Isoscalar Giant Monopole Resonance within QRPA formalism using Gogny force

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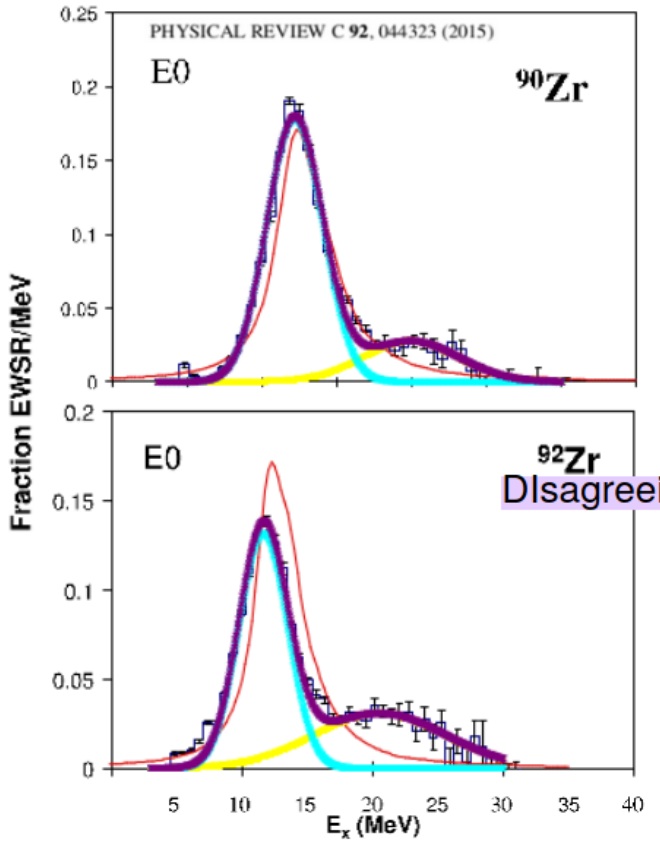
Does QRPA with Gogny force reproduce experimental data in Zr isotopes? Yes... No... And why ?

Texas A & M *Background to substract*



-> 2 bumps vs 1 bump => different m1/m0

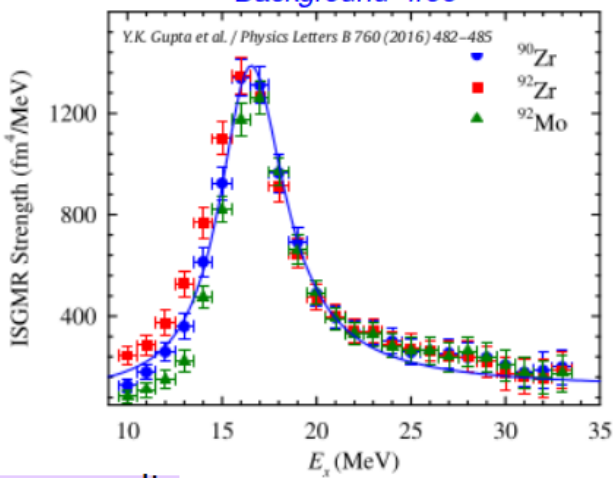
-> Decreasing m1/m0 (against the 80A^{-1/3} law

vs

increasing m1/m0 (as expected)

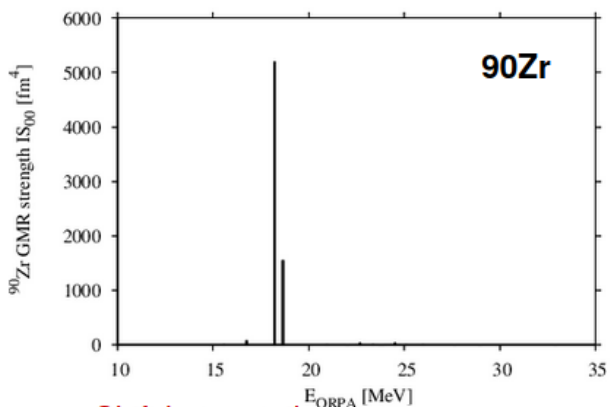
RCNP Osaka

Background "free"



DIsagreeing exp. results

Fig. 4. (Color online.) ISGMR strength distributions for all the three nuclei, ^{90}Zr (blue circles), ^{92}Zr (red squares), and ^{92}Mo (green triangles). The solid line represents the Lorentzian fit for ^{90}Zr.



