

Missing gammas: beta-delayed neutron emission of ^{94}Rb

Shell Model Assisted Hauser-Feshbach Description of Beta-Delayed
Neutron Emission

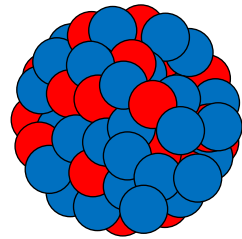
Oliver Gorton^{1,2}

Calvin Johson¹, and Jutta Escher²

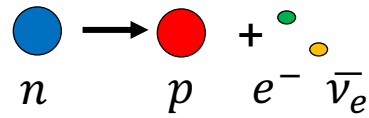
¹San Diego State University

²Lawrence Livermore National Laboratory

Beta-delayed neutron emission of ^{94}Rb : what is it?

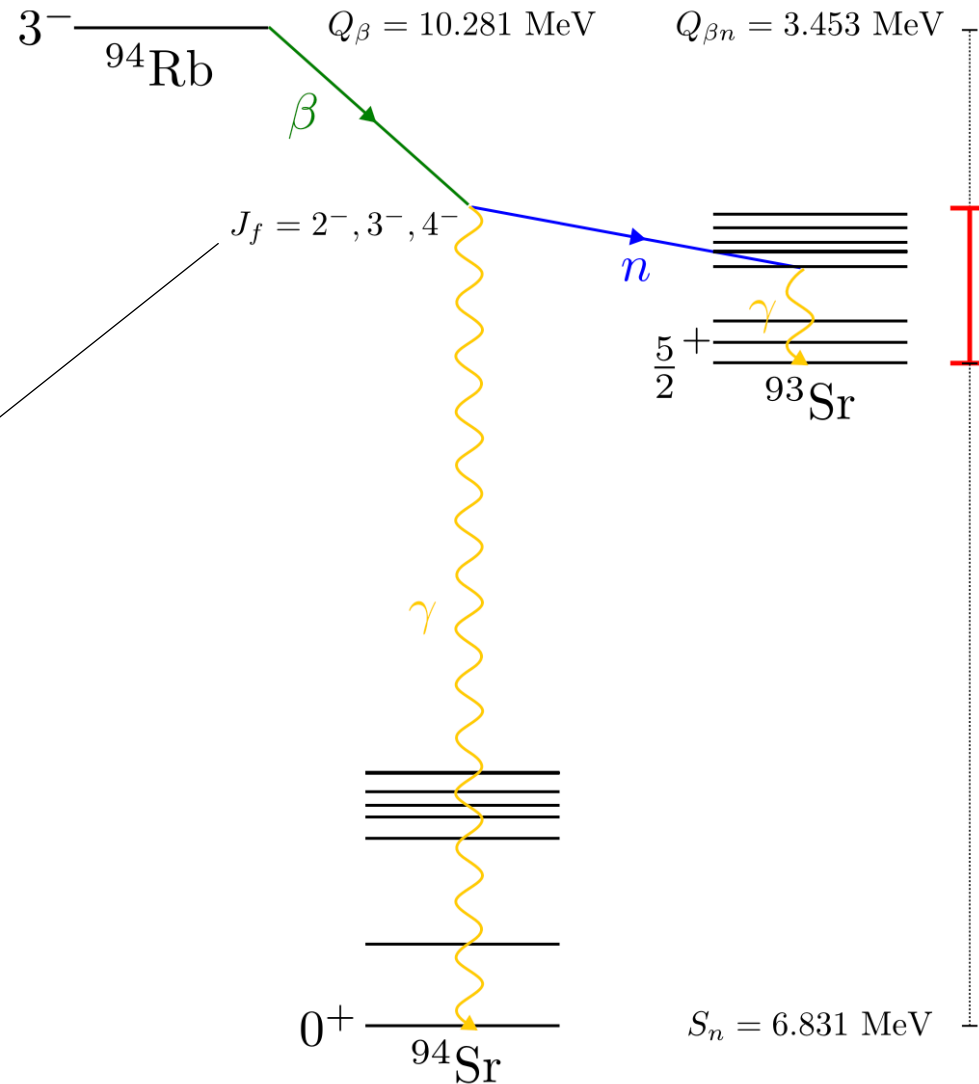


β^- decay:



