researcher, utilizing Coulomb excitation tools I have always carried with me. I will also present the scientists who have had a significant impact on my scientific career, whom I met during my journey to reach my final destination in Warsaw. I will acknowledge the challenges that shaped my scientific interests in collectivity, nuclear shapes, and deformation (especially superdeformation) of atomic nuclei in Z$\sim$6, 20, 28, 82 regions. I will present the highlights of Coulomb excitation experiments performed at HIL Warsaw (Poland), INFN LNL (Italy), IJC Lab Orsay (France), CERN-ISOLDE (Switzerland), and FSU (USA), with the stress on the implementation of the charged-particle detectors such as SPIDER [1] and SilCA-DSSD [2] to work with gamma-ray spectrometers: AGATA [3], GALILEO [4], MINIBALL [5], nuBall2 [6], and EAGLE [7]. I will also present the perspectives and open questions in the regions of A$\sim$40 and A$\sim$56, constantly within the scope of my interest.

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