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

The Ni-Cu cycle, which features the competition between $^{59}$Cu(p,α)$^{56}$Ni and $^{59}$Cu(p,γ)$^{60}$Zn, is thought to operate in X-ray bursts and core-collapse supernovae through the νp-process. If $^{59}$Cu(p,α)$^{56}$Ni dominates, it can halt the reaction flow above Cu which directly impacts the X-ray burst light curves and casts doubts over the νp-process as a producer of p-nuclei. We performed the first direct measurement of the $^{59}$Cu(p,α)$^{56}$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,α)$^{56}$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,α)$^{56}$Ni reaction may not hinder the flow in νp-process.