Rezultate preconizate ale proiectului

In cadrul acestui proiect ne-am propus studiul unor nuclee asa zise exotice, adica departate de linia de stabilitate si avand o structura atipica; astfel de studii sunt importante atat pentru intelegerea evolutiei structurii nucleare, cat si pentru dezvoltarea si validarea modelelor teoretice de structura.

Prin aceste studii experimentale, realizate cu ajutorul unor echipamente complexe si in cadrul unor echipe internationale, am dorit sa clarificam niste aspecte, iar prin concluziile noastre sa contribuim la intelegerea structurii nucleelor din aceasta regiune.

In cazul nucleului 26F, aceasta stare izomera a fost prezisa de modelele teoretice, si observarea ei a fost asteptata ca o validare a acestora, in plus mai multe detalii de structura mai pot fi evidentiate in acest studiu.

Excitarea coulombiana este o metoda care permite investigarea structurii nucleare prin intermediul masurarii probabilitatilor reduse de tranzitie. Prin masurarea acestora in nucleele 43S, 44S si 46Ar se ating mai multe obiective:

- se clarifica o situatie controversata in cazul nucleului 43S, pentru care mai multe masuratori au dat valori diferite;
- se dezvaluie noi aspecte privind structura nucleara in regiunea aceasta;
- se pun la incercare mai multe modele teoretice pentru interpretarea rezultatelor obtinute.

Nu in ultimul rand, avand in vedere complexitatea aranjamentelor experimentale, multitudinea echipamentelor folosite si eforturile conjugate ale intregii echipe in ceea ce priveste pregatirea, efectuarea experimentului si analiza datelor experimentale obtinute, aceste studii sunt un prilej pentru tinerii cercetatori de a invata, de a se specializa, de a aplica in practica cunostintele pe care le au. Deasemeni, este o performanta tehnica deosebita si implica si formarea unor astfel de specialisti. Aceasta experienta este utila si va servi pe termen lung.

Experimental study of 26F

A long-lived J^{π} =4+ isomer, $T_{1/2}$ =2.2(1) ms, has been discovered at 643.4(1) keV in the weakly bound ^{26}F nucleus. It was populated at Grand Accélérateur National d'Ions Lourds (GANIL, France) by fragmentation of a ^{36}S beam. It decays by an internal transition to the J^{π} =1+ ground state [82(14)%], by β decay to 26Ne, or β-delayed neutron emission to 25Ne.

From the β-decay studies of the J^{π} =1+ and J^{π} =4+ states, new excited states have been discovered in 25Ne and 26Ne. Gathering the measured binding energies of the $J\pi$=1+–4+ multiplet in 26F, we find that the proton-neutron $\pi 0d5/2\nu 0d3/2$ effective force used in shell-model calculations should be reduced to properly account for the weak binding of 26F. Microscopic coupled cluster theory calculations using interactions derived from chiral effective field theory are in very good agreement with the energy of the low-lying 1+, 2+, 4+ states in 26F. Including three-body forces and coupling to the continuum effects improve the agreement between experiment and theory as compared to the use of two-body forces only.

Experimental study of 43,44S via Coulomb excitation

The reduced transition probability B(E2;7/2$_2$-→3/2-) value in ^{43}S has been measured using Coulomb excitation at intermediate energies.
The nucleus of interest was produced by fragmentation of a ^{48}Ca beam at GANIL. The reaction products were separated in the LISE spectrometer. After ^{43}S Coulomb-excitation in a ^{208}Pb secondary target, the γ rays emitted in-flight were detected by 64 BaF_2 detectors of the Château de Cristal array.
The preliminary value of the B(E2;7/2$_2$-→3/2-) is in agreement with shell model calculations and support a prolate-spherical shape coexistence in this nucleus.