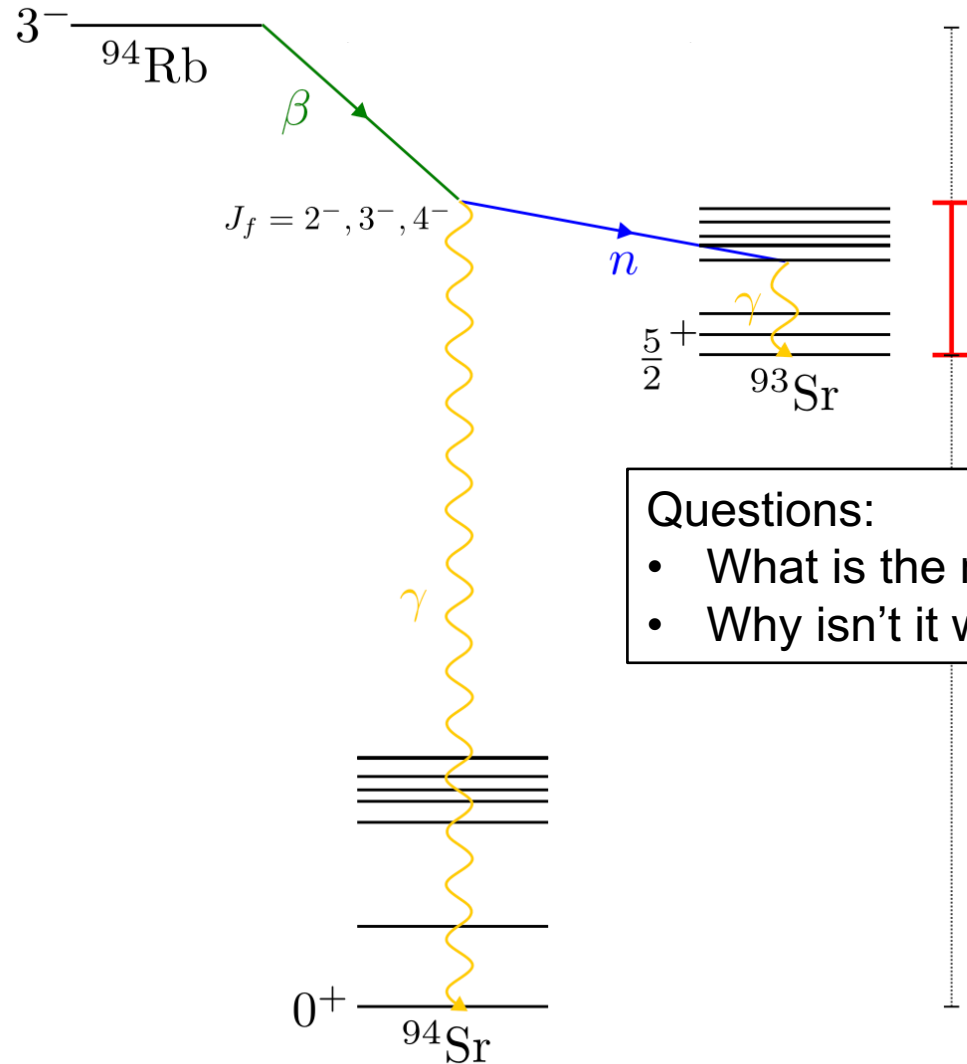
Beta decay selection rules

Type	ΔJ	Parity change
Allowed	$0\hbar, 1\hbar$	No
1 st Forbidden, <i>non-unique</i>	$0\hbar, 1\hbar$	Yes
1 st Forbidden, <i>unique</i>	$2\hbar$	Yes