Shift but no tail

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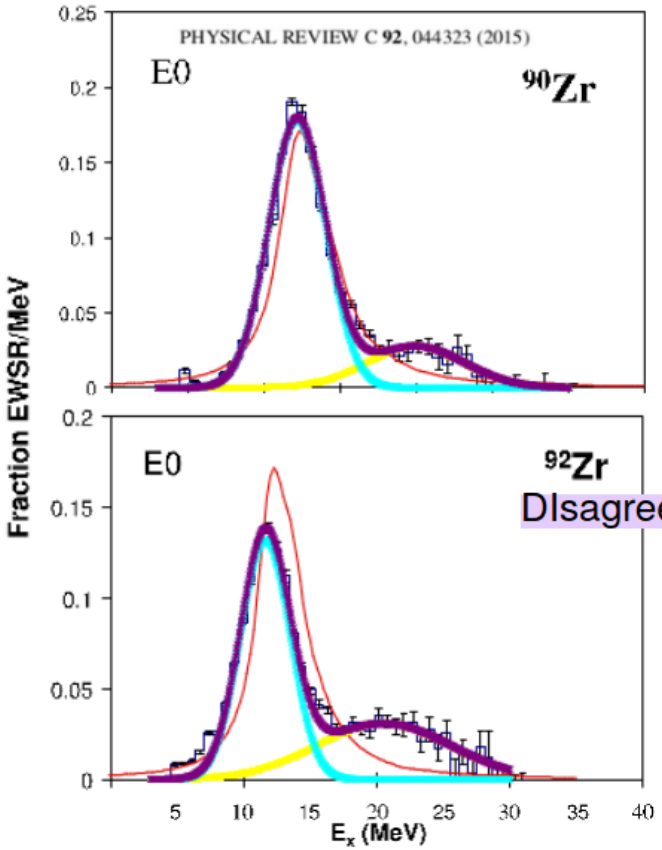

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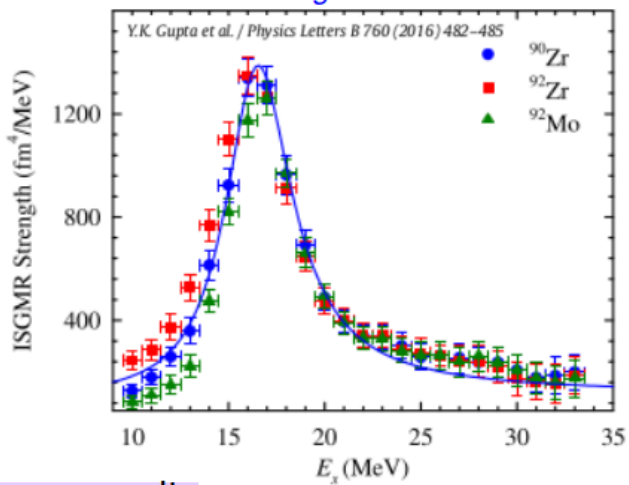

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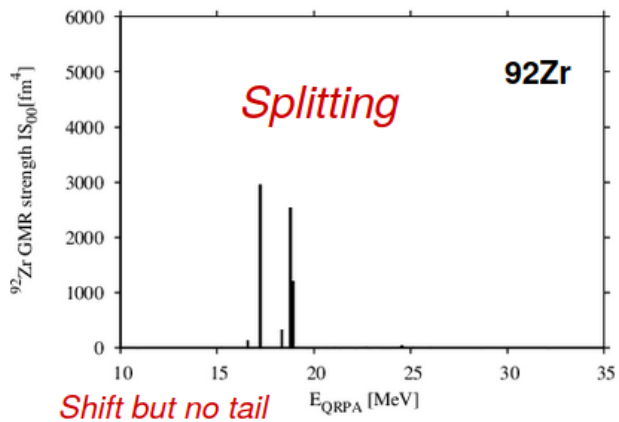

