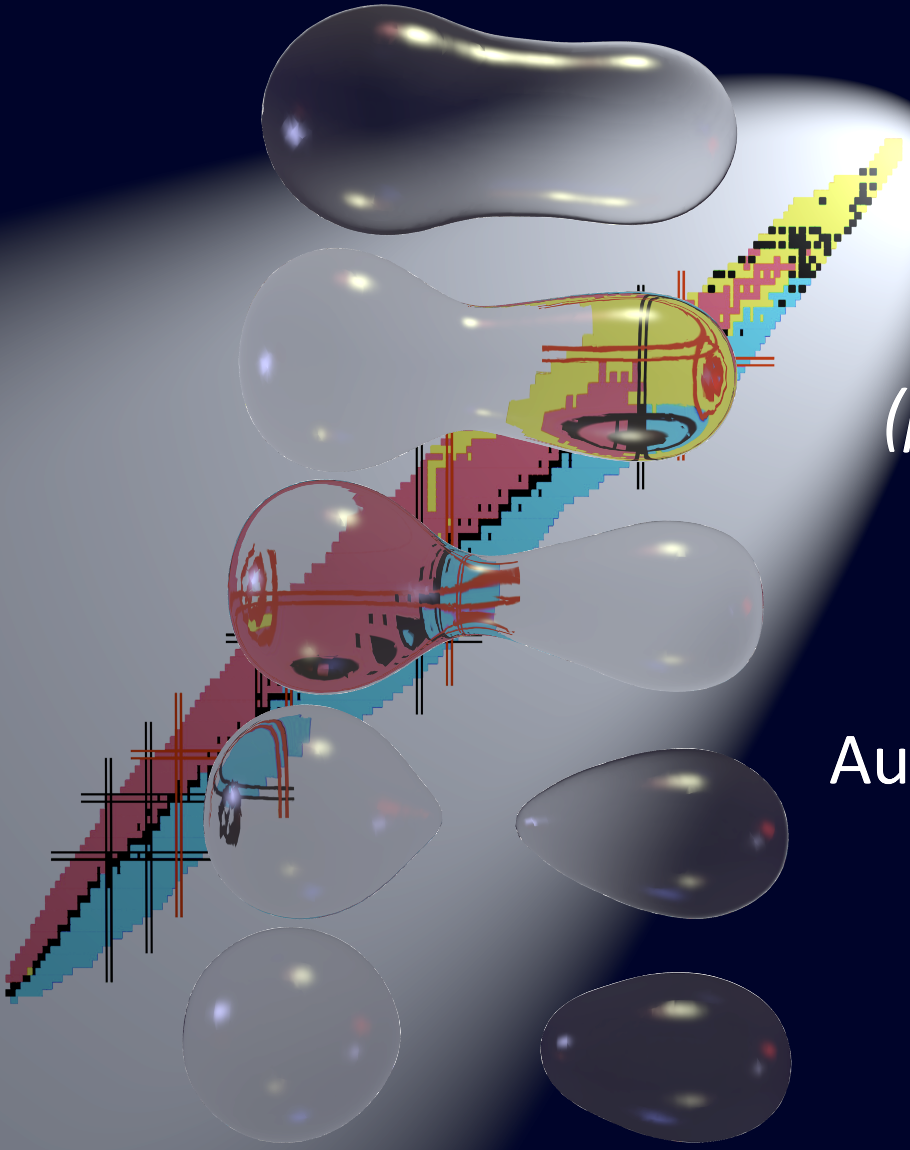
Role of octupole deformed shell on fission



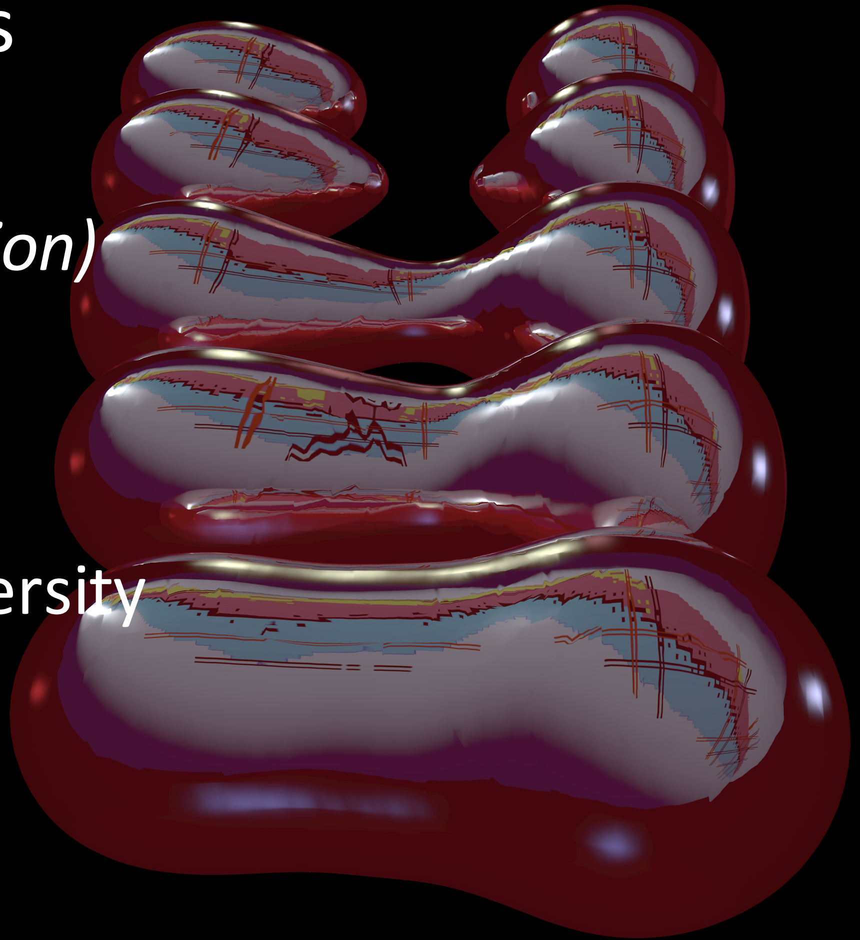
Guillaume Scamps

Tsukuba University

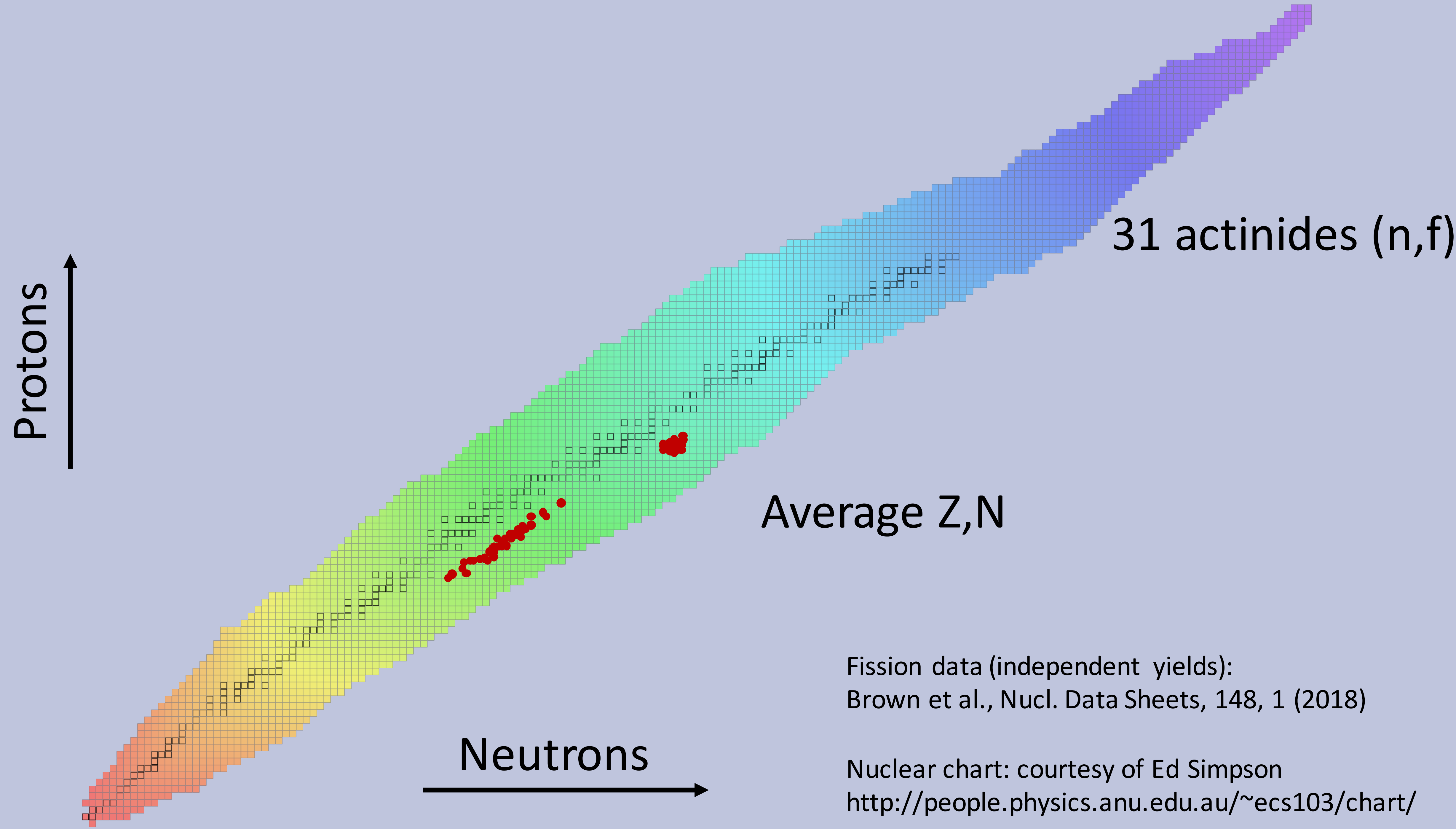
(poster on mercury region)

Cedric Simenel

Australian National University



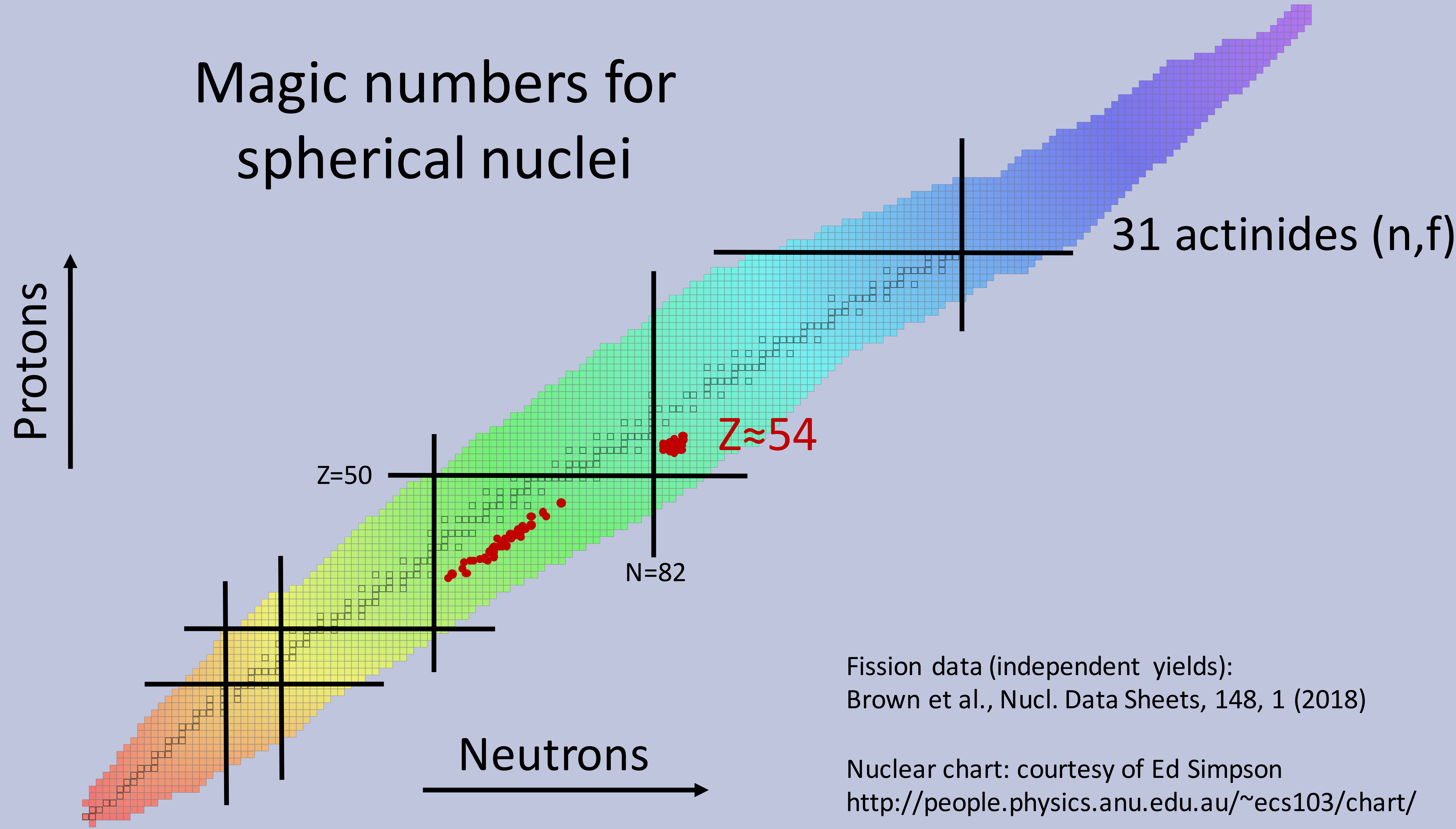
Nature 564, 382 (2018)



