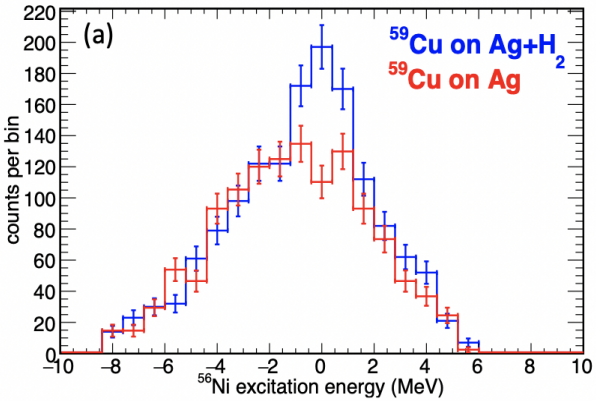
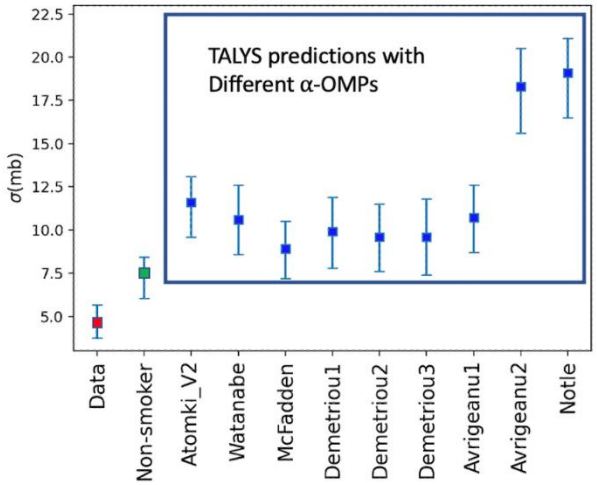
First direct measurement of the $^{59}Cu(p,\alpha)^{56}Ni$ cross-section to understand the Ni-Cu cycle





The Ni-Cu cycle, which features the competition between $^{59}Cu(p,\alpha)^{56}Ni$ and $^{59}Cu(p,\gamma)^{60}Zn$, is thought to operate in X-ray bursts and core-collapse supernovae through the *vp*-process. If $^{59}Cu(p,\alpha)^{56}Ni$ dominates, it can halt the reaction flow above Cu which directly impacts the X-ray burst light curves and casts doubts over the *vp*-process as a producer of p-nuclei. We performed the first direct measurement of the $^{59}Cu(p,\alpha)^{56}Ni$ reaction using an exotic beam of ^{59}Cu and IRIS detector array at TRIUMF. A frozen H_2 target was formed on a thin Ag-foil cooled down to 4 K. Our measurement found that $^{59}Cu(p,\alpha)^{56}Ni$ is a factor of 2-4 lower compared to the statistical model predictions in use. The current measurement suggests that the $^{59}Cu(p,\alpha)^{56}Ni$ reaction may not hinder the flow in vp-process.

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