Statistical reaction theory fails for beta-delayed neutron emission

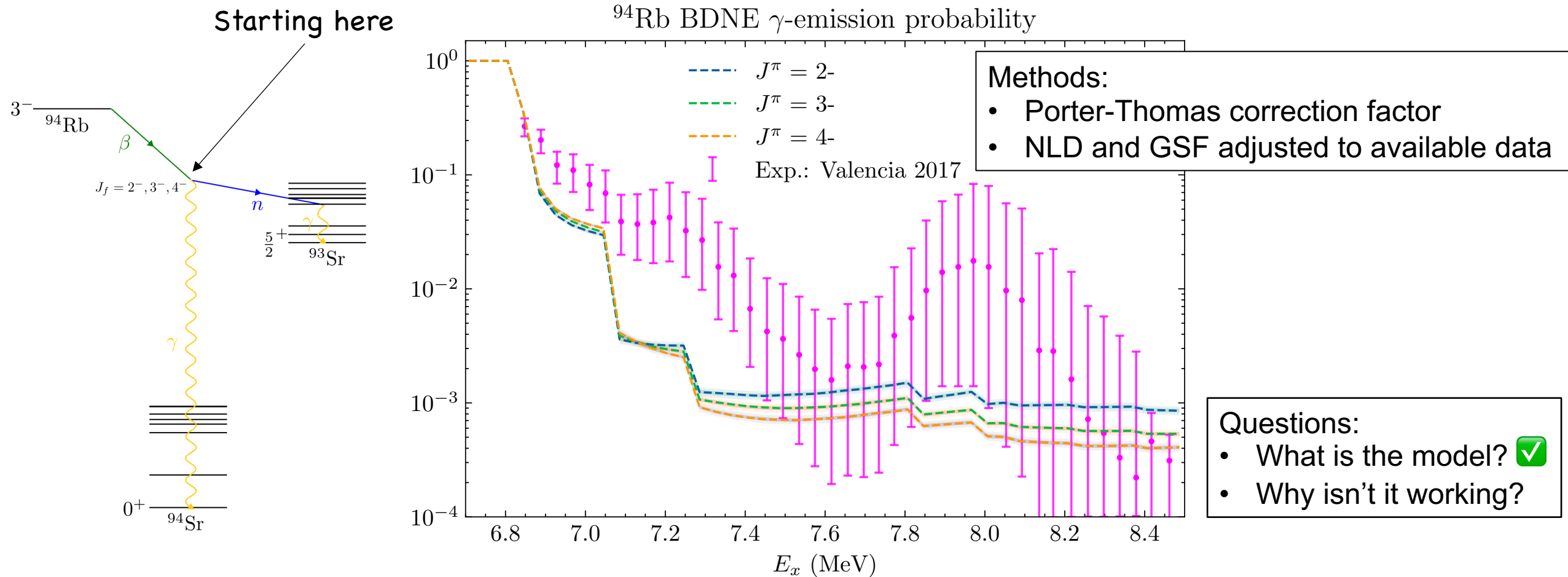
(under-estimates gammas & over-estimates neutrons)