Fission data (independent yields):
Brown et al., Nucl. Data Sheets, 148, 1 (2018)

Nuclear chart: courtesy of Ed Simpson
http://people.physics.anu.edu.au/~ecs103/chart/

Magic numbers for spherical nuclei



Fission data (independent yields):
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Nuclear chart: courtesy of Ed Simpson
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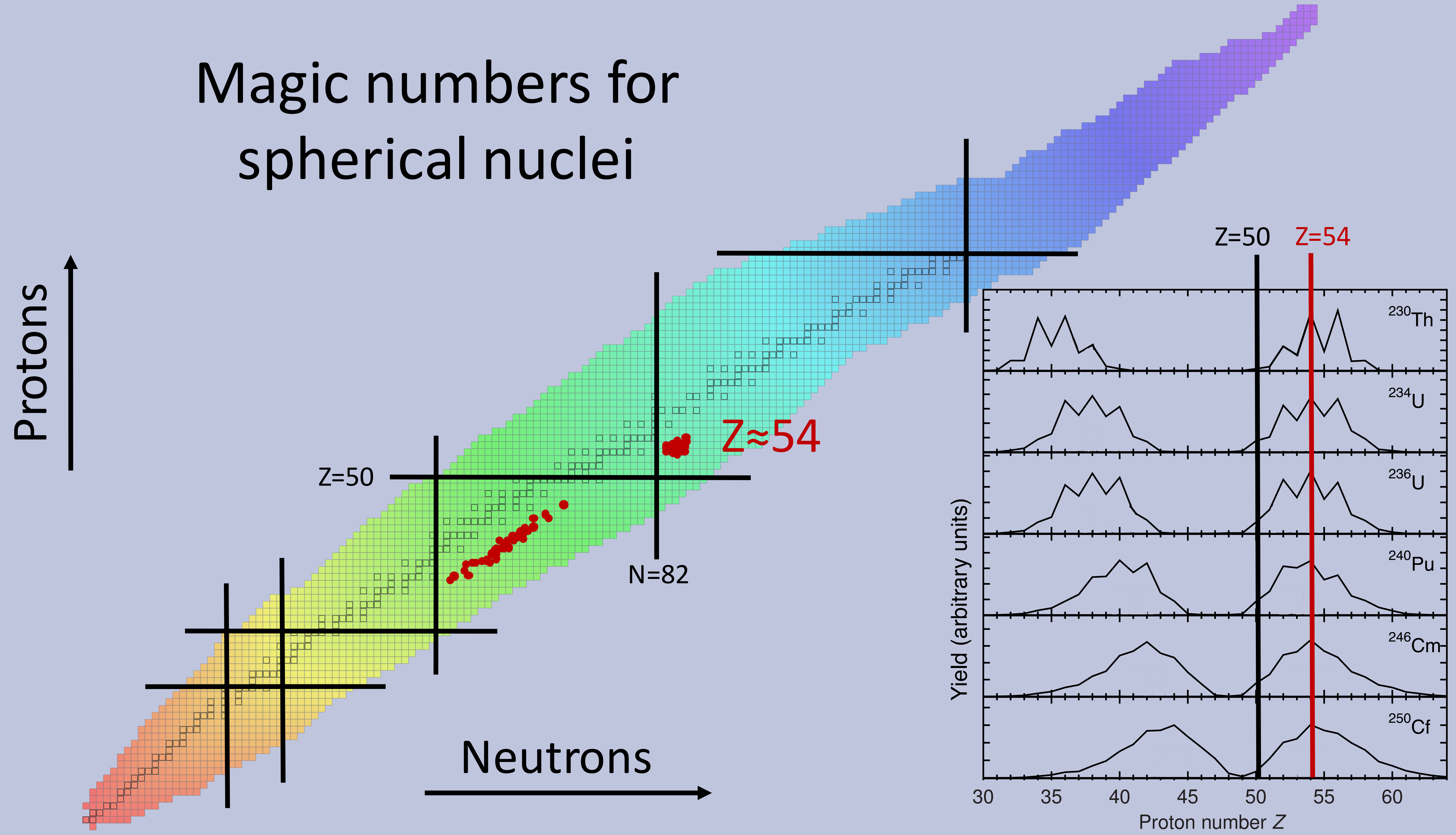
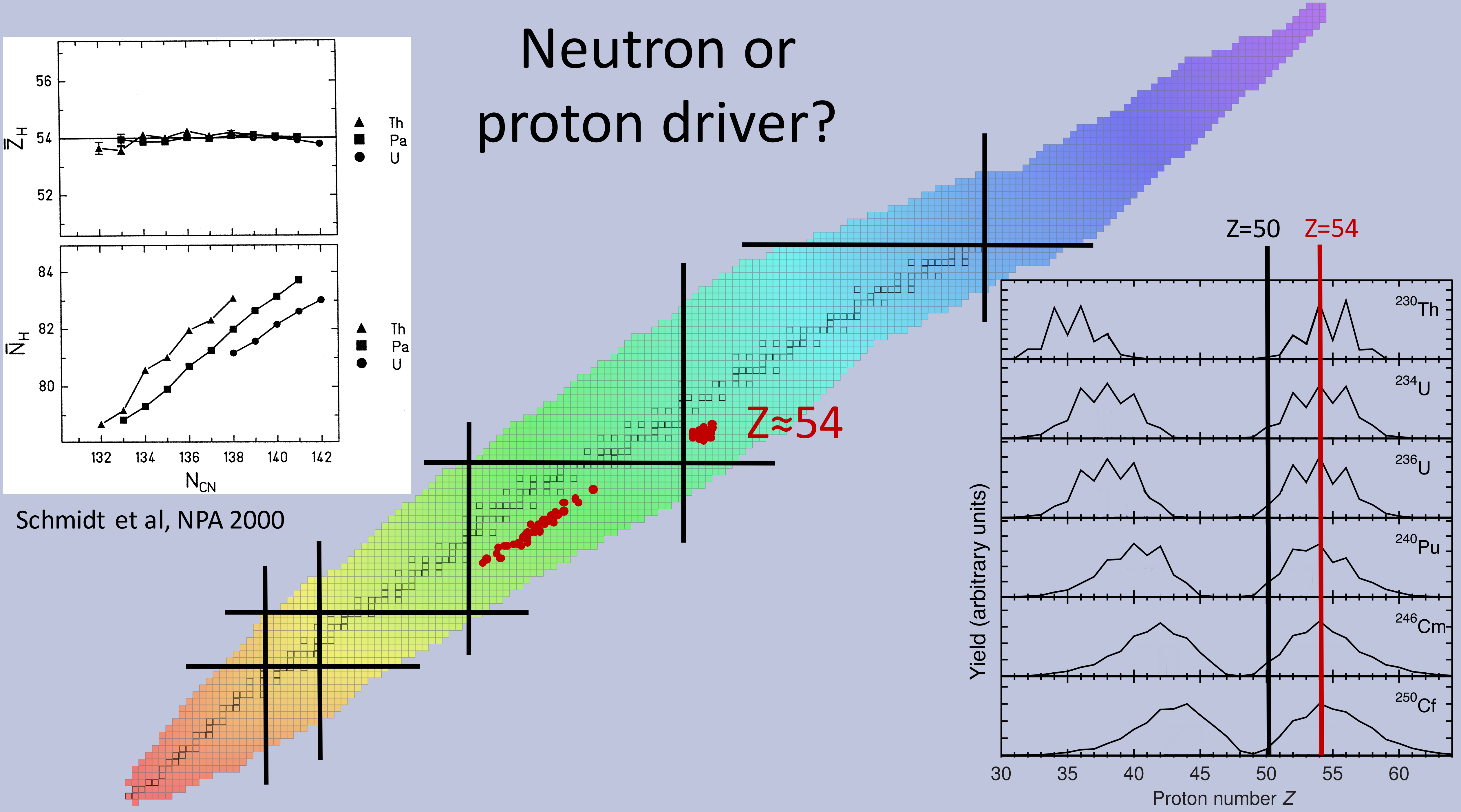
Magic numbers for spherical nuclei



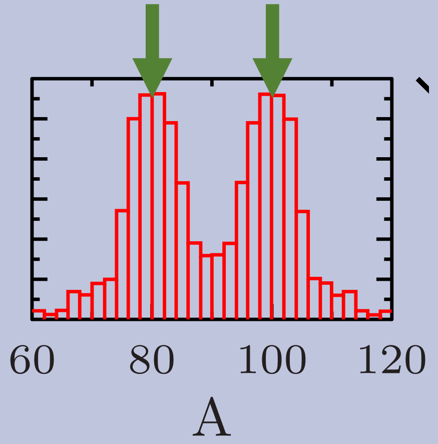
Neutron or proton driver?



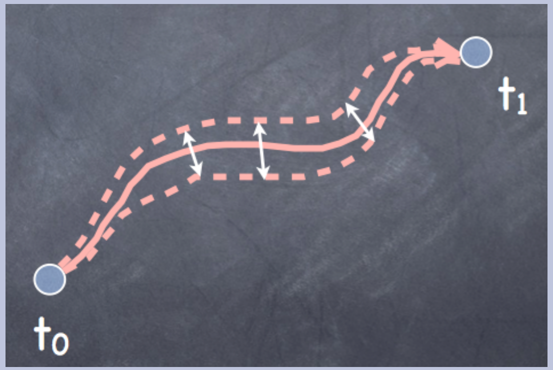
Schmidt et al, NPA 2000

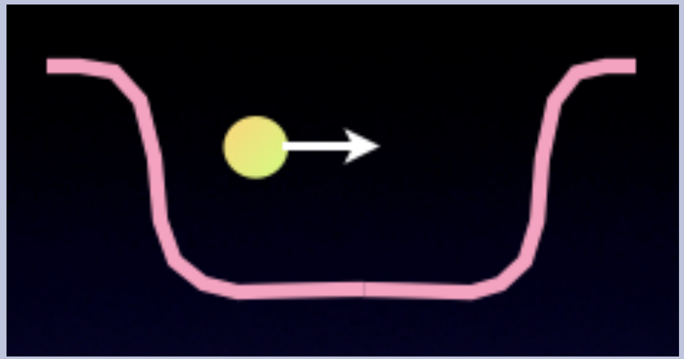
Time-dependent Hartree-Fock + BCS simulations

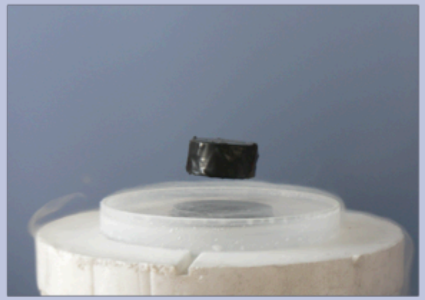
Mean-field of independent particles (**fully microscopic**)



