Summer SLAM!

Learning Nuclear Reaction Theory with DJINN

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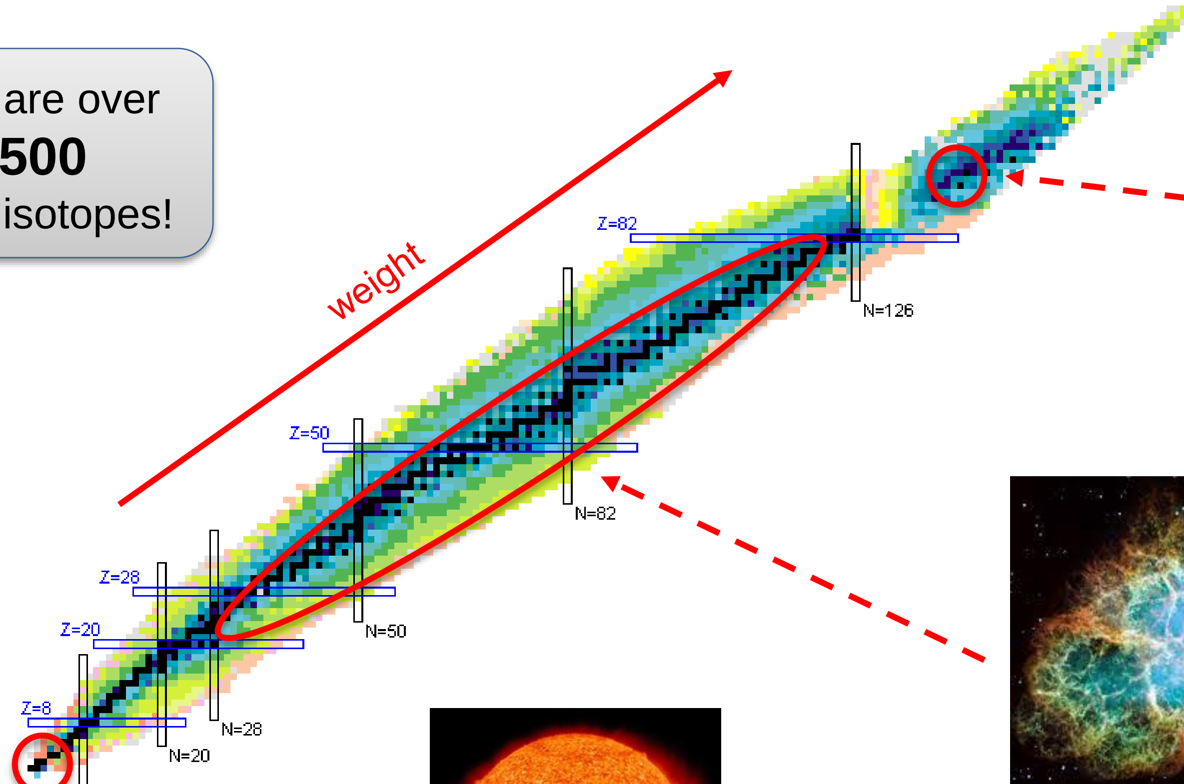
Nuclear reactions are ubiquitous

There are over
3,500
known isotopes!