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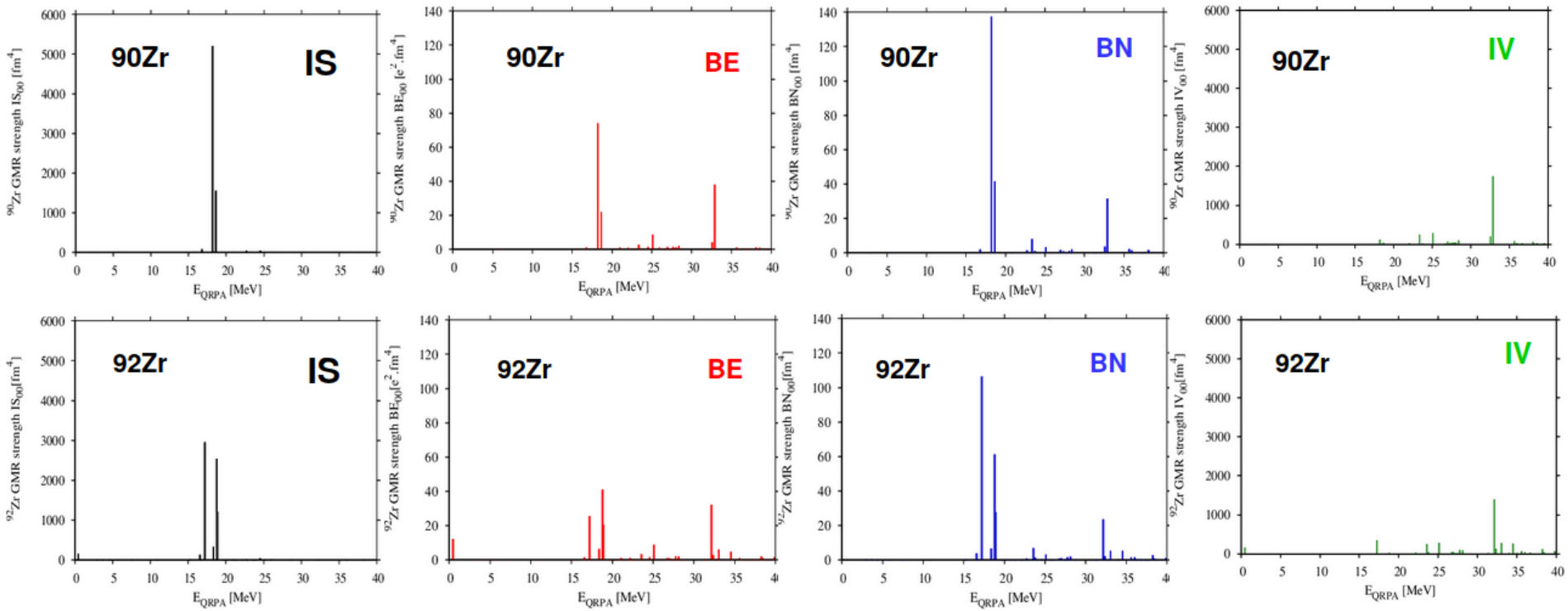
The origin of splitting

