Role Of The Delta Resonance In The Population Of A Four-particle State In The $^{56}Fe \rightarrow {}^{54}Fe$ Reaction

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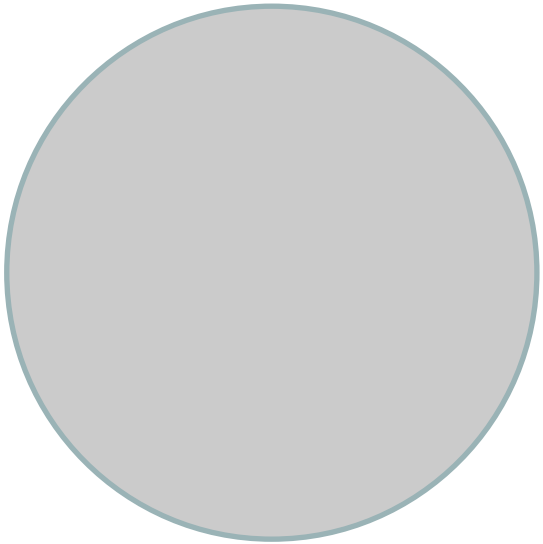
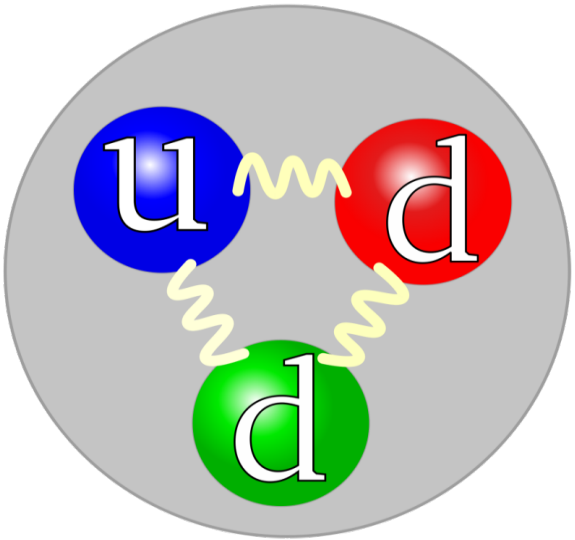


OR



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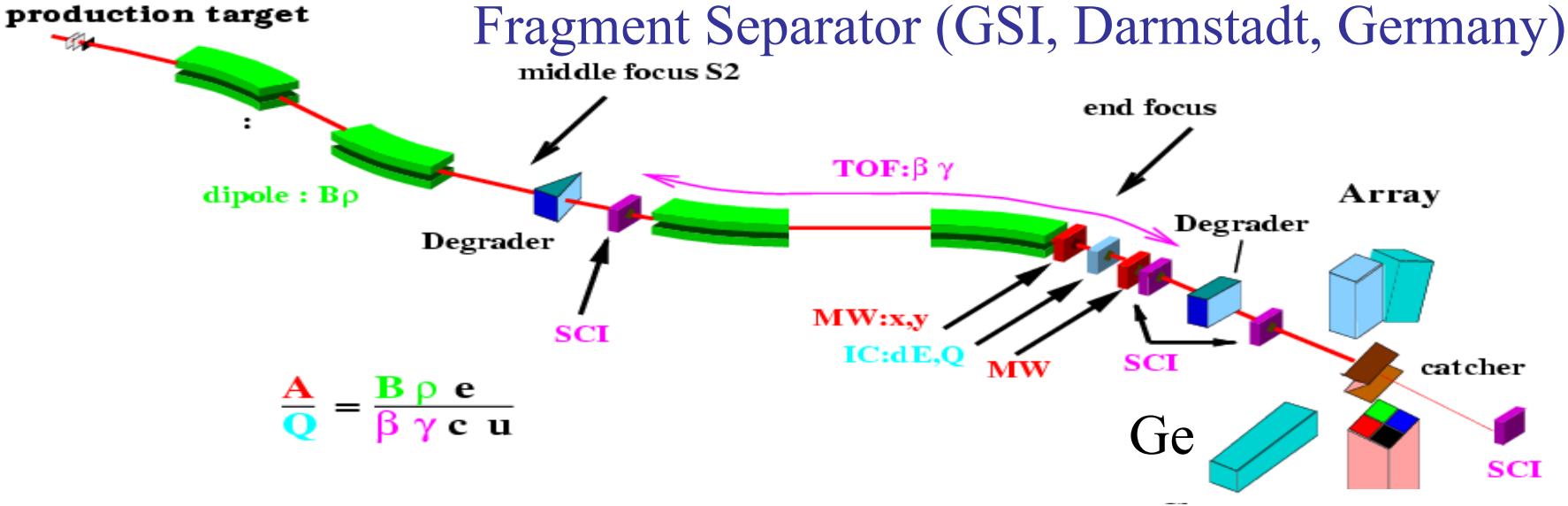
In flight fragmentation: separation and identification

Fragment Separator (GSI, Darmstadt, Germany)