Fluctuations are underestimated



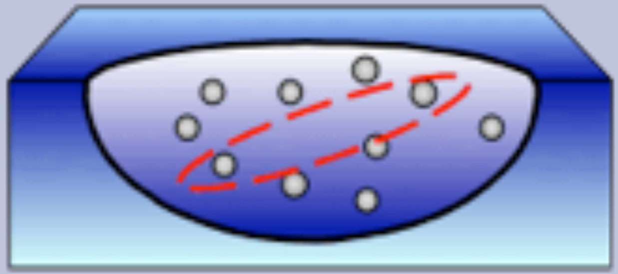




superconductivity

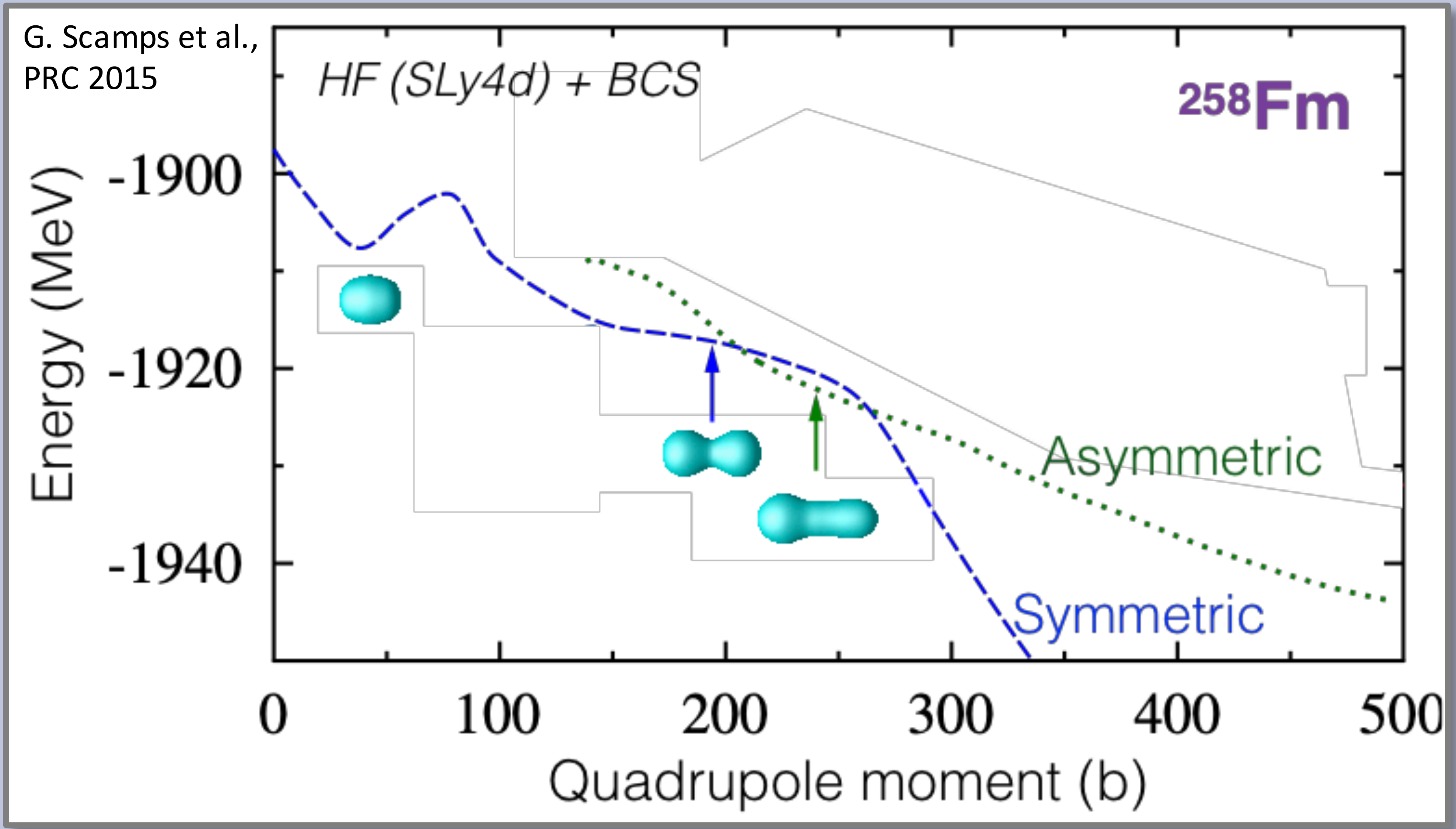
superfluidity

Pairing correlations



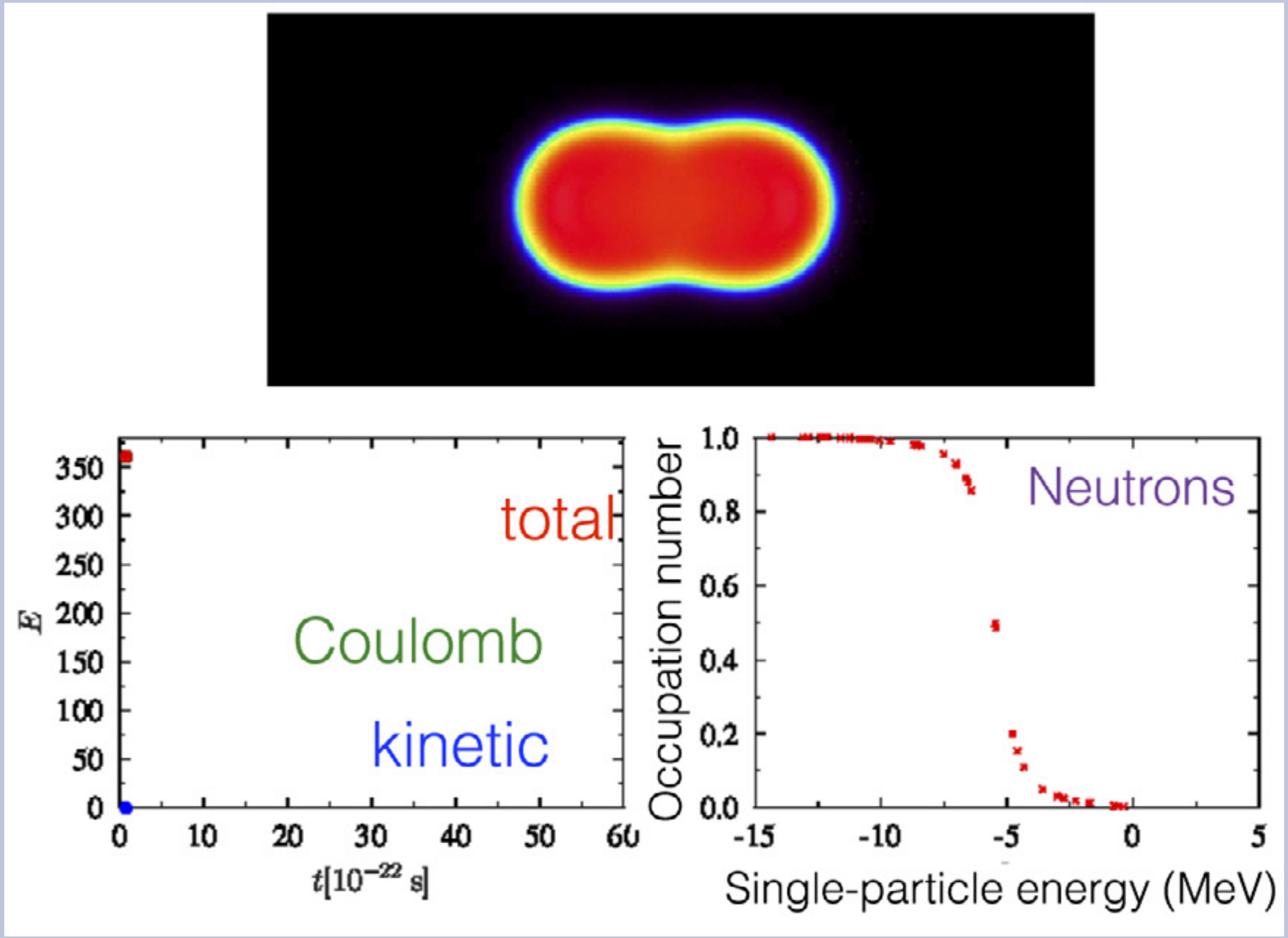
<u>No parameter</u>:
Only input is the interaction
(Energy Density Functional)

Time-dependent Hartree-Fock + BCS simulations



Time-dependent Hartree-Fock + BCS simulations

G. Scamps et al.,
PRC 2015

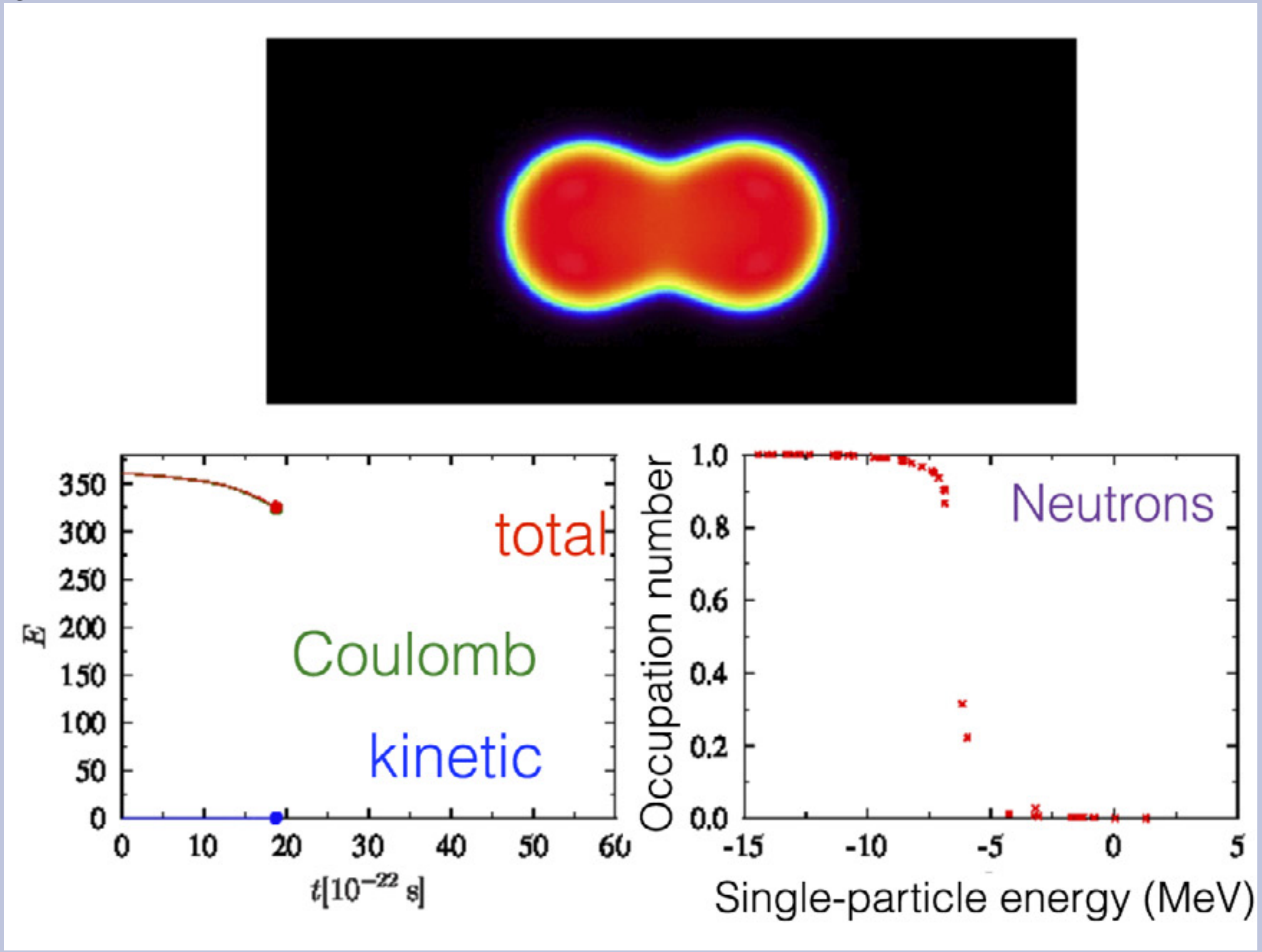


^{258}Fm
(sym.)

Time-dependent Hartree-Fock + BCS simulations

G. Scamps et al., PRC 2015

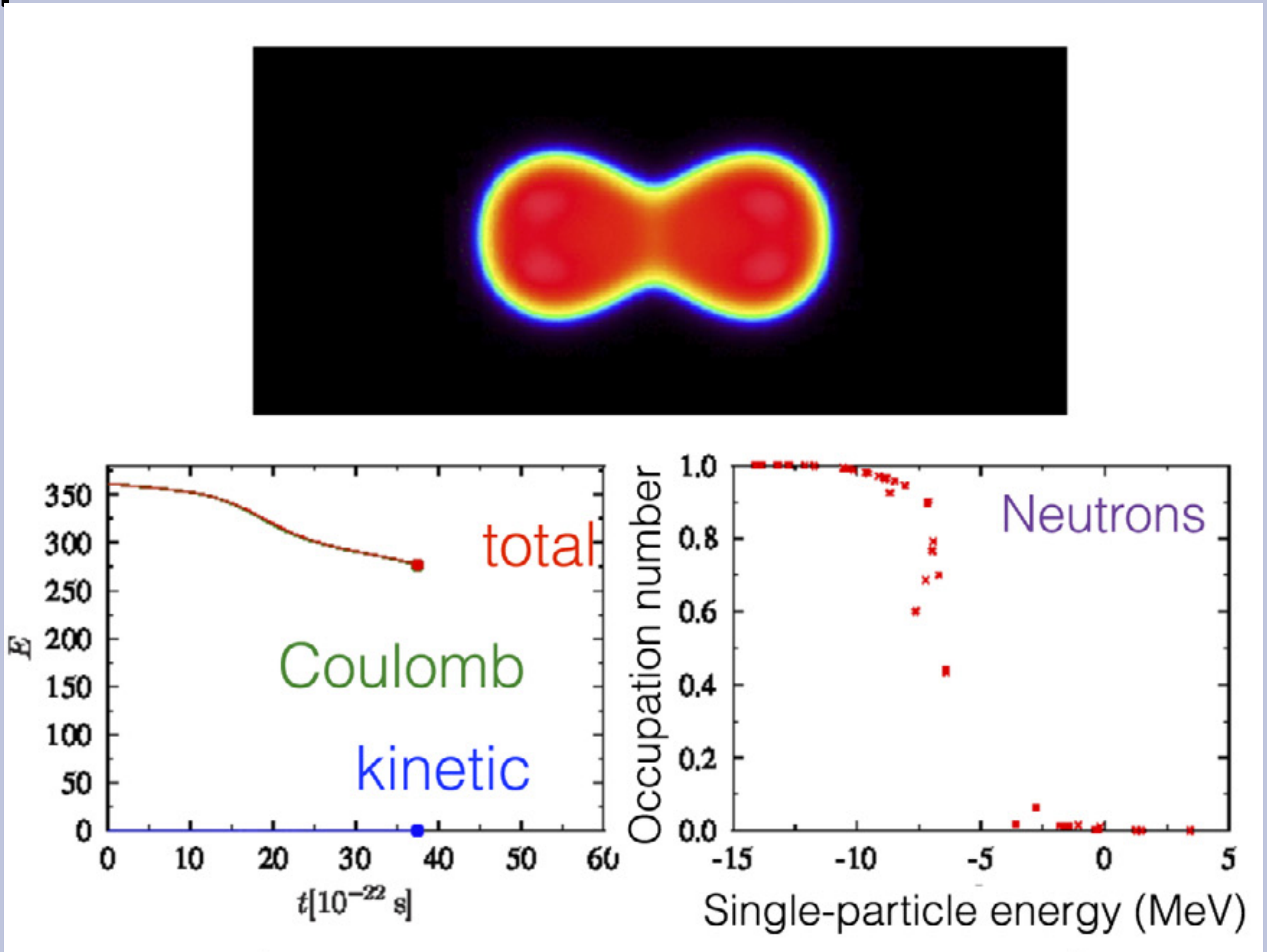
^{258}Fm (sym.)