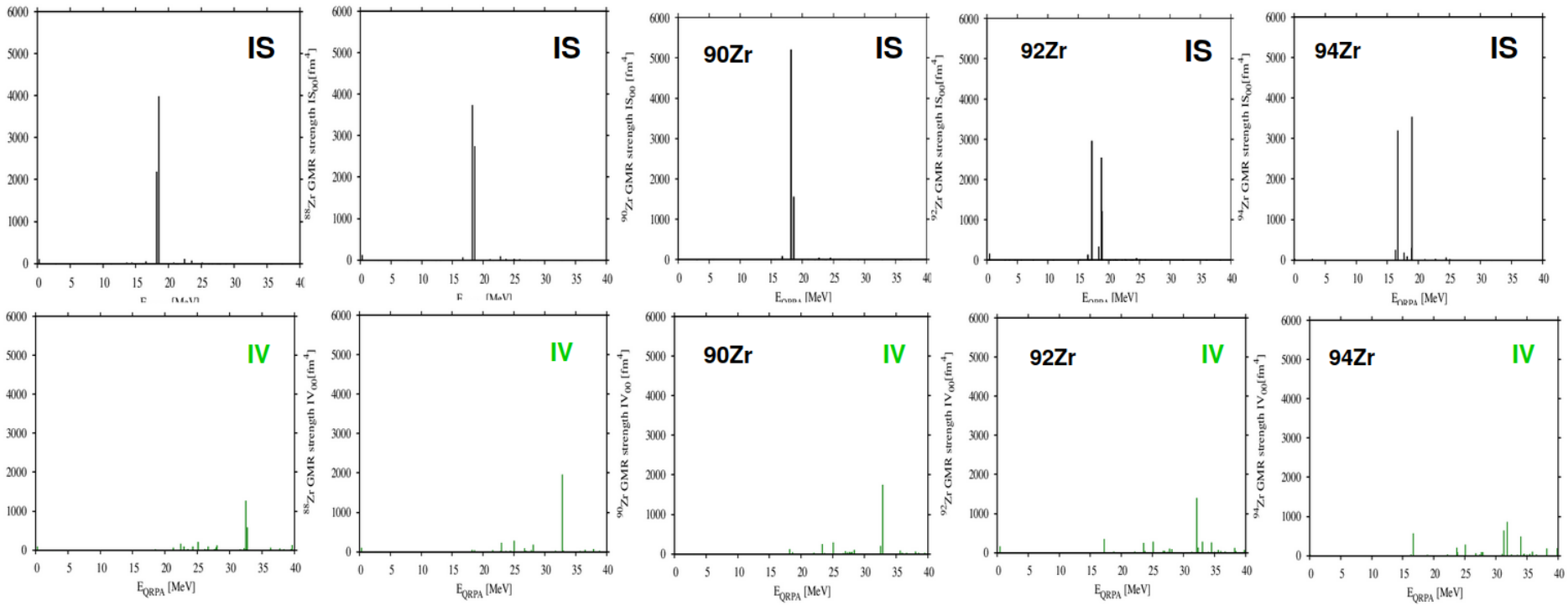


Low Energy range th. [15:20] MeV
Low Energy range exp. [10:20] MeV

High Energy range th. [20:35] MeV
High Energy range exp. [20:35] MeV

- Second main peak at low energies for 92Zr strongly proton
- IS at low energies, IV at high energies

