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Exploiting two-proton transfer reactions for probing shape coexistence

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The regions of the nuclear chart displaying a rapid change of the collectivity with respect to the proton or neutron number, are of a particular interest for testing nuclear models [1]. Such kind of behaviour has been noticed along the iron isotopic chain as moving from the stable towards the N=50 shell closure. Theoretical calculations performed with the LNPS interaction which was developed to study the Fe isotopes predicts an island of inversion around the N=40 with strong quadrupole correlations in Fe for N≥30 [2]. Similar conclusions were drawn also by the shell model employing pairing and multipole interaction [3]. Therefore Fe isotopes with N≥28 are a good testing ground for rapid shape evolution from a spherical to a well deformed region close to N=40.

Two proton transfer reactions employing 14C and 18O beams have been used in the past for performing spectroscopy of several elements such as: 34Si, 44Ti, 62Fe, 68Ni [4-6].
We aim to use a 18O beam with 63 MeV on a target of 64Ni to populate excited states in 62Fe and perform lifetime measurements via RDDS/DSAM techniques employing the AGATA array coupled to the Sauron silicon detector. Based on Fresco calculations the cross section for the 0_2^+ and 2_2^+ states in 62Fe are peaked at the forward angles [7]. Lifetime measurements of the 0_2^+ and 2_2^+ states could be used to benchmark the structure of 62Fe nucleus and could help to predict features at more neutron rich isotopes, towards the N=40 island of inversion.

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Authors: GADEA RAGA, Andres F. (IFIC CSIC-University of Valencia); PELLUMAJ, Julgen (Istituto Nazionale di Fisica Nucleare); POLETTINI, Marta (GSI Helmholtzzentrum für Schwerionenforschung); PÉREZ VIDAL, Rosa (IFIC-CSIC)

Presenter: PELLUMAJ, Julgen (Istituto Nazionale di Fisica Nucleare)

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