Time-dependent Hartree-Fock + BCS simulations

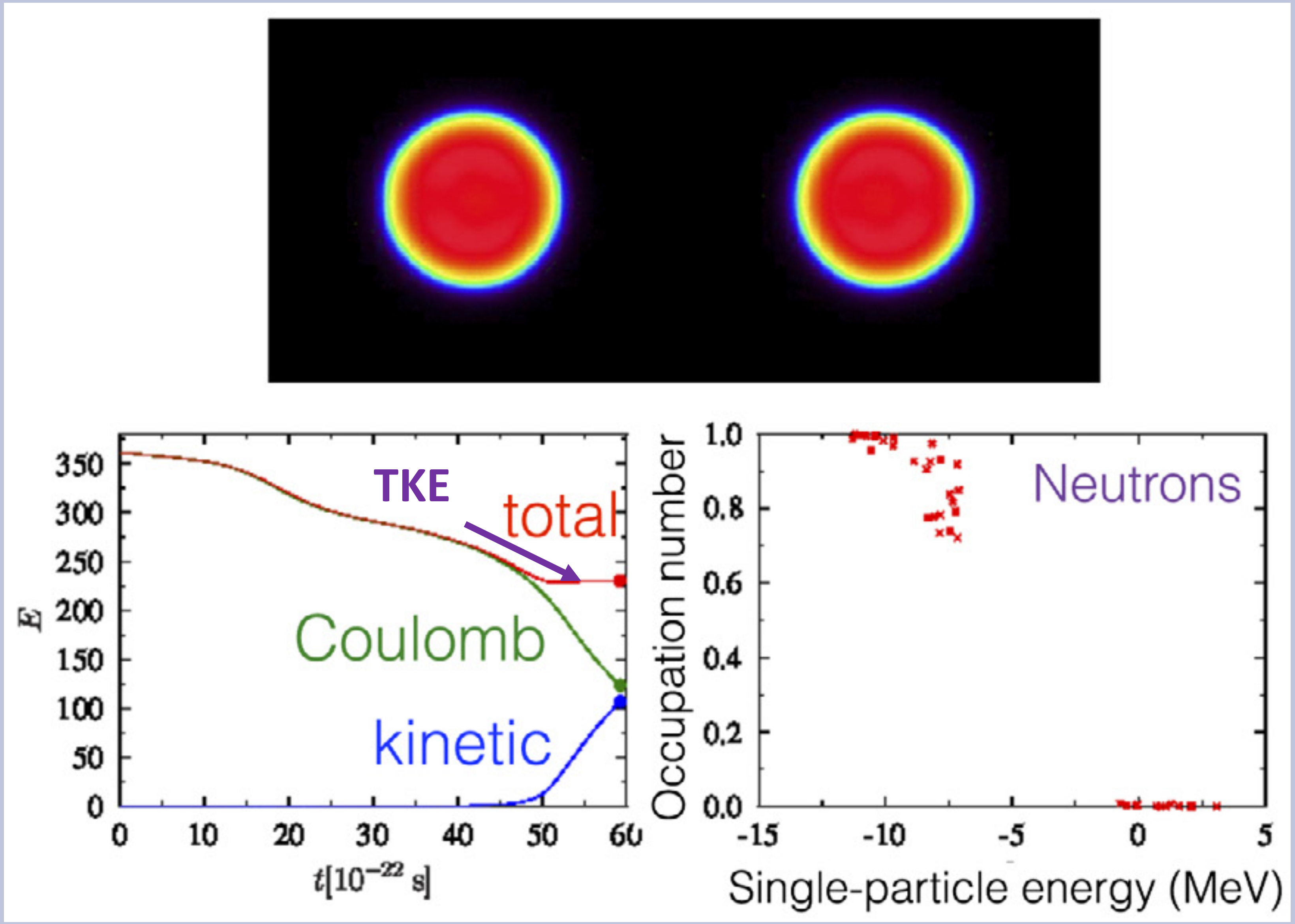
G. Scamps et al.,
PRC 2015

^{258}Fm
(sym.)



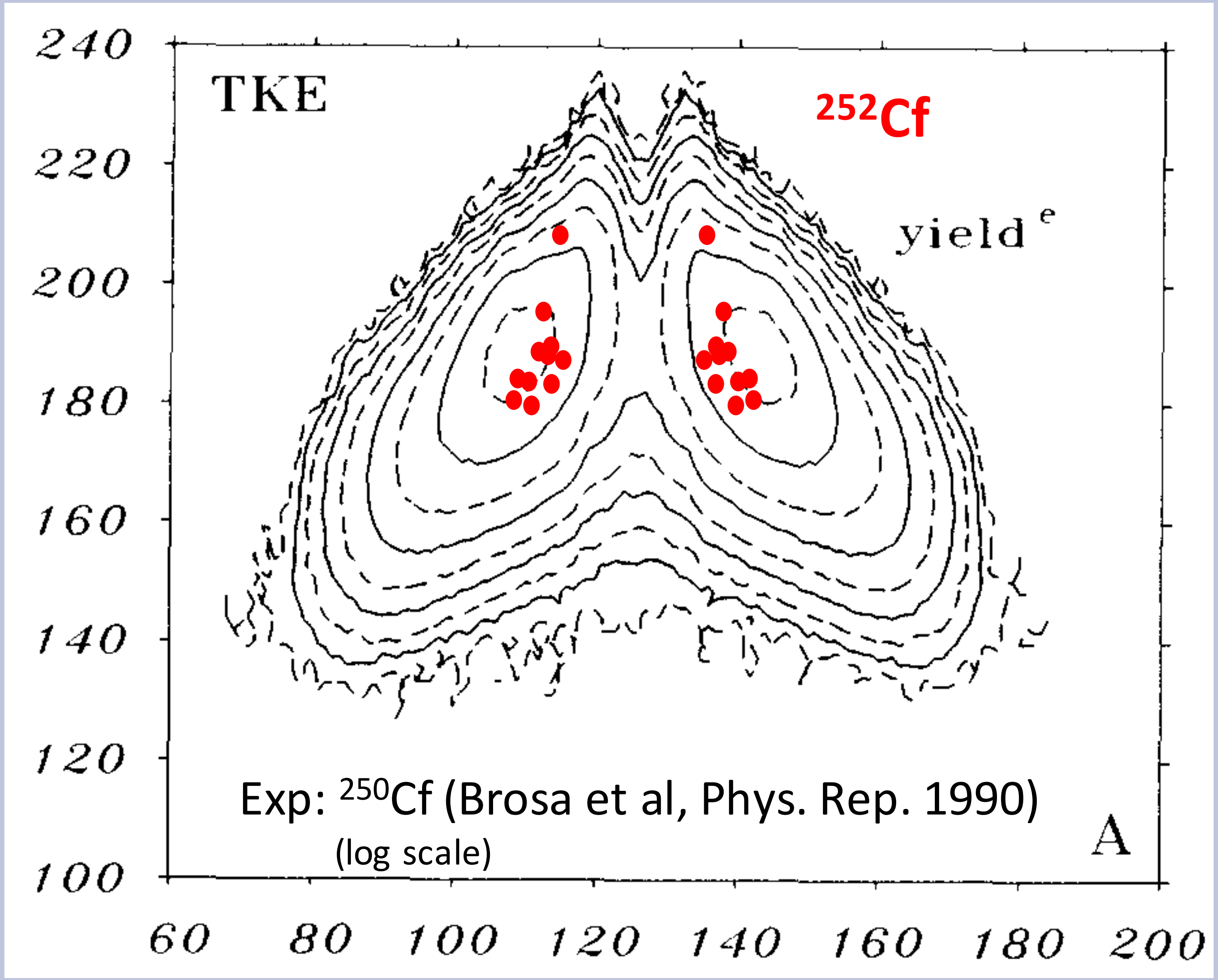
Time-dependent Hartree-Fock + BCS simulations

G. Scamps et al., PRC 2015



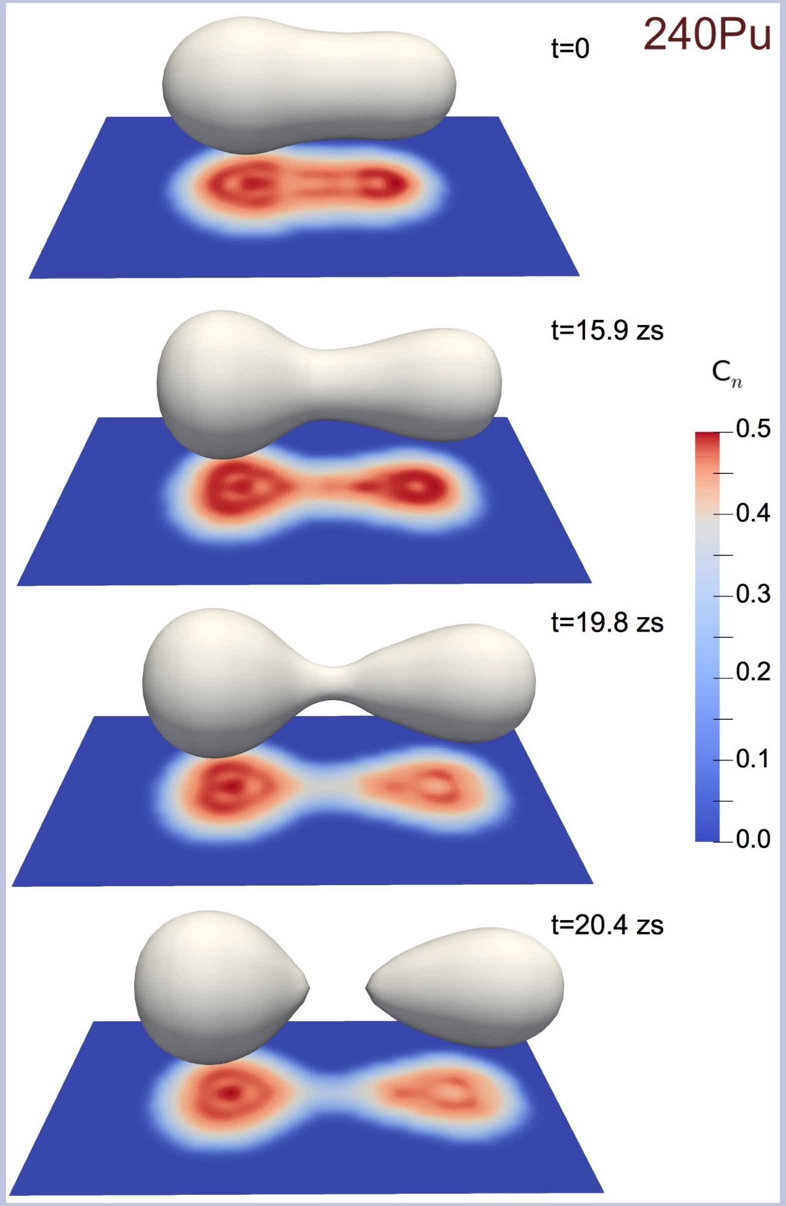
^{258}Fm
(sym.)

