

# Neutron Capture for Stellar Evolution

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- Primarily for s-process
- Does not affect energy generation
- Requires neutron production mechanism
  - Can be a delicate probe of stellar conditions including temperature and neutron density
- Beta decay rates are also critical
  - Not part of talk, but not discussed elsewhere

# S-process scenarios

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- AGB Stars (1-3 Solar Masses)
  - Primarily affects  $A > 90$
  - Stable isotopes are *mostly* understood
  - 5% precision or better needed
- Massive Stars
  - Mass region of interest:  $60 < A < 90$
  - Neutron capture rates have to be revisited on stable isotopes (*in progress*)
- Precision measurements of unstable isotopes needed in all scenarios
  - Samples are a big problem!
- Measurements are primarily direct, with neutron beams

# “Exotic” Scenarios

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- LEPP, i-process
  - High neutron densities
  - Creates s-process-like environments, but paths and branchings involve much shorter lived isotopes
- These environments require new measurement techniques
  - They will likely be indirect (with radioactive beams)
  - Theory will play a significant role
  - Significant development is needed

# Handling Uncertainties

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- For s-process scenarios, cross sections are measurement driven, uncertainties are small and uncorrelated
- For the exotic scenarios, many cross sections are theory driven
  - Systematic correlations and model dependencies need to be included
  - This can give quantify nuclear physics uncertainties