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## AGATA@GANIL(E768S) (ONLINE): New measurement of oxygen-15 alpha capture for neutron stars in binary systems

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We present new experimental results for a measurement utilising the combination of AGATA, MUGAST, and VAMOS for a determination of the astrophysical  $^{15}\text{O}$  alpha capture reaction rate [1]. This reaction is a key breakout route from the Hot CNO cycle leading to explosive nucleosynthesis via the rp-process on the surface of neutron stars in binary systems. Determining an accurate cross section for the relevant states is critical for a better understanding of the X-ray burst energy production and light-curves [2], and may even initiate rp-process nucleosynthesis in other novel binary stellar systems involving neutron stars, such as the common envelope scenario [3].

An indirect  ${}^7\text{Li}({}^{15}\text{O},\text{t}){}^{19}\text{Ne}$  alpha transfer reaction measurement in inverse kinematics is presented and the direct link to the astrophysical reaction rate is demonstrated. In this reaction we populate the relevant states for temperatures up to 1GK. In the experiment we take advantage of the post-accelerated  $^{15}\text{O}$  Radioactive Ion Beam provided at GANIL and the state-of-the-art detection system VAMOS [4] + AGATA [5] + MUGAST [6] coupled together for the first time [7]. This allows us an unrivalled selectivity for detecting coincidences of all final state particles in this reaction.

We will present the experimental set-up and analysis, results for the strongest populated resonances in  ${}^{19}\text{Ne}$  as well as a new result with reduced errors for the alpha width of the critical 4.033MeV excited state. We will finally relate this to the astrophysical  ${}^{15}\text{O}(\alpha,\gamma){}^{19}\text{Ne}$  reaction rate.

- [1] M. R. Hall et al. Phys. Rev. C 99, 035805 (2019)
- [2] R. H. Cyburt et al. Astrophys. J. 830, 55 (2016)
- [3] J. Keegans et al. MNRAS, 485, Issue 1, Pages 620–639 (2019)
- [4] M. Rejmund et al. NIMA 646, 184 (2011)
- [5] S. Akkoyun et al. NIMA 668, 26 (2012)
- [6] M. Assié et al. J. Phys.: Conf. Ser. 1643 012070 (2020)
- [7] M. Assié et al. Submitted for publication in NIMA (2021)

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