Total Kinetic Energy

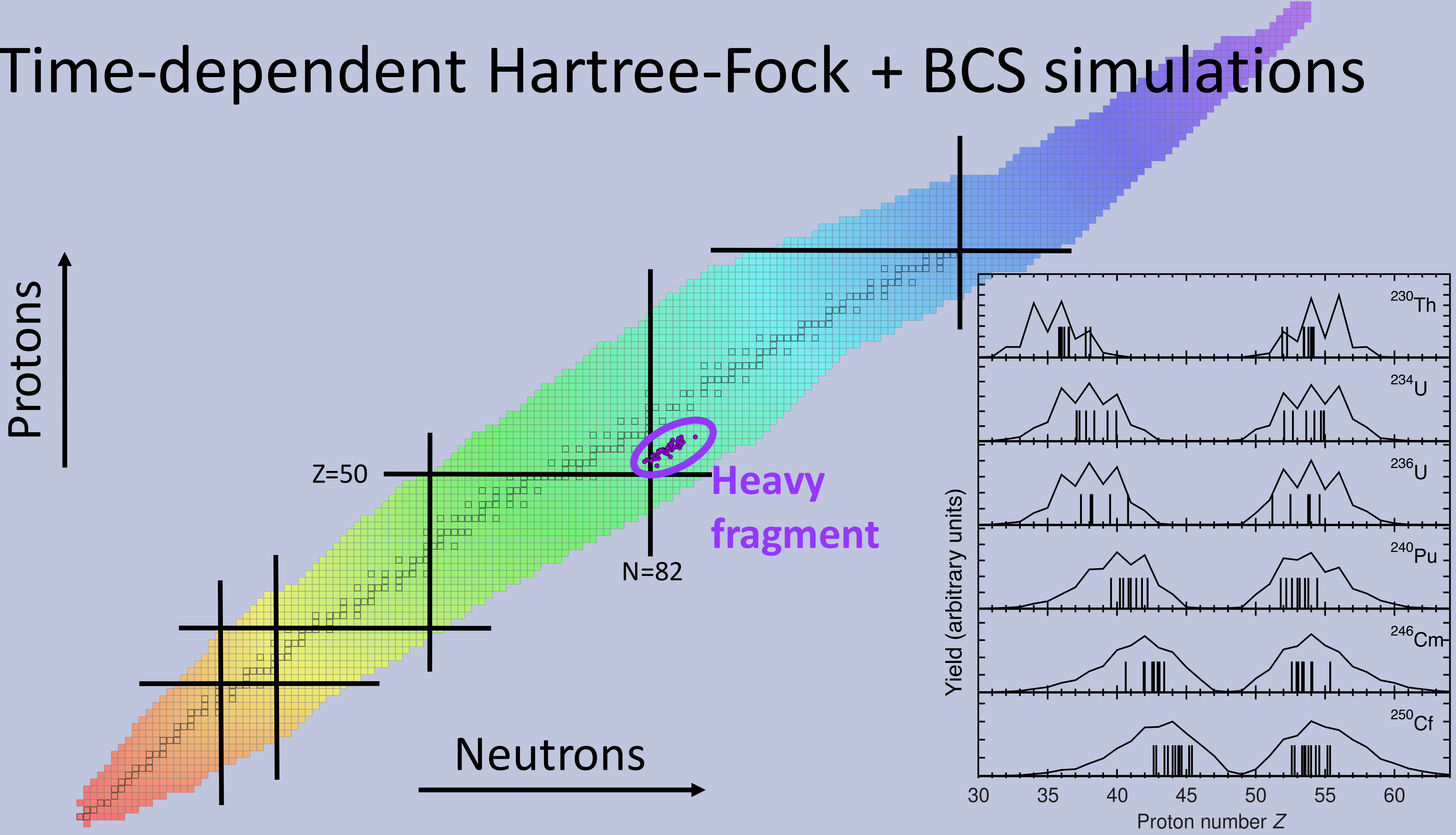


Exp: ^{250}Cf (Brosa et al, Phys. Rep. 1990)
(log scale)

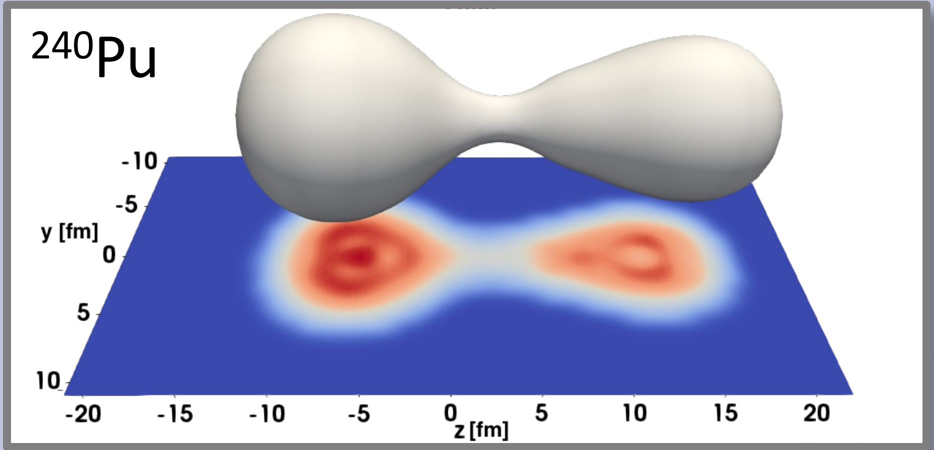
Time-dependent Hartree-Fock + BCS simulations



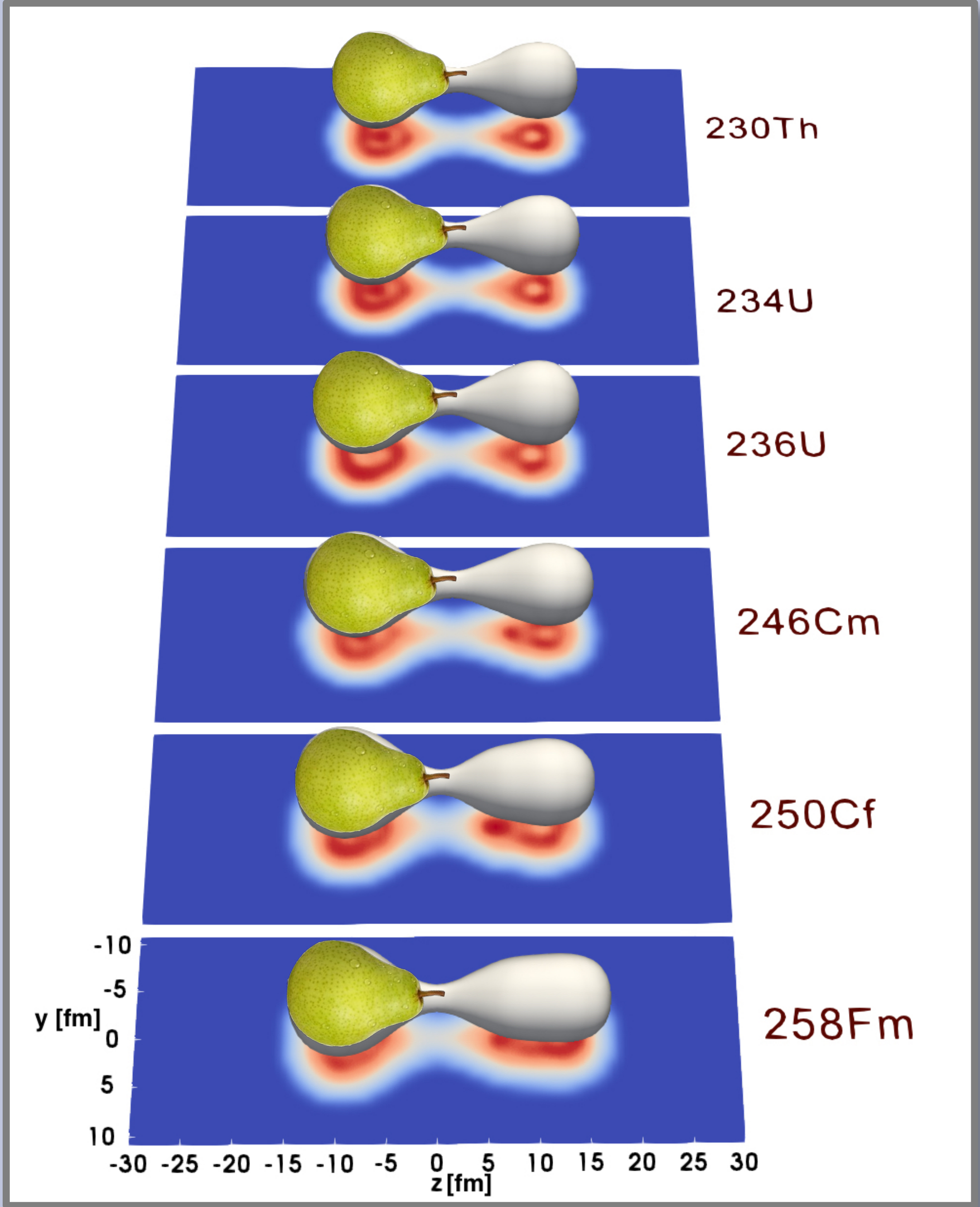
Time-dependent Hartree-Fock + BCS simulations



