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## AGATA@GANIL(E775s): Lifetime measurements of excited states in $^{20}\text{O}$ populated by direct nucleon transfer

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Neutron-rich oxygen isotopes constitute a perfect playground for testing three-body forces. For example, the neutron drip line is correctly predicted only when these forces are included in the calculation, as demonstrated by the work of Otsuka *et al.* [1].

In fact, standard shell model calculations including only two-body forces predict the drip line to be positioned at  $N = 20$ .

The inclusion of three-body forces has the effect of raising the  $d_{3/2}$  orbital with the consequence of shifting the drip line from  $N = 20$  to  $N = 16$ , as observed experimentally.

The importance of three-body forces is now established, however their contribution has yet to be quantified.

For this purpose, the  $^{20}\text{O}$  represents an interesting case of study.

The non-yrast states  $2_2^+$  and  $3_1^+$  are based on a mixed  $(d_{5/2})^3(s_{1/2})^1$  neutron configuration.

Hence, electromagnetic properties of the  $2_2^+$  and  $3_1^+$  states, such as the excitation energies, the branching ratios and the reduced transition probabilities, provide meaningful information on the position of the  $d_{3/2}$  and  $s_{1/2}$  orbitals, that are influenced by three-body forces.

An experiment aimed at measuring the lifetime of these states was performed at GANIL (France).

The  $^{20}\text{O}$  was populated via a (d,p) reaction, using a post-accelerated radioactive beam of  $^{19}\text{O}$  provided by the SPIRAL complex and a deuterated polyethylene target deposited on a gold degrader.

The beam-like and target-like partners were detected using the VAMOS spectrometer [2] and the MUGAST array [3], respectively.

The chosen reaction and the MUGAST and VAMOS detectors guaranteed a strong control on the population of the excited states and the capability of eliminating the effect of the feeders.

The  $\gamma$  rays emitted by the  $^{20}\text{O}$  were detected by the AGATA array [4] at backward angles.

The lifetimes of the states were measured using the Doppler-Shift Attenuation method by comparing the lineshape of the experimental peaks to realistic Monte Carlo simulations.

In this contribution, the lifetime of the  $2_2^+$  and  $3_1^+$  states are presented.

[1] T. Otsuka *et al.*, Phys. Rev. Lett. **105**, 032501 (2010).

[2] M. Rejmund *et al.*, Nucl. Instr. and Meth. A **646**, 184 (2011).

[3] M. Assiè *et al.*, Nucl. Instr. and Meth. A, **1041**, 165743 (2021).

[4] E. Clément *et al.*, Nucl. Instr. Meth. A **855**, 1 (2017).

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