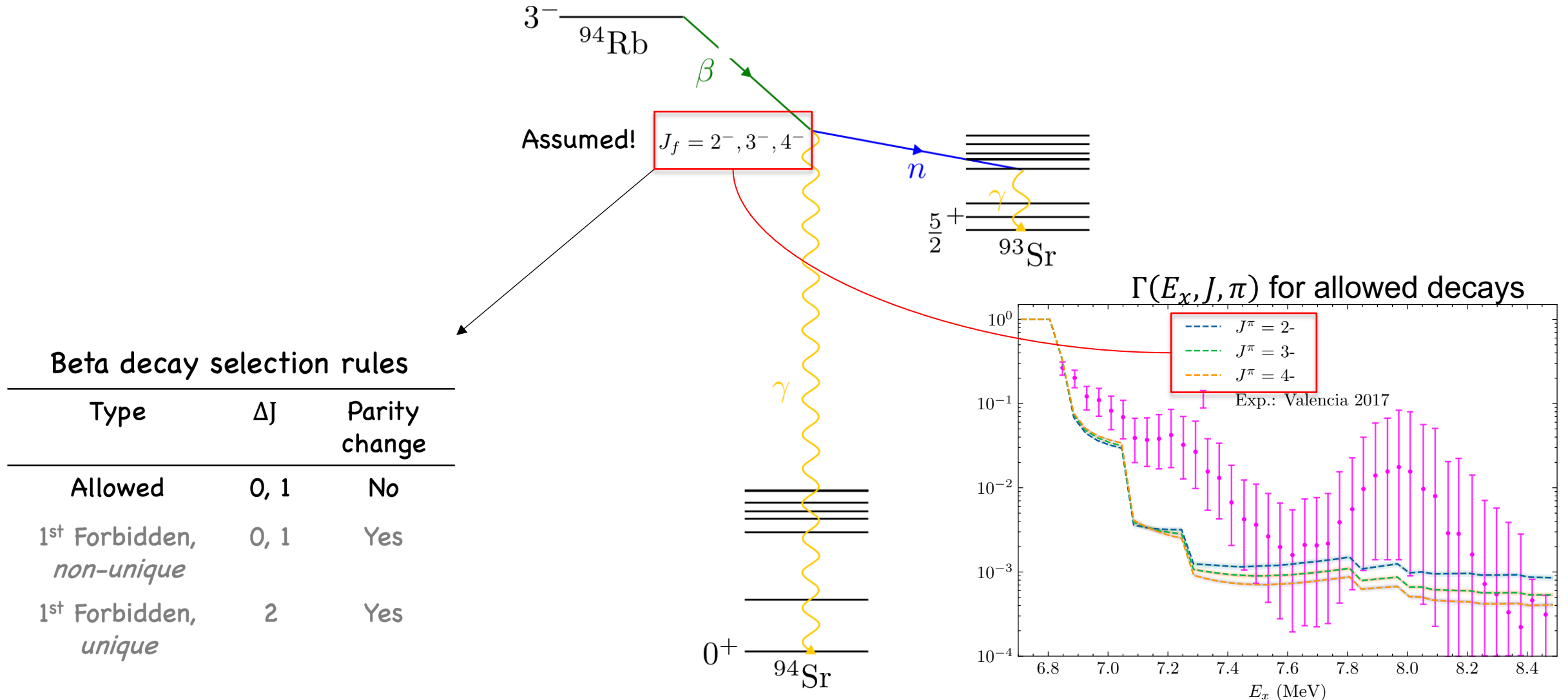
Questions:

- What is the model?
- Why isn't it working?

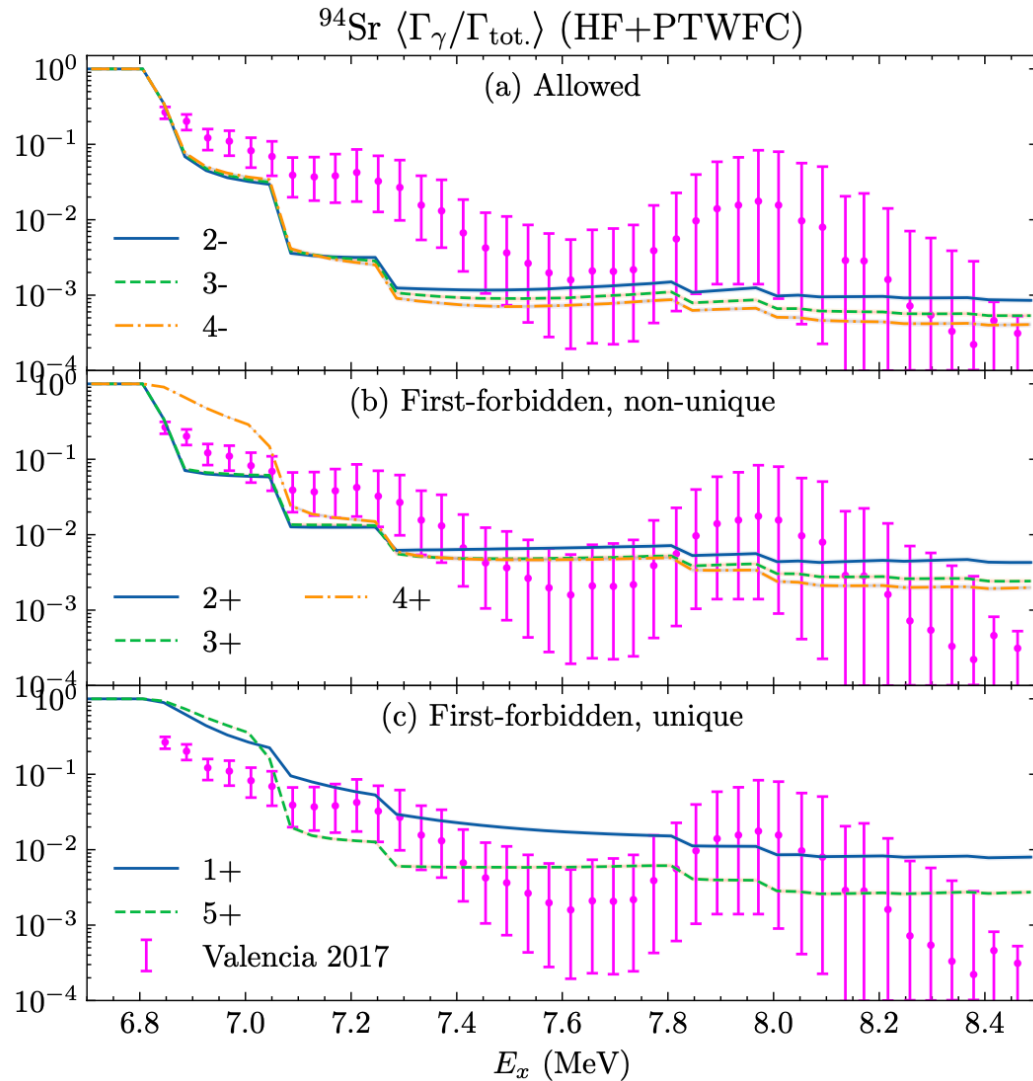
The model: Hauser-Feshbach decay of compound nucleus