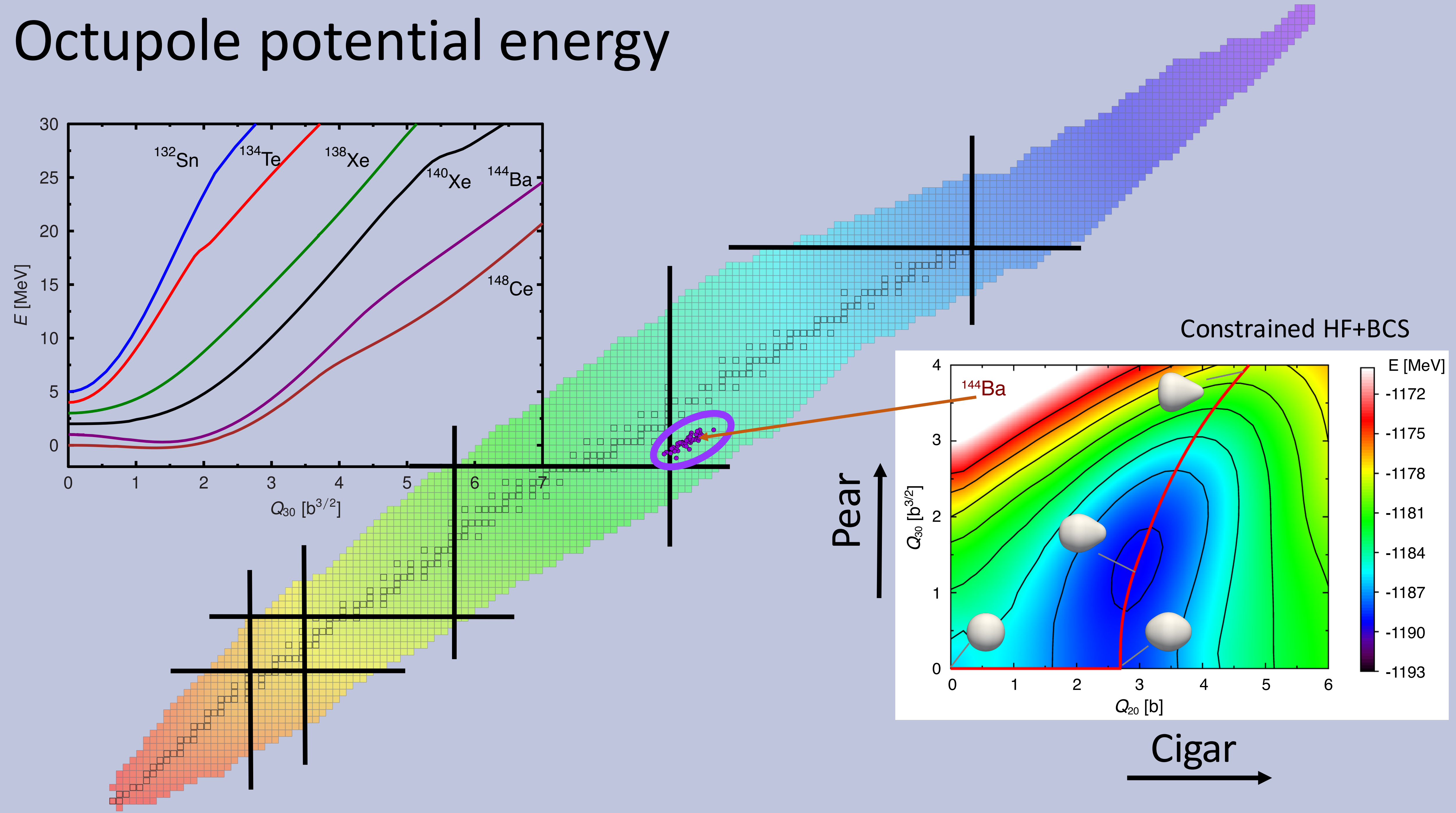
Pear shapes at scission



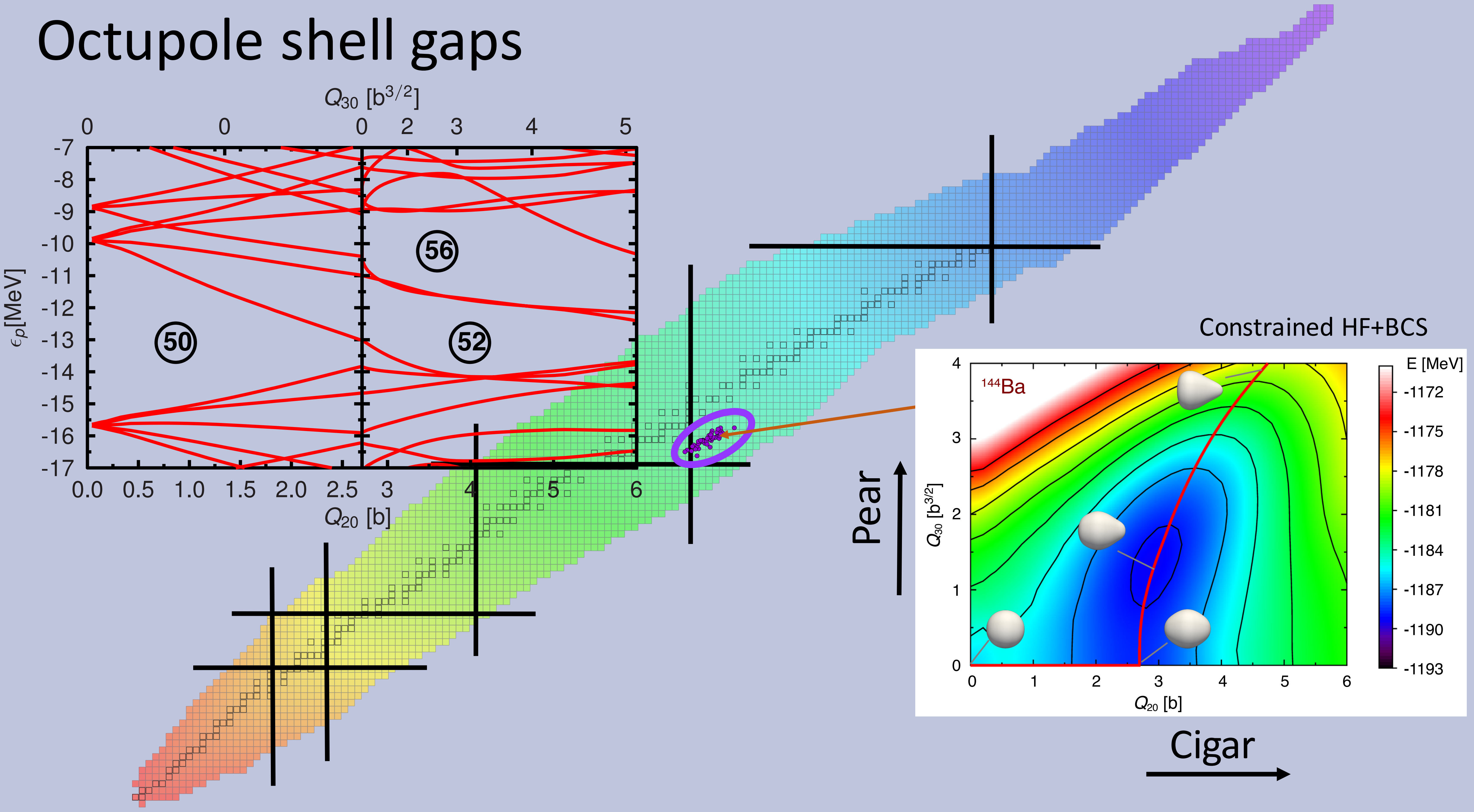
Direct evidence of octupole deformation in ^{144,146}Ba
Bucher et al, PRL 2016, 2017



