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# Insight to the Explosion Mechanism of Core Collapse Supernovae Through $\gamma$-ray Spectroscopy of $^{46}$Cr

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Currently, the explanation behind the explosion mechanism of core collapse supernovae is yet to be fully understood. New insight to this phenomena may come through observations of $^{44}$Ti cosmic $\gamma$ rays; this technique compares the observed flux of cosmic $^{44}$Ti $\gamma$ rays to that predicted by state-of-the-art models of supernova explosions. In doing so, the mass cut point of the star can be found. However, a road block in this procedure comes from a lack of precision in the nuclear reactions that destroy $^{44}$Ti in supernovae, most notably the reactions $^{44}$Ti$(\alpha,p)^{47}$V and $^{45}$V$(p,\gamma)^{46}$Cr. Therefore, this study aims to better understand the $^{45}$V$(p,\gamma)^{46}$Cr reaction by performing $\gamma$-ray spectroscopy of $^{46}$Cr with the aim of identifying proton-unbound resonant states.

The experiment was conducted at the ATLAS facility at Argonne National Laboratory, using the GRETINA+FMA setup, where $^{46}$Cr was produced via the fusion-evaporation reaction $^{12}$C($^{36}$Ar,2$n$). The cross section for producing $^{46}$Cr, in this reaction, is estimated to be in the $\mu$b range. Nevertheless, with the power of the GRETINA+FMA setup, we show that it is possible to cleanly identify $\gamma$ rays in $^{46}$Cr. These include decays from previously unidentified states above the proton-emission threshold, corresponding to resonances in the $^{45}\mathrm{V}+p$ system.

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