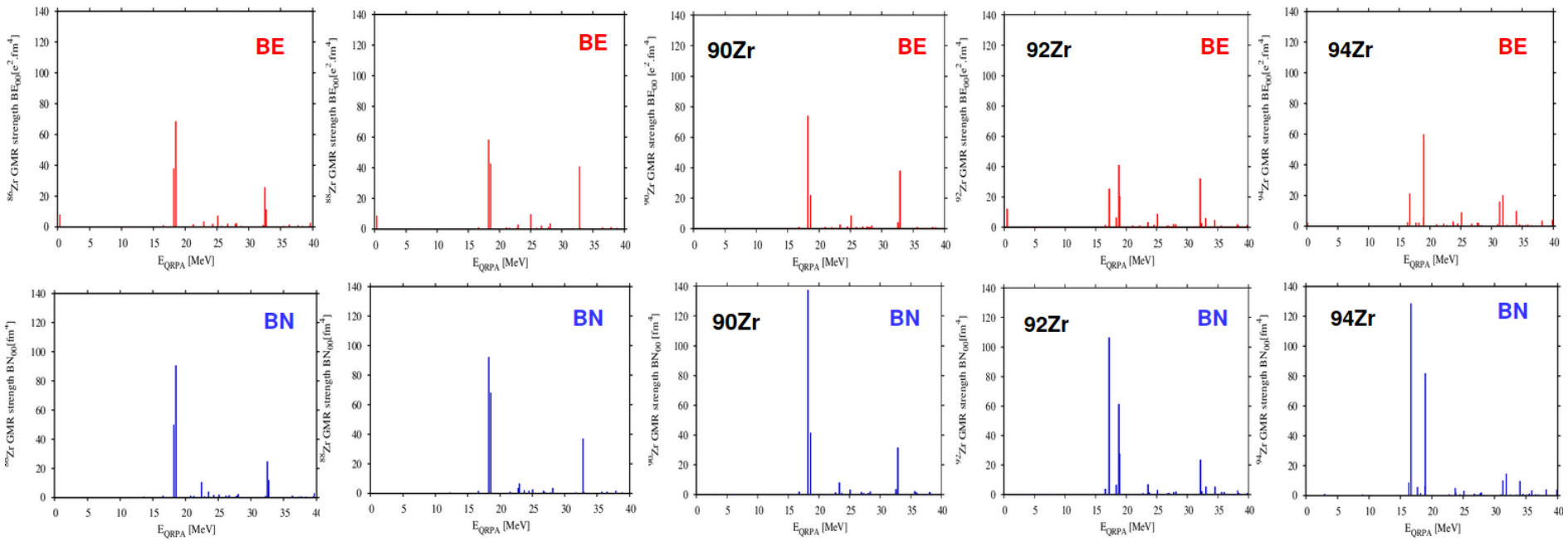
Comparison of IS and IV component along Zr chain: $^{86-88-90-92-94}$Zr



Low Energy range th. [15:20] MeV **High Energy range th. [20:35] MeV**
Low Energy range exp. [10:20] MeV **High Energy range exp. [20:35] MeV**

- Pairing influence splitting AND relative strengths
- IS at low energies, IV at high energies ALWAYS