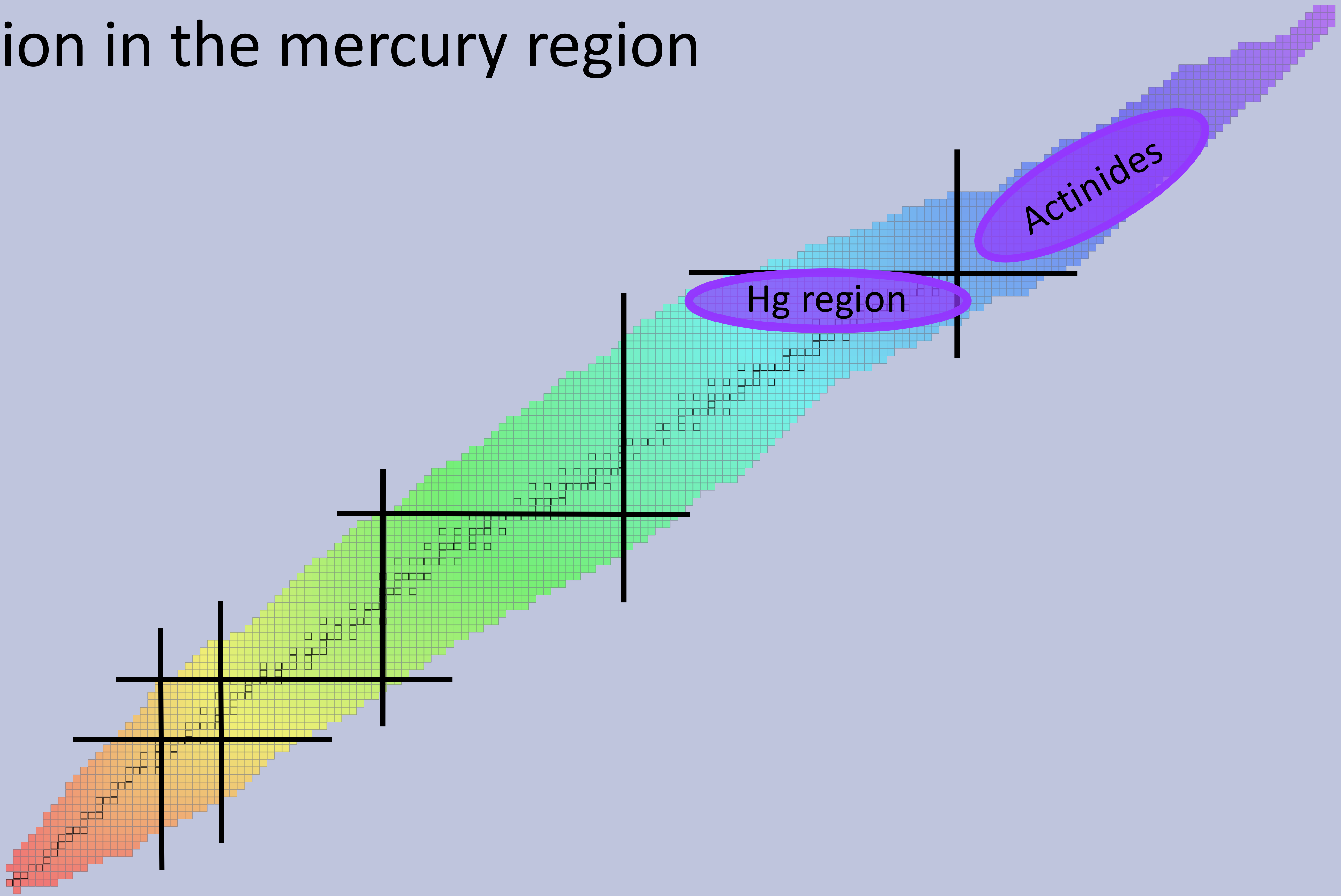
Octupole potential energy



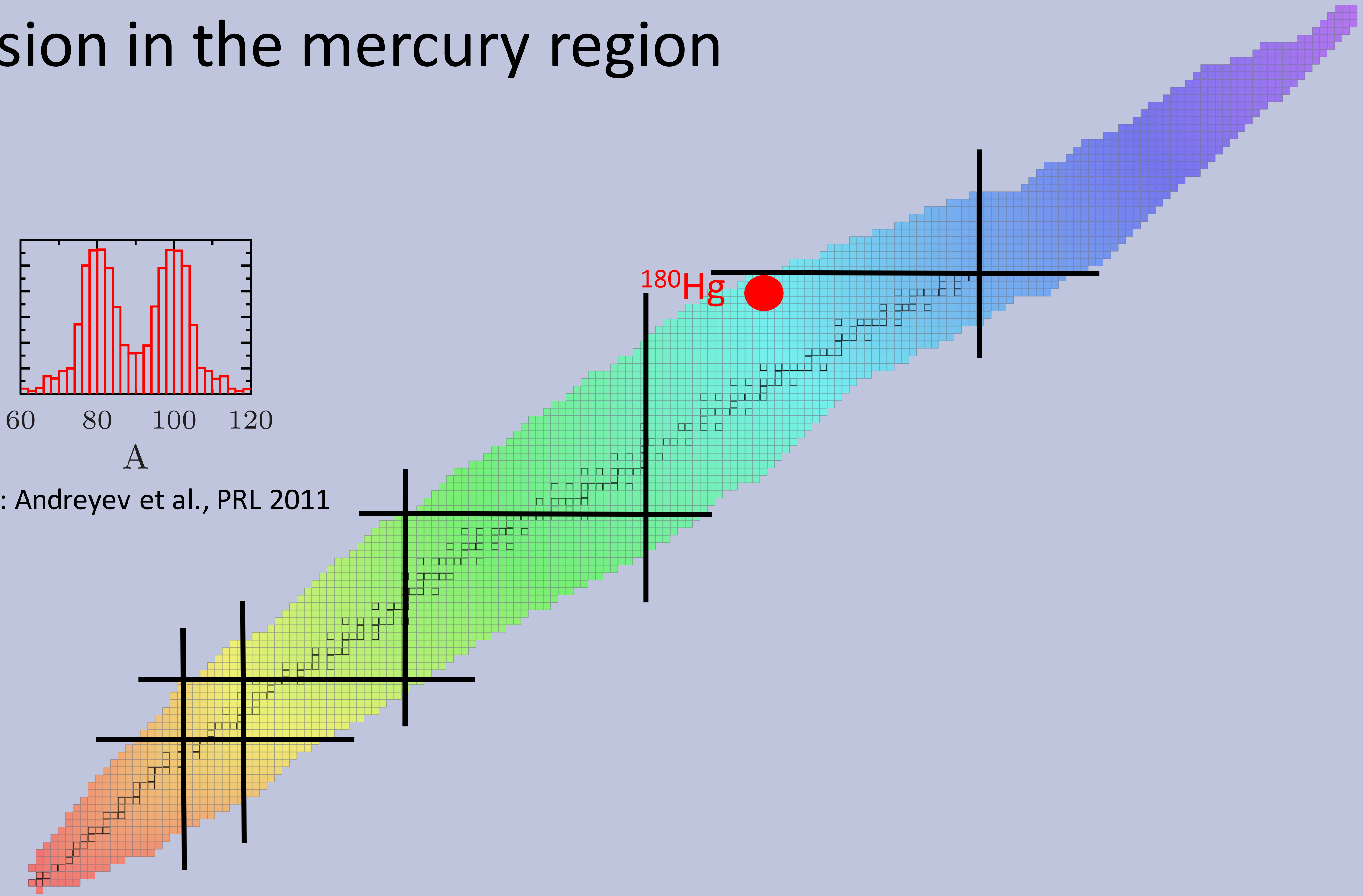
Octupole shell gaps



Fission in the mercury region

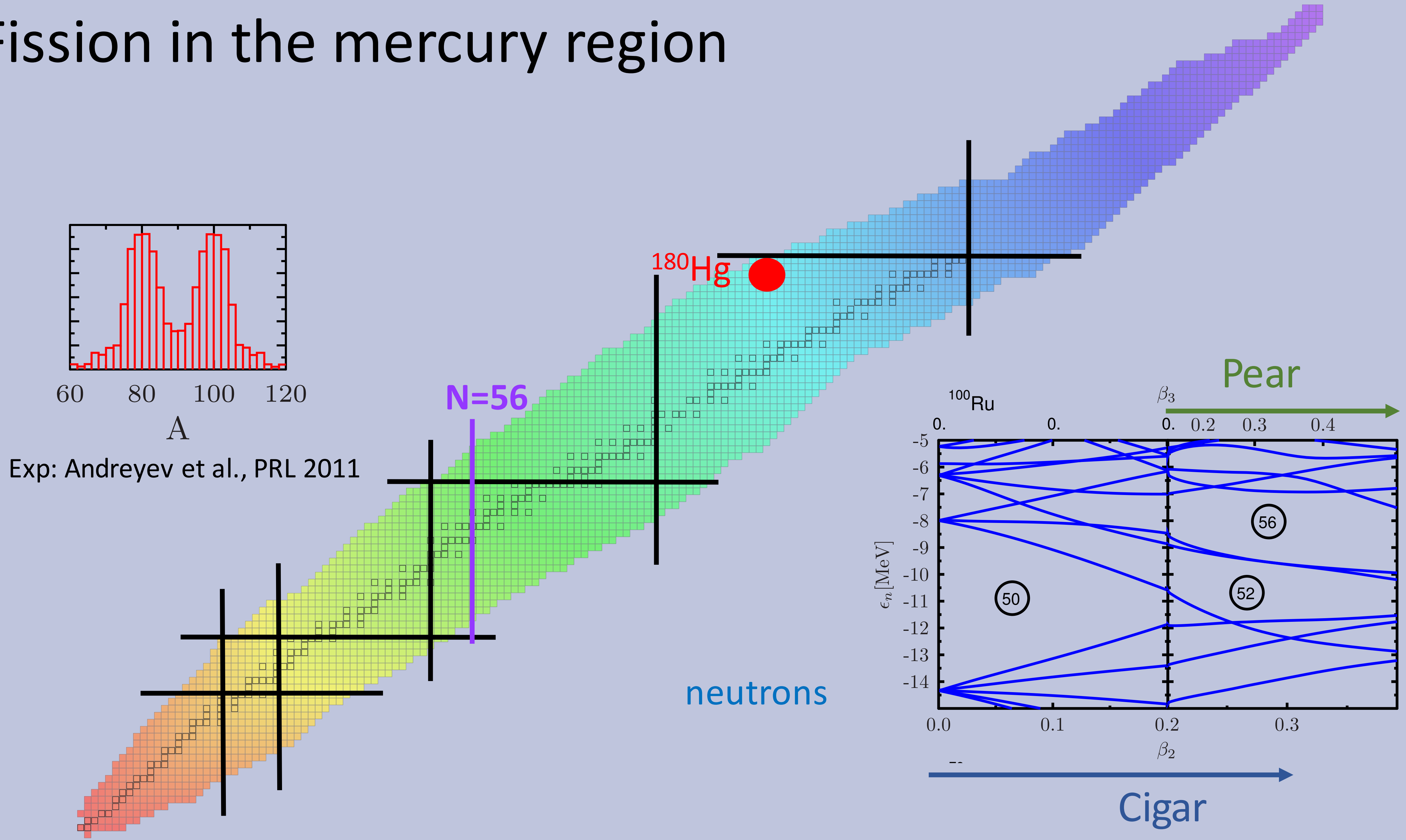


Fission in the mercury region

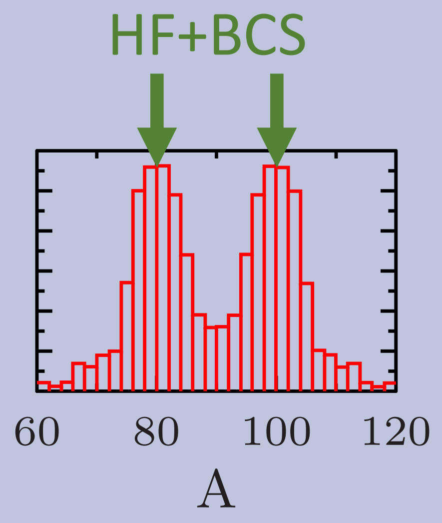


Exp: Andreyev et al., PRL 2011

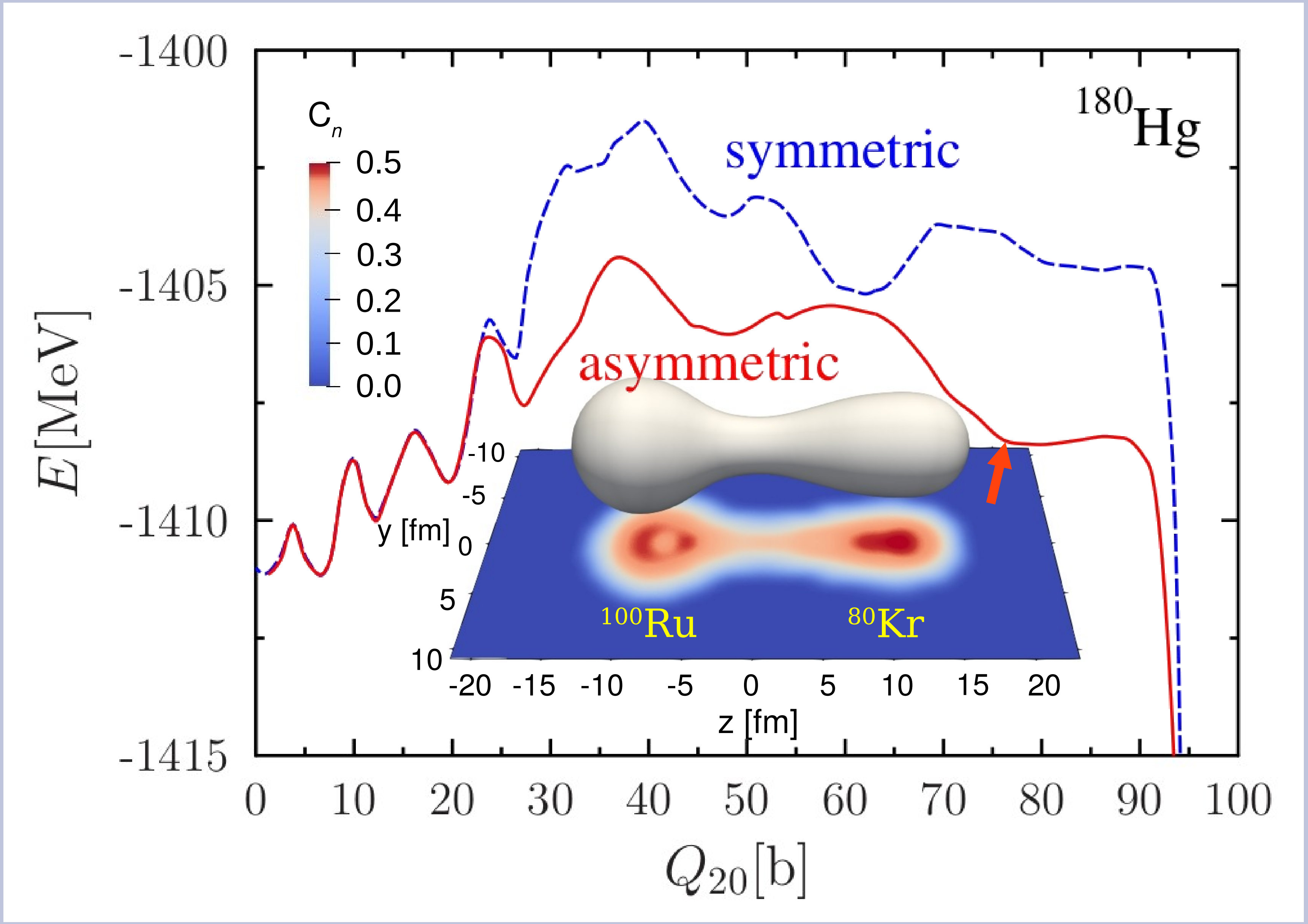
Fission in the mercury region



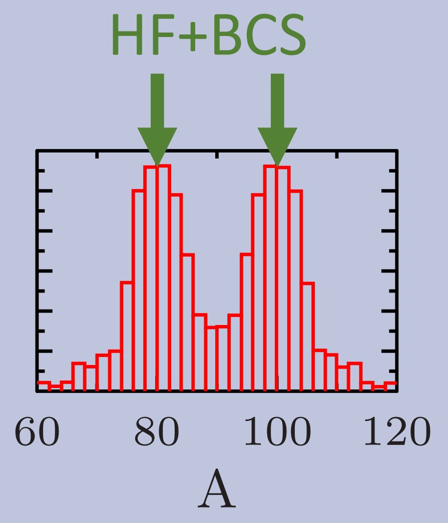
Fission in the mercury region



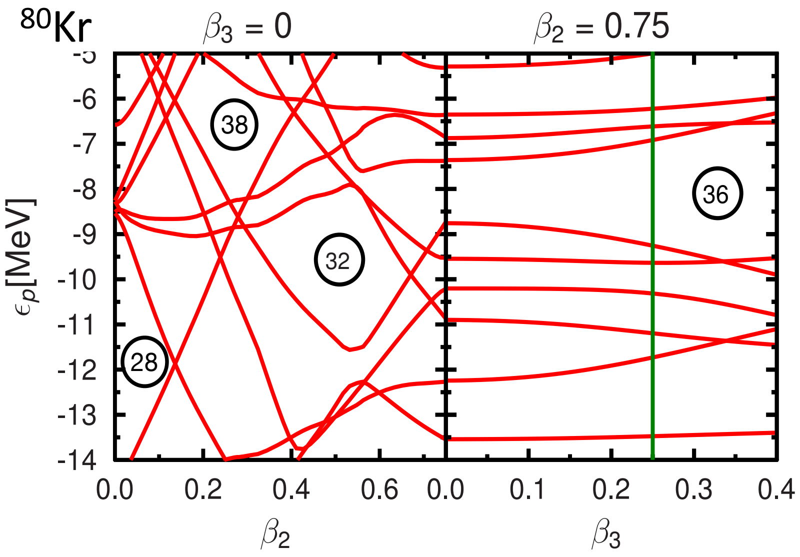
Exp: Andreyev et al., PRL 2011

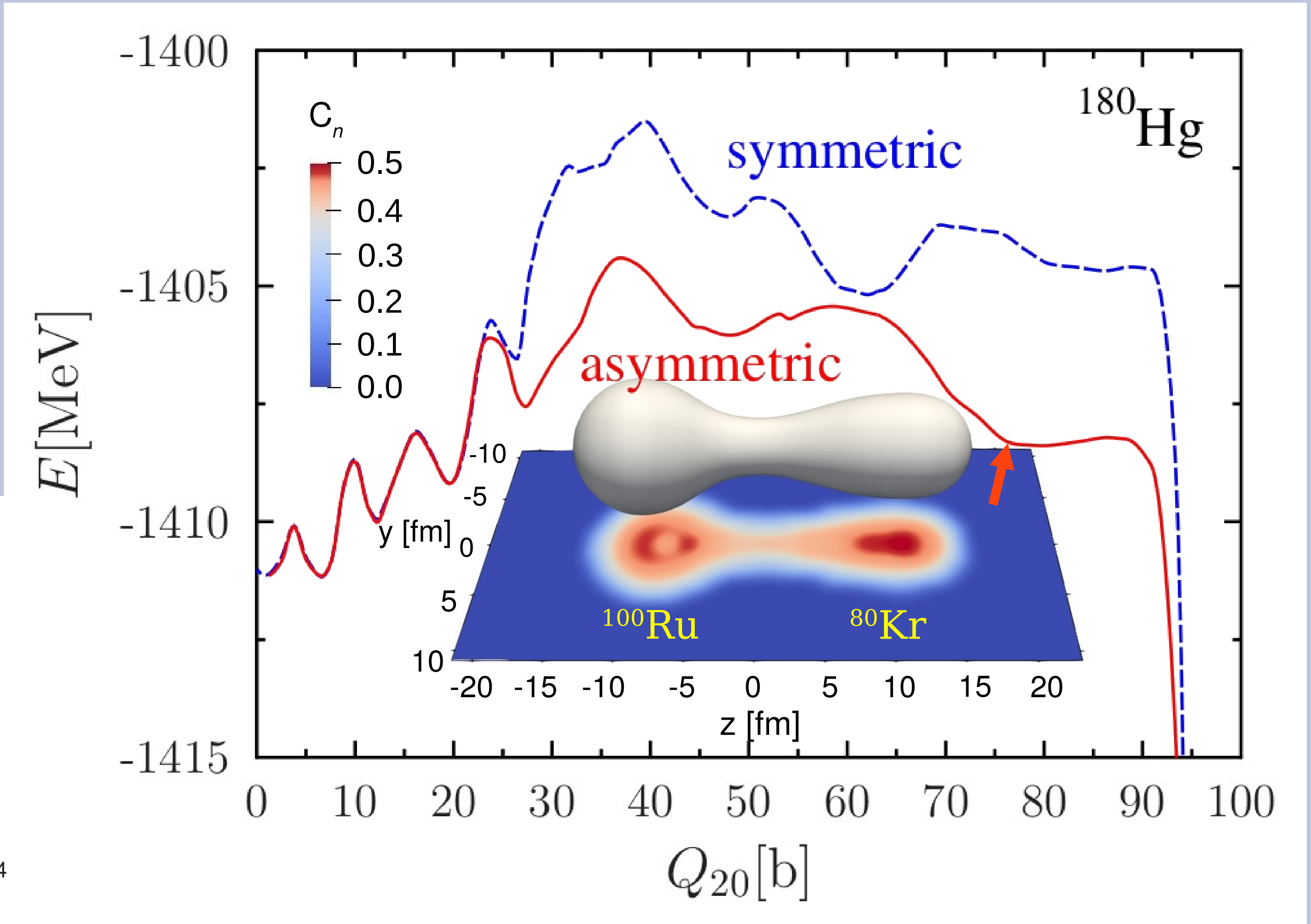


Fission in the mercury region



Exp: Andreyev et al., PRL 2011





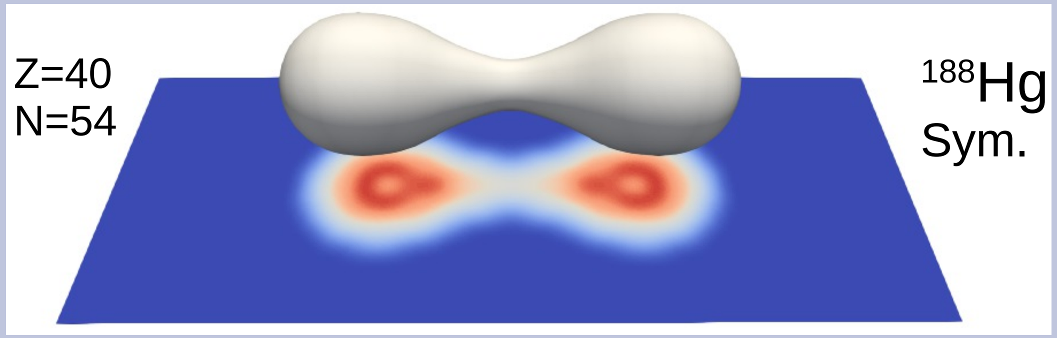
Fission in the mercury region

Asymmetric modes

A	N_H	Z_H	def. H.	N_L	Z_L	def. L.
198	63.1	43.4	Elong.	**54.9**	36.6	**Comp.**
196	62	43.4	Elong.	**54**	36.6	**Comp.**
194	61.7	43.5	Elong.	**52.3**	36.5	**Comp.**
	65	*45.5*	*Elong.*	49	34.5	Elong.
192	60.9	43.5	Elong.	**51.1**	36.5	**Comp.**
	64.5	*45.6*	*Elong.*	47.5	34.4	Elong.
190	58.7	42.7	Elong.	**51.3**	37.3	**Comp.**
	64	*46*	*Elong.*	*46*	34	*Elong.*
188	62	*45.4*	*Elong.*	*46*	34.6	*Elong.*
186	**57.3**	43.2	**Comp.**	48.7	**36.8**	**Elong.**
184	**56.9**	43.5	**Comp.**	47.1	**36.5**	**Elong.**
182	**56.1**	44	**Comp.**	45.9	**36**	**Elong.**
180	**55.8**	44.5	**Comp.**	44.2	**35.5**	**Elong.**
178	**56.1**	46.1	**Comp.**	41.9	33.9	Elong.
176	**55.6**	46.4	**Comp.**	40.4	33.6	Elong.