Hypothesis 1: What if forbidden decays play a role?



What about other beta decay types?



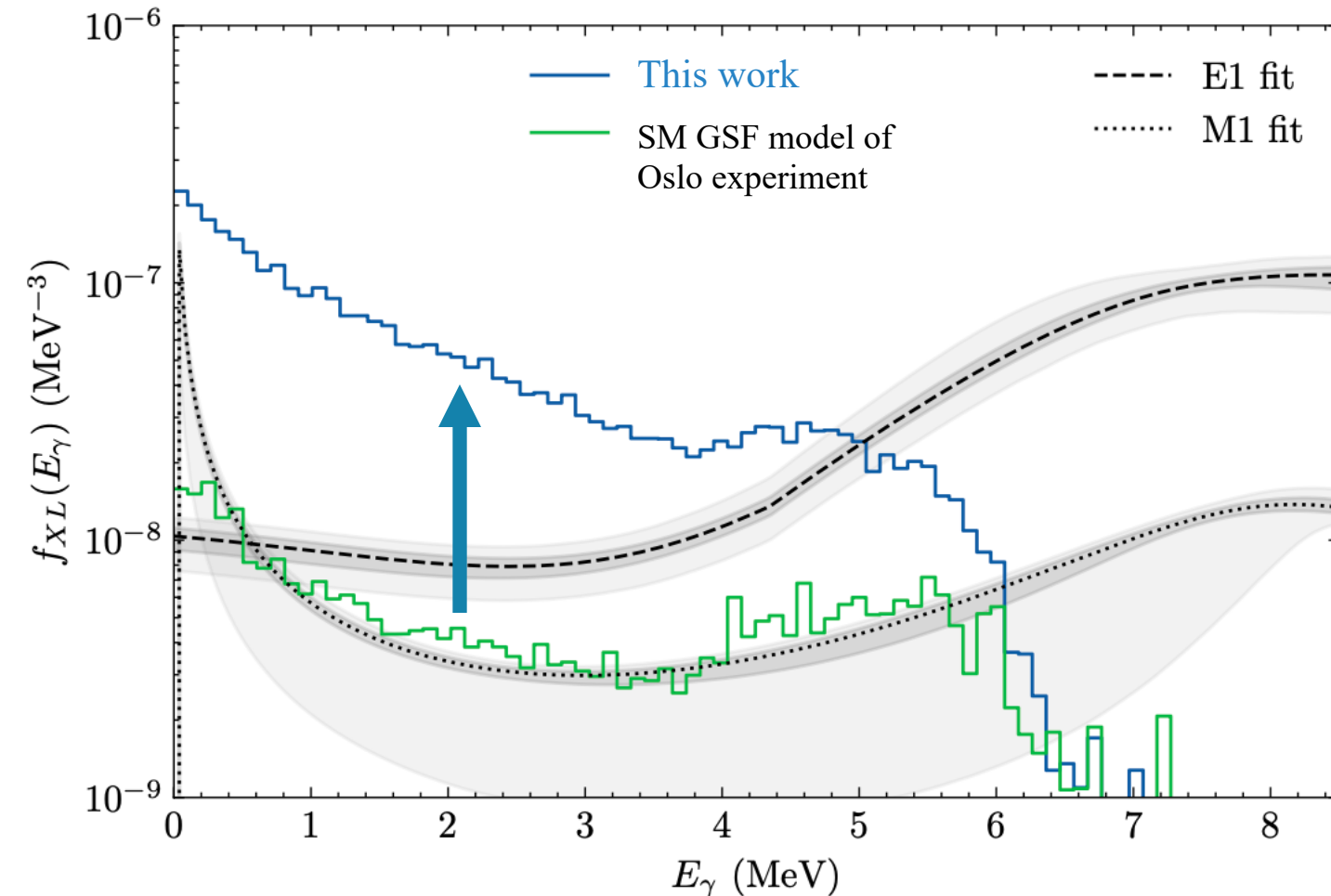
$$\Gamma(E_x) = \sum_{J, \pi} F(E_x, J, \pi) \Gamma(E_x, J, \pi)$$