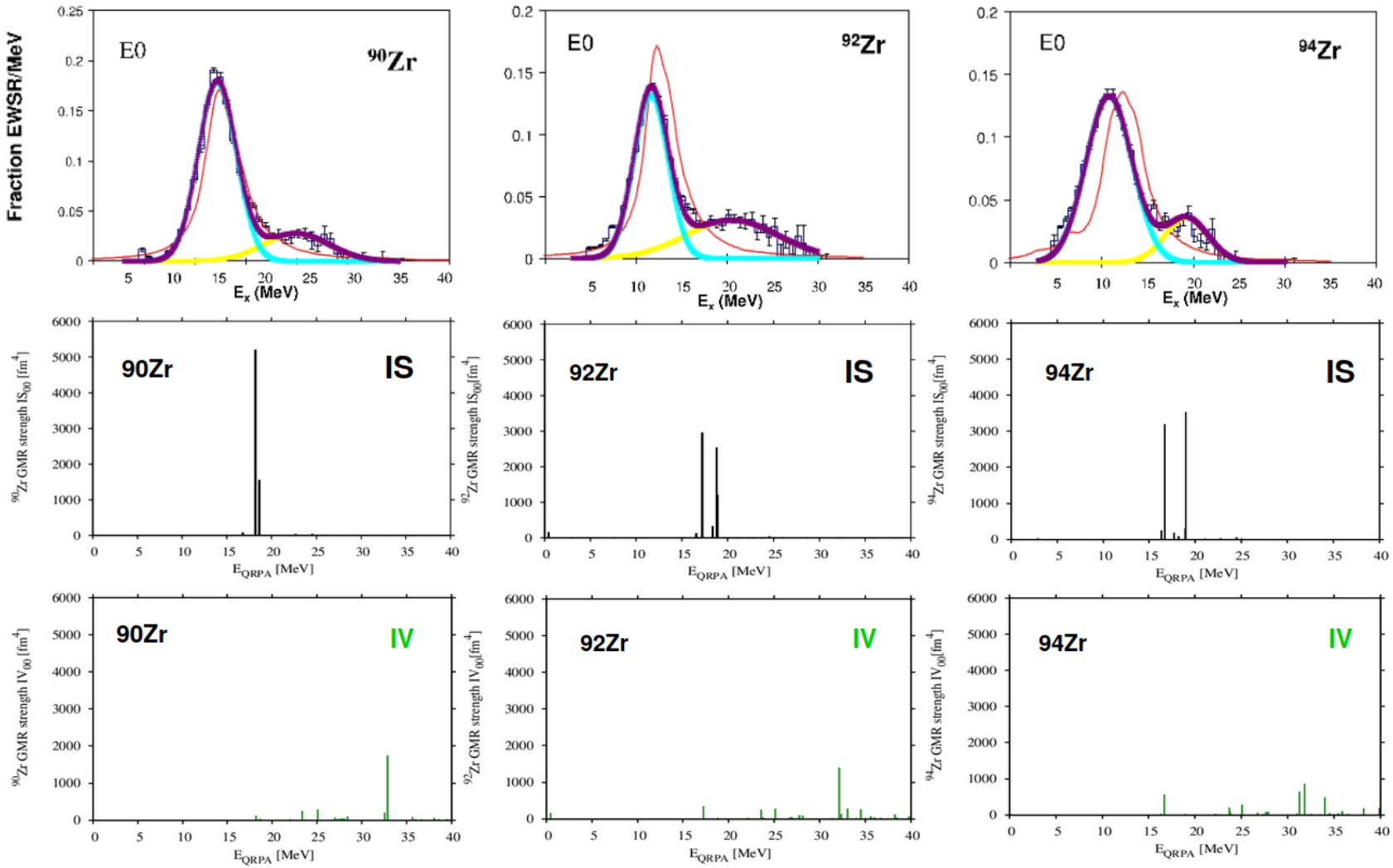
Comparison of BE and BN components along Zr chain: $^{86-88-90-92-94}$Zr