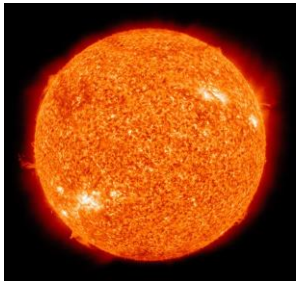


Z, number of protons

N, number of neutrons

Nuclear power

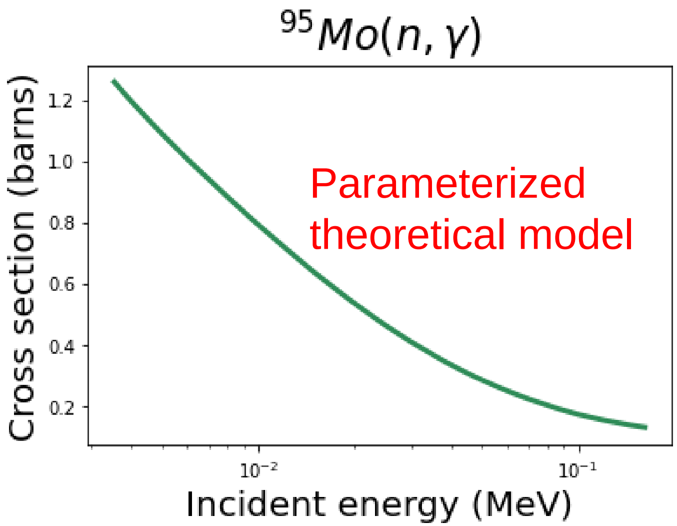
R-process in supernova

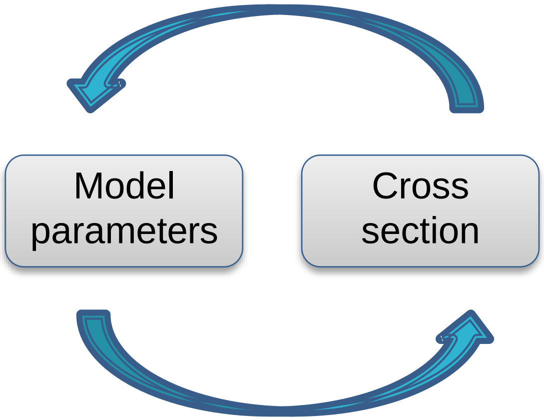


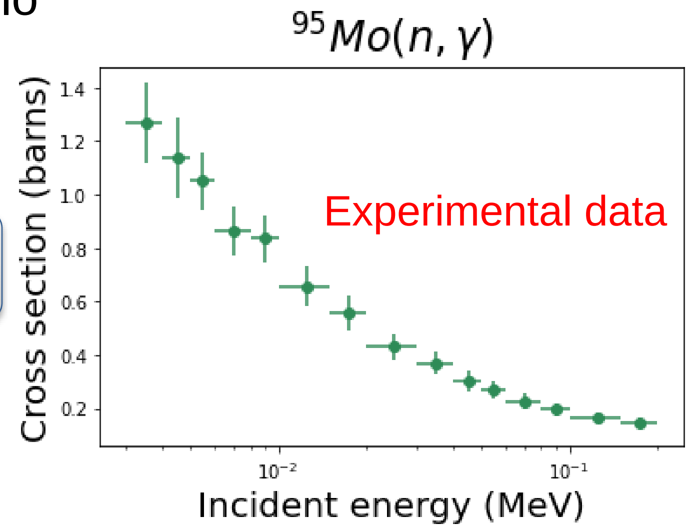
Fusion inside the Sun

Reaction models that match experimental data are computationally demanding

Inverse model
Markov Chain Monte Carlo





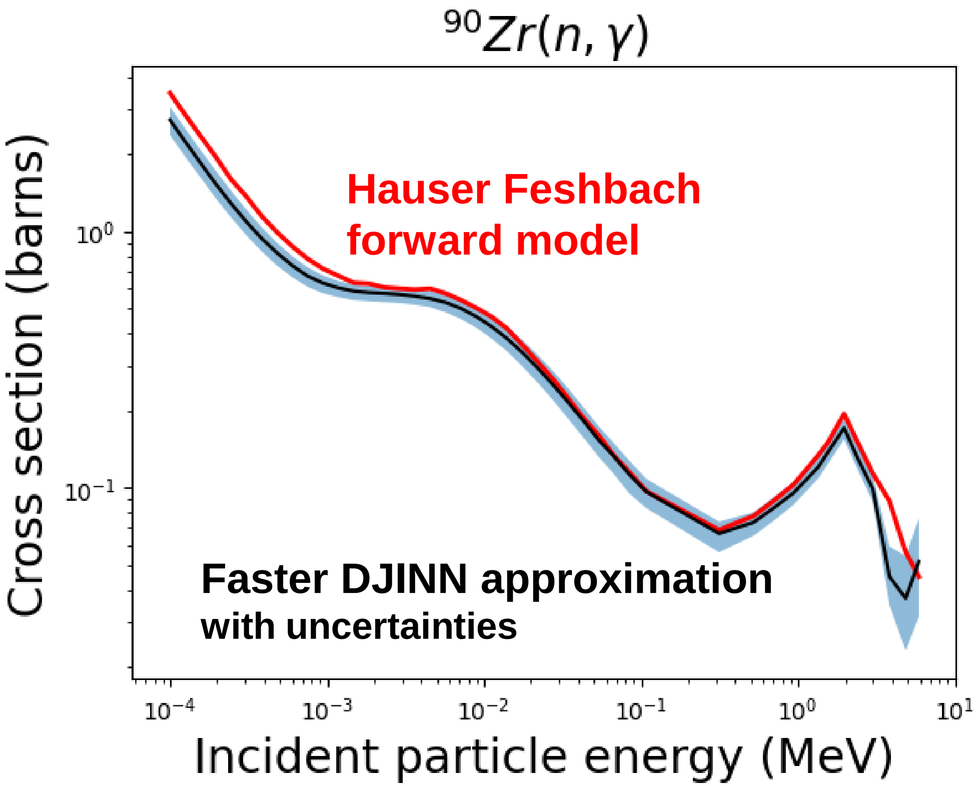


14 (or more) parameters!

Forward Model
Statistical reaction model
(Hauser-Feshbach)

Problem: MCMC is slow, it requires many evaluations of the forward model.

A trained Bayesian neural network speeds up parameter estimation



Bayesian DJINN:

Decision-tree initialized neural network with model uncertainty.

Speedup for 1 evaluation:

20x

- B-DJINN trained for $^{90}Zr(n,\gamma)$ reaction.
- B-DJINN integrated into parameter estimation method.

Takeaway: This method is ready to be used for other nuclear reactions.