Allowed, forbidden?

Forbidden decay *may* explain discrepancy

Future: compute "secret recipe" $F(E, J, \pi)$ with shell model

Hypothesis 2: gamma strength function stronger than assumed



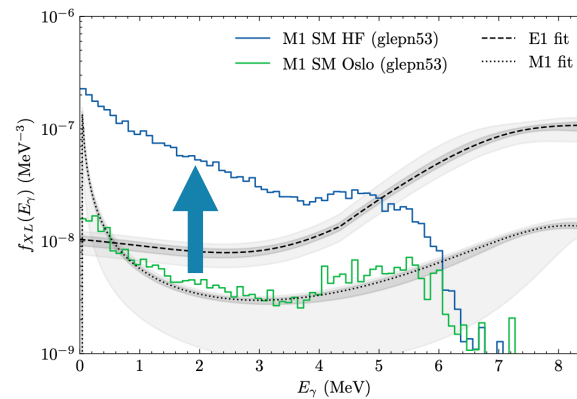
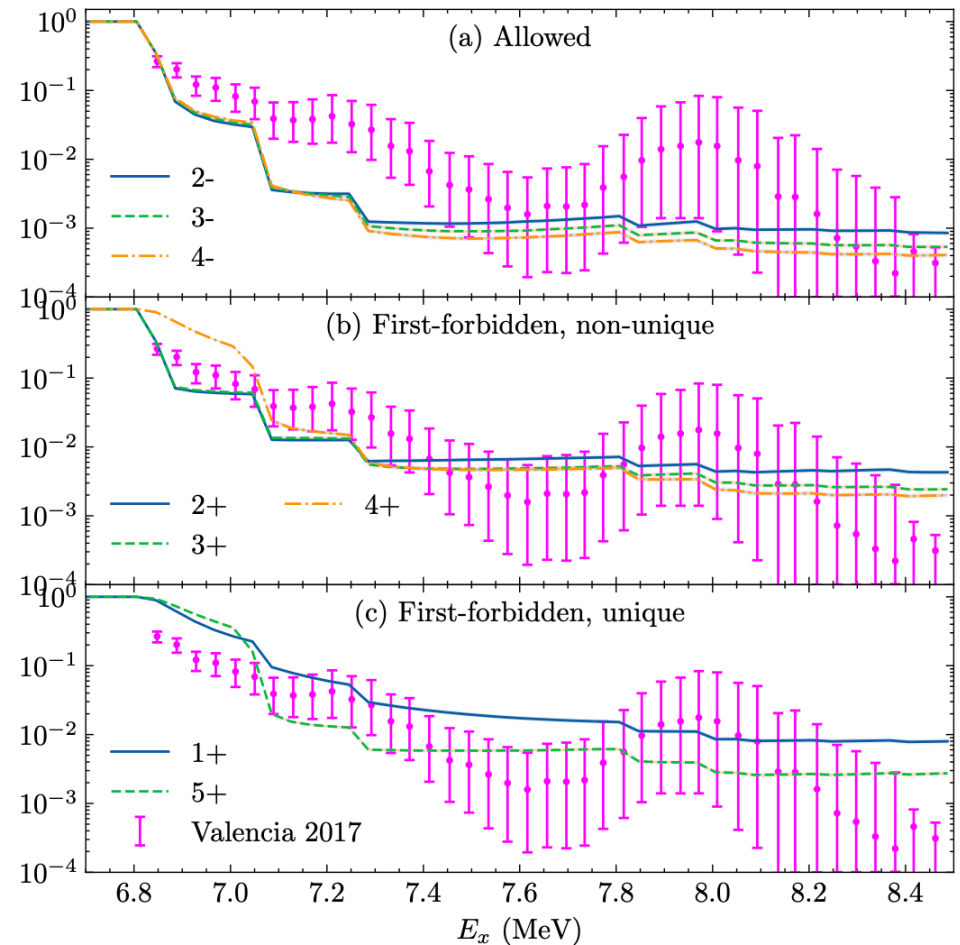
Shell model GSF for HF predicts a 10x enhancement of the low-energy M1 GSF