Low Energy range th. [15:20] MeV **High Energy range th. [20:35] MeV**

Low Energy range exp. [10:20] MeV **High Energy range exp. [20:35] MeV**

Comparison of IS and IV components with experimental data



Low Energy range th. [15:20] MeV **High Energy range th. [20:35] MeV**

Low Energy range exp. [10:20] MeV **High Energy range exp. [20:35] MeV**

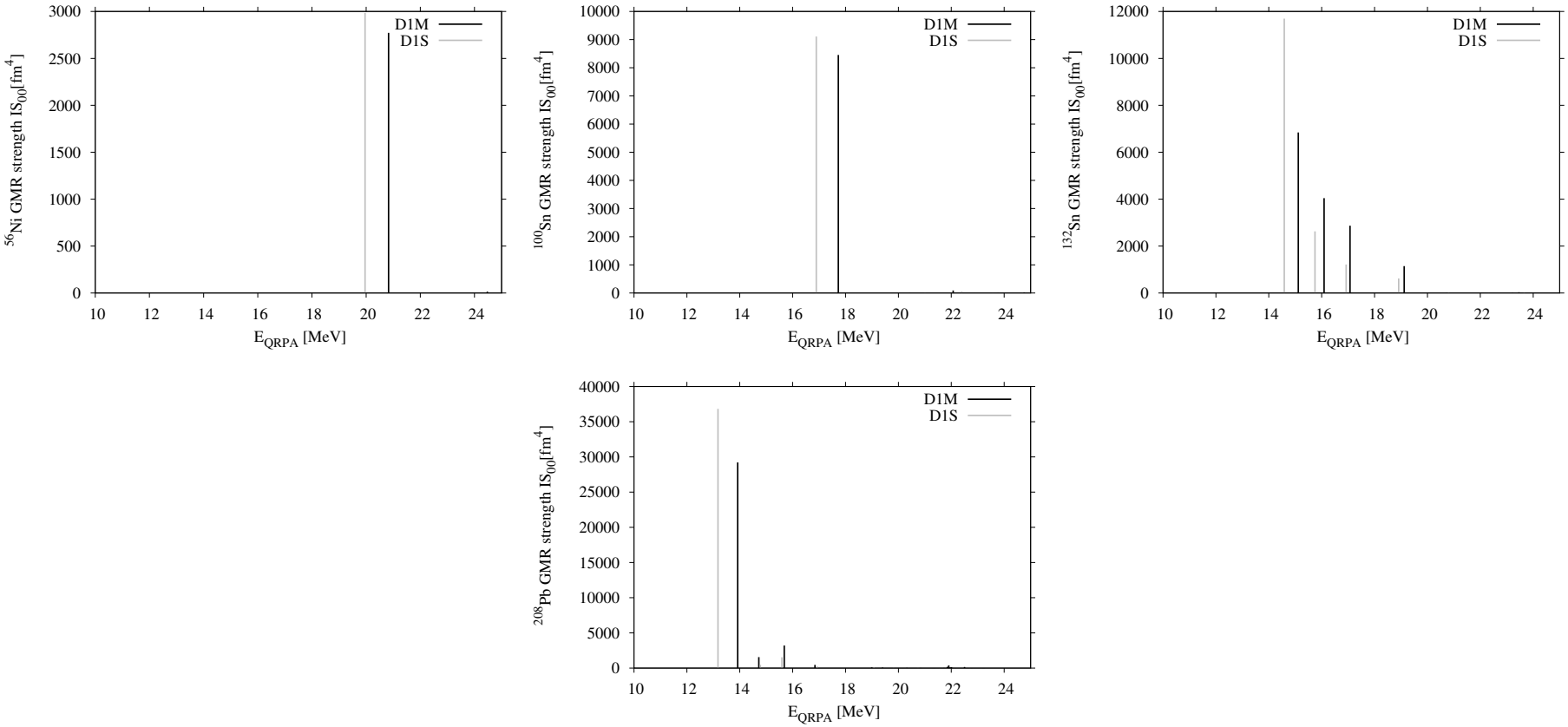
How about other nuclei ?

Nucleus	main peak exp. energy (MeV)	main peak th. energy *(MeV)*	*main peak* % *EWSR* th.	m_1/m_0 exp. (MeV)	m_1/m_0 th. (MeV)
^{56}Ni	19.1 ± 0.5	20.82	97.52	-	20.94
^{58}Ni	18.43 ± 0.15	20.10	74.54	$19.20^{+0.44}_{-0.19}$	20.76
^{60}Ni	17.62 ± 0.15	19.41	59.88	$18.04^{+0.35}_{-0.23}$	20.44
^{90}Zr	16.55 ± 0.08	18.21	73.10	18.13 ± 0.09	18.42
^{92}Zr	16.12 ± 0.04	17.22	37.90	18.05 ± 0.05	18.23
^{112}Sn	16.1 ± 0.1	17.04	77.27	16.2 ± 0.1	17.03
^{204}Pb	13.8 ± 0.1	14.0	91.9	-	14.1
^{206}Pb	13.8 ± 0.1	14.0	85.8	-	14.1
^{208}Pb	13.7 ± 0.1	13.8	84.0	-	14.1

Table: $E0$ experimental and theoretical ISGMR main peak values and related quantities

- D1M main peak $>$ exp. by abt. 1.5 MeV

Influence of the interaction used: D1S vs D1M



- D1S different from D1M by 0.5 to 1 MeV !

$\Rightarrow$ strong influence of the interaction !

Conclusions

- Good reproduction of global ISGMR shape with D1M

- D1M: shift (abt. 1.5 MeV) for ALL nuclei but Pb isotopes (used for fitting)

- D1S: shift (abt. 0.6 MeV) for ALL nuclei

- Need for a new interaction ?