Fission in the mercury region

In addition to symmetric modes stabilised by N=52-56

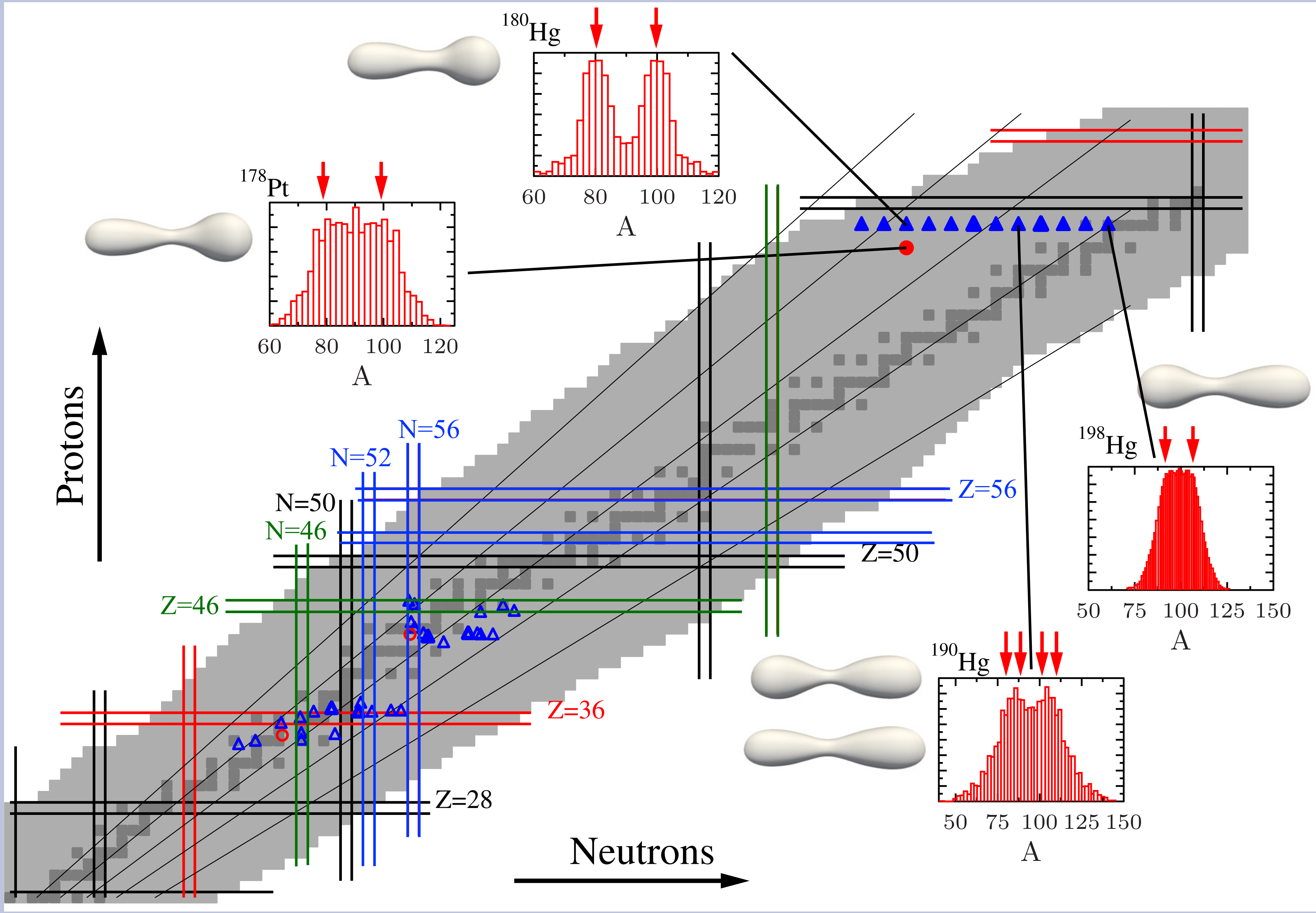


Asymmetric modes

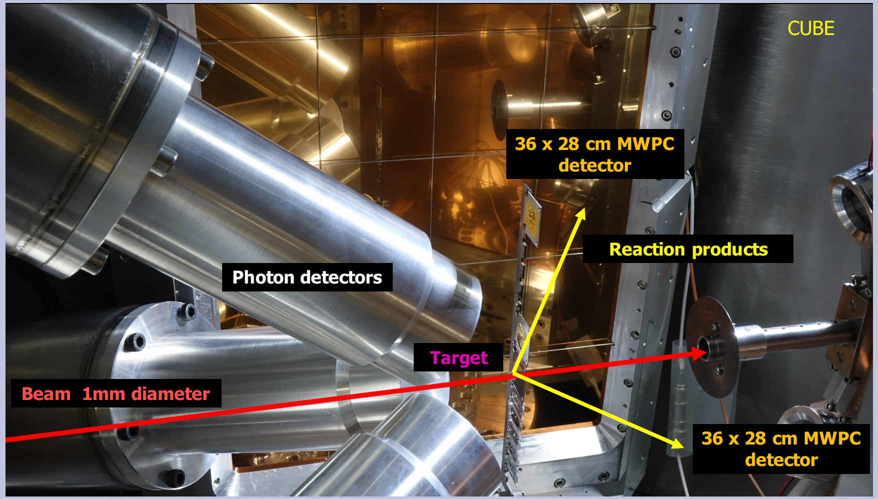
A	N_H	Z_H	def. H.	N_L	Z_L	def. L.
198	63.1	43.4	Elong.	**54.9**	36.6	**Comp.**
196	62	43.4	Elong.	**54**	36.6	**Comp.**
194	61.7	43.5	Elong.	**52.3**	36.5	**Comp.**
	65	*45.5*	*Elong.*	49	34.5	Elong.
192	60.9	43.5	Elong.	**51.1**	36.5	**Comp.**
	64.5	*45.6*	*Elong.*	47.5	34.4	Elong.
190	58.7	42.7	Elong.	**51.3**	37.3	**Comp.**
	64	*46*	*Elong.*	*46*	34	*Elong.*
188	62	*45.4*	*Elong.*	*46*	34.6	*Elong.*
186	**57.3**	43.2	**Comp.**	48.7	**36.8**	**Elong.**
184	**56.9**	43.5	**Comp.**	47.1	**36.5**	**Elong.**
182	**56.1**	44	**Comp.**	45.9	**36**	**Elong.**
180	**55.8**	44.5	**Comp.**	44.2	**35.5**	**Elong.**
178	**56.1**	46.1	**Comp.**	41.9	33.9	Elong.
176	**55.6**	46.4	**Comp.**	40.4	33.6	Elong.

Fission in the mercury region

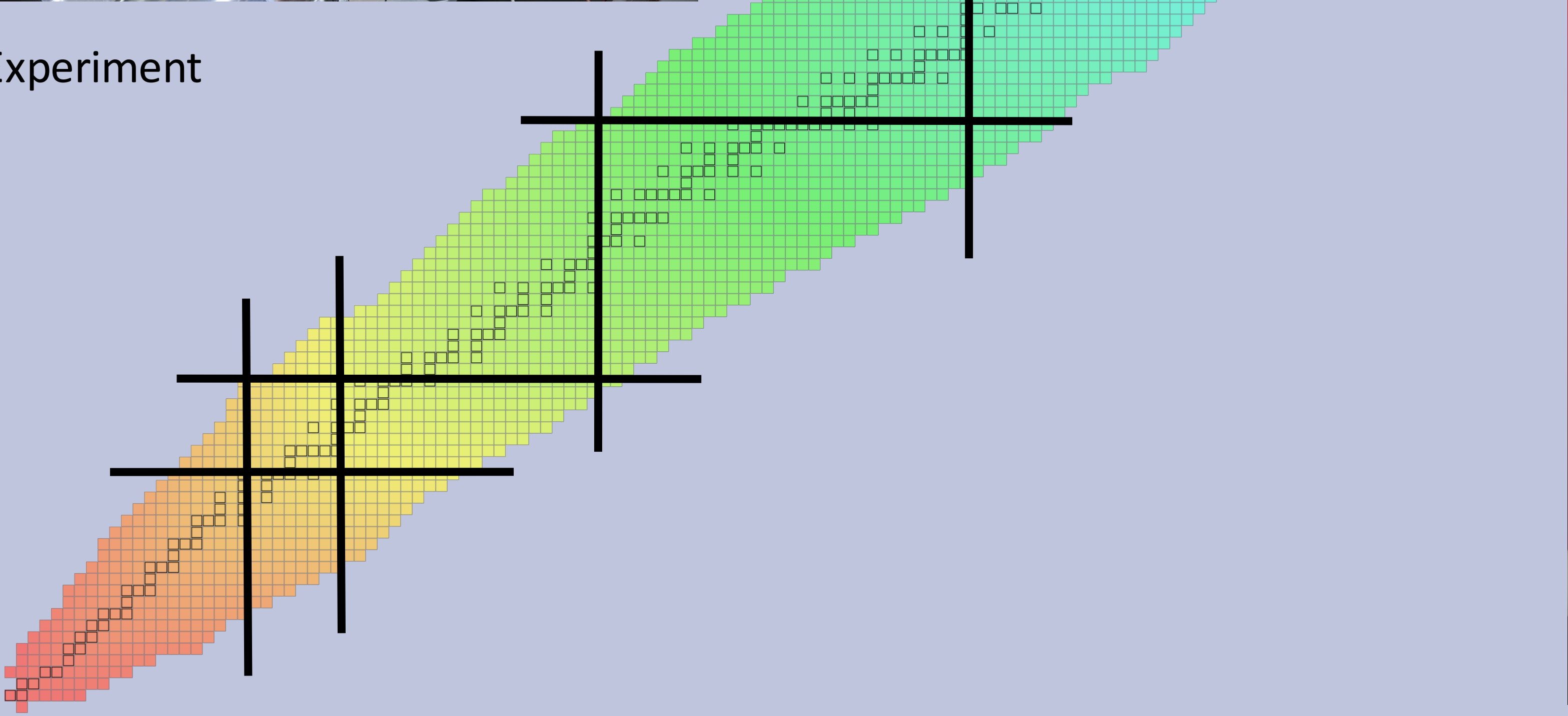
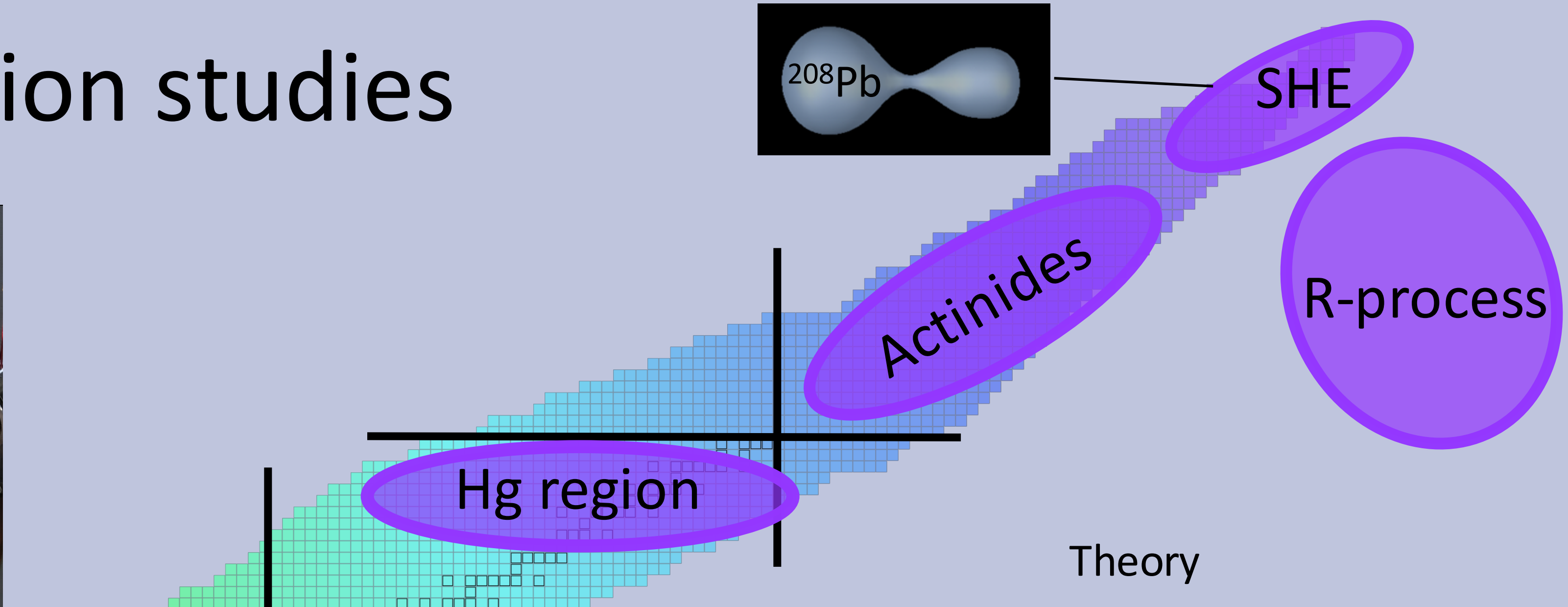
Asymmetric modes



Perspectives for fission studies



Experiment

Theory