Tail of the E1 GSF fit to data with COMMCAS

Tail of the M1 GSF fit to global model

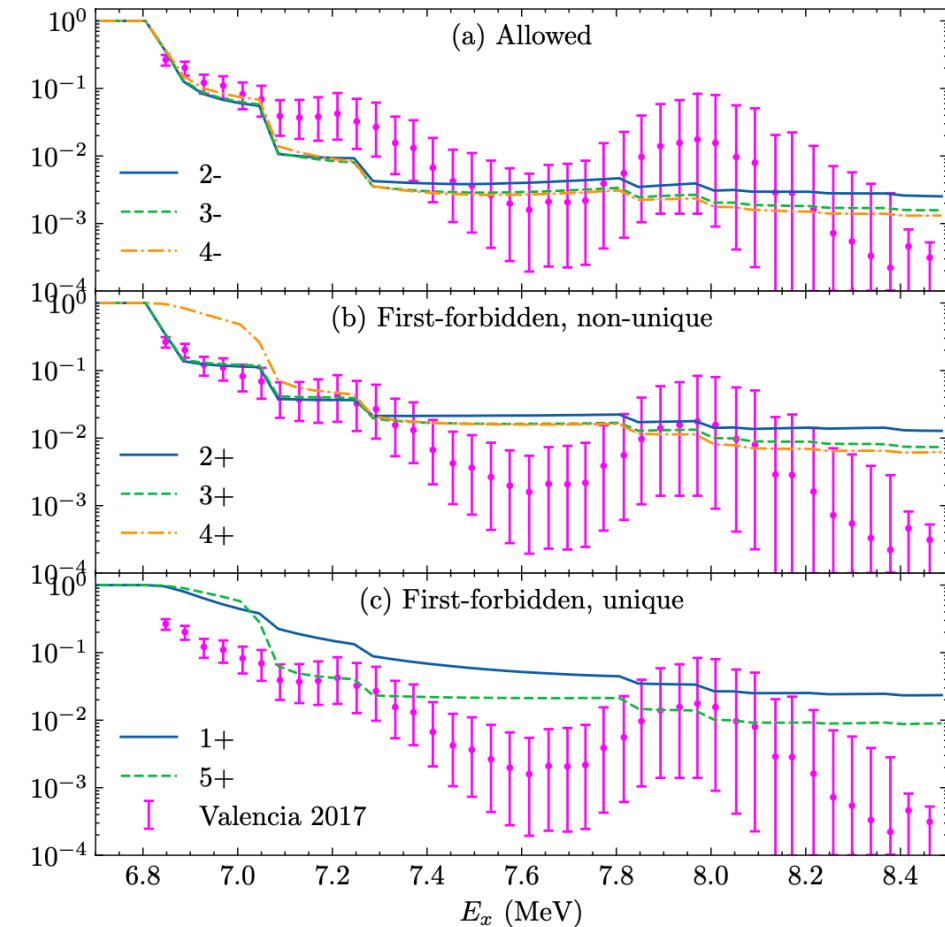
GSF enhancement reduces need for forbidden decay

Prior knowledge of GSF



E1, E2 enhancement yet to be investigated.

