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Results on the lifetimes measurements around 82Nb using knock out reactions

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Nuclear structure is a challenging topic as we deal with systems that are not small enough to use standard quantum methods, nor large enough for statistical mechanics. Nuclei with similar numbers of neutrons and protons ($N \approx Z$) exhibit competition between different shapes, such as oblate and prolate, leading to phenomena like shape coexistence. These $N \approx Z$ nuclei are particularly interesting for studying proton and neutron interactions within specific orbitals. The region around $A \approx 80$ near the $N = Z$ line is not well explored due to the difficulty in reaching it with current facilities.

A common approach to compare theoretical models and experiments is to measure transition probabilities between excited states. The reduced quadrupole transition probability $B(E\lambda; J_i \rightarrow J_f)$ is related to the lifetime of the excited state, which can be measured down to a few picoseconds using the Recoil Distance Doppler Shift (RDDS) method. This method relates the state lifetime to the energy splitting generated by a degrader placed at a known distance.

To study the region around ^{84}Mo, ^{82}Nb and ^{82}Zr, the e19034 multinucleon knockout experiment was performed at MSU. A ^{92}Mo primary beam was impinged on a beryllium target, and the produced nuclei were identified and separated by the A1800 spectrometer using TOF measurements before reaching a second beryllium target for the knockout reaction. The different channels produced, such as -2n and -1p-3n, were separated by the S800 spectrometer. Surrounding the secondary target, the GRETINA array provided high-resolution gamma-ray energy measurements.
In this work we will present part of the results from this experiment and their implications for the $N = Z$ vicinity.

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