Improving r-process calculations through precision mass measurements using JYFLTRAP - M. Vilen, J.M. Kelly et al.

- Rare-earth peak formation depends sensitively on atomic masses in this region of nuclear deformation.
- Measured for the first time six masses, and improved precisions on six others, using JYFLTRAP Penning trap at the University of Jyväskylä.
- NS merger environment confirmed as one astrophysical site by recent multi-messenger observations.
- Half of elements heavier than iron produced by the rapid neutron capture process, which proceeds in uncharted territory.
- Smoothening of odd-even staggering results in closer match to solar abundances.
- Final abundance changes due to recalculated neutron capture rates using new $S_n$ values.
- Our new masses reduce the pairing gap, $D_n$, relative to mass models.

- D$_n$ reduction seen across all measured isotopic chains, impacting final abundances.

- Relative Abundance
  - Old
  - New
  - w/ Fission Recycling
  - $\chi^2 = 18.9 \rightarrow 10.7$
  - w/o Fission Recycling
  - $\chi^2 = 42.3 \rightarrow 28.5$

Gd (Z=64)

<table>
<thead>
<tr>
<th>$D_n(N) = \langle -1 \rangle^{\text{even}} [S_k(N,Z) + 1] - S_n(N,Z)\rangle$</th>
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<tbody>
<tr>
<td>80</td>
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<tr>
<td>1.0</td>
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- JYFLTRAP
- AME16
- FRDM12
- WS4+
- HFB-24
- Duflo-Zuker
- UNEDF0