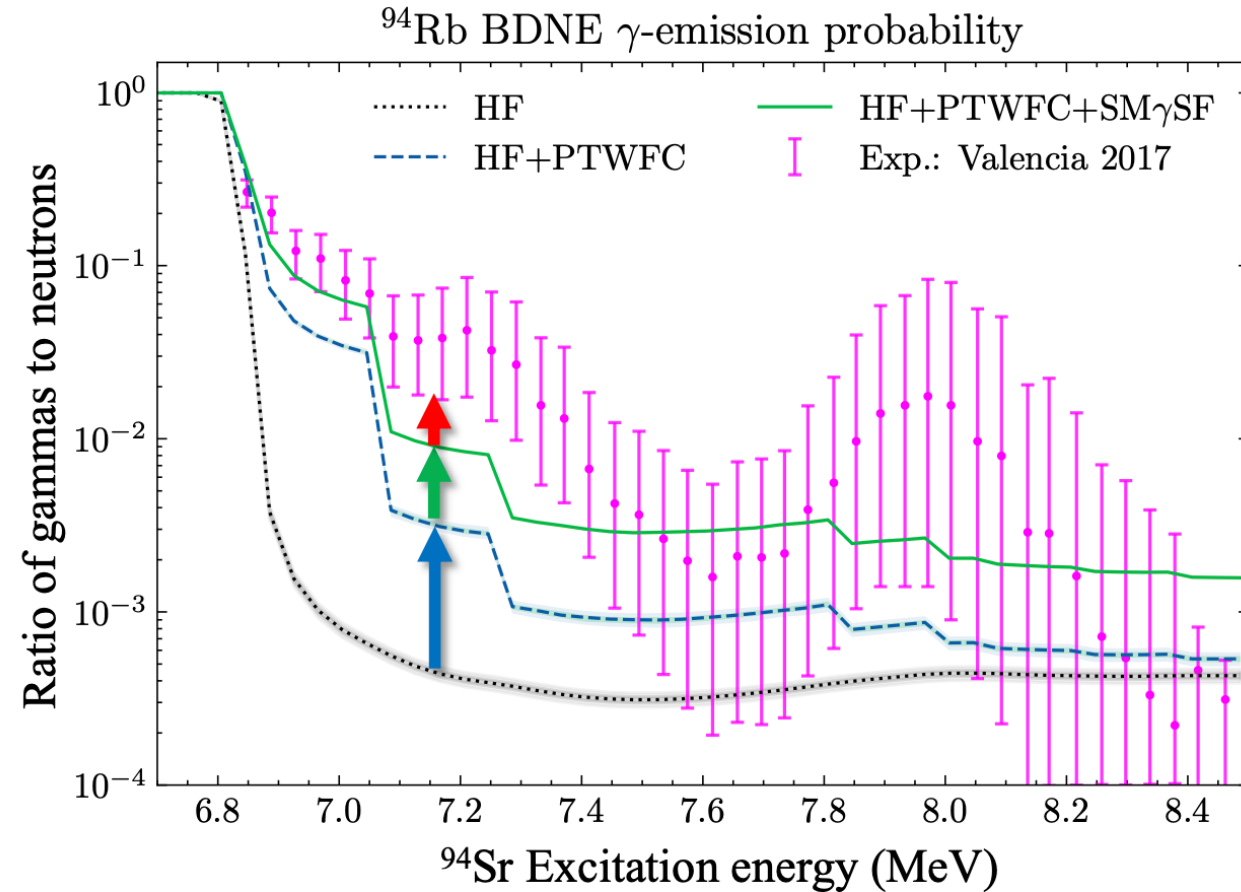
Shell model M1 GSF enhancement



What should we conclude based on this new theoretical evidence?

Discrepancy **can** be explained:

Significant enhancement to M1 gamma strength function
+
Small contributions from forbidden beta decay





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