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 ^{14}C and ^{18}O beams have been used in the past for performing spectroscopy of several elements such as: ^{34}Si,^{44}Ti, ^{62}Fe, ^{68}Ni [4-6].
We aim to use a ^{18}O beam with 63 MeV on a target of ^{64}Ni to populate excited states in ^{62}Fe 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 ^{62}Fe 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 ^{62}Fe nucleus and could help to predict features at more neutron rich isotopes, towards the N=40 island of inversion.

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