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Experimental study of the $^{15}O(\alpha,\gamma)^{19}Ne$ reaction for understanding type I X-ray bursts

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The $^{15}O(\alpha,\gamma)^{19}Ne$ reaction is a key breakout route from the hot CNO cycle in explosive environments such as type I X-ray bursts. Determining an accurate cross section for the relevant resonant states is critical for a better understanding of the X-ray burst energy production and light-curves, and of the subsequent nucleosynthesis through the αp- and rp-processes.

The relevant ^{19}Ne states for temperatures up to 1 GK were populated using an indirect $^{15}O(^{7}Li,t)^{19}Ne$ alpha transfer reaction measurement in inverse kinematics. The experiment used an intense radioactive ^{15}O beam produced by SPIRAL1 at GANIL and the state-of-the art detection system VAMOS + MUGAST + AGATA, for the detection of the heavy residues, the light charged particles and the de-exciting γ-rays, respectively. This allowed to reach an unprecedented selectivity for detecting triple coincidences of all final state particles in this reaction.

In this presentation, we will outline the experimental set-up and analysis, providing results for the strongest populated resonances in ^{19}Ne. In particular, our result with reduced uncertainty for the alpha width of the critical 4.033 MeV excited state will be presented. New astrophysical $^{15}O(\alpha,\gamma)^{19}Ne$ reaction rates will be presented and the impact on X-ray burst light-curves will be discussed.

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