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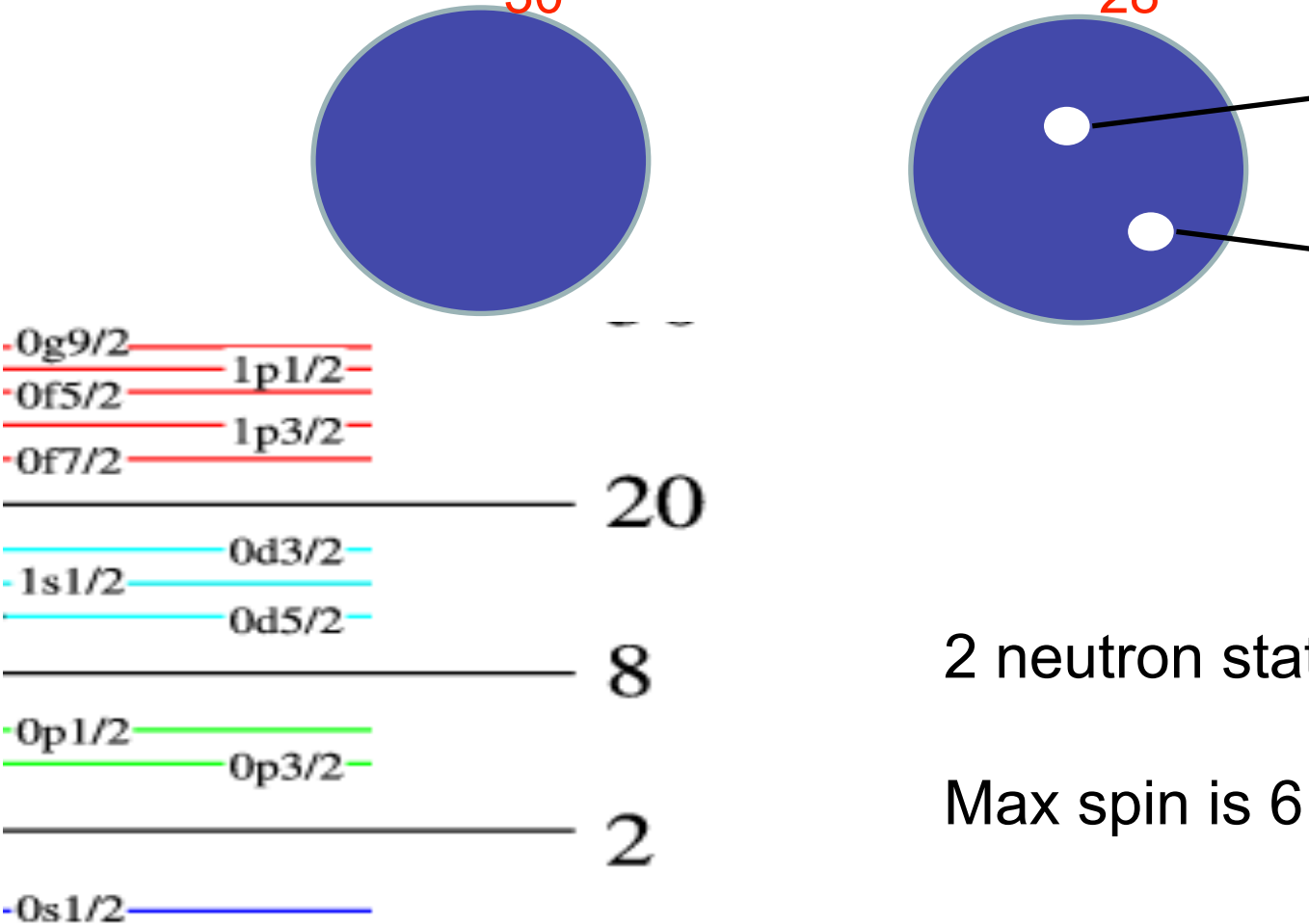
^{56}Fe beam at E/A=500 MeV.

^{54}Fe secondary beam stopped.

Isomeric decay detected with AGATA array.

$^{56}Fe_{30}$ → $^{54}Fe_{28}$ + 2n



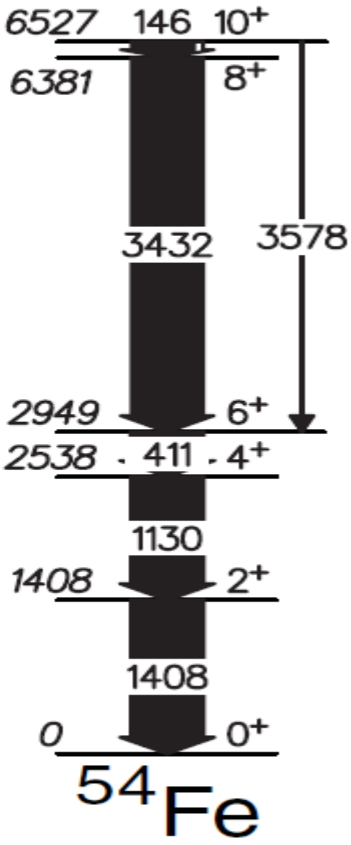
2 neutron states populated

Max spin is 6

10^+ isomer in ^{54}Fe

$T_{1/2}$=364(7) ns

Predominantly $\pi f^{-2}_{7/2}\ \nu f^{-1}_{7/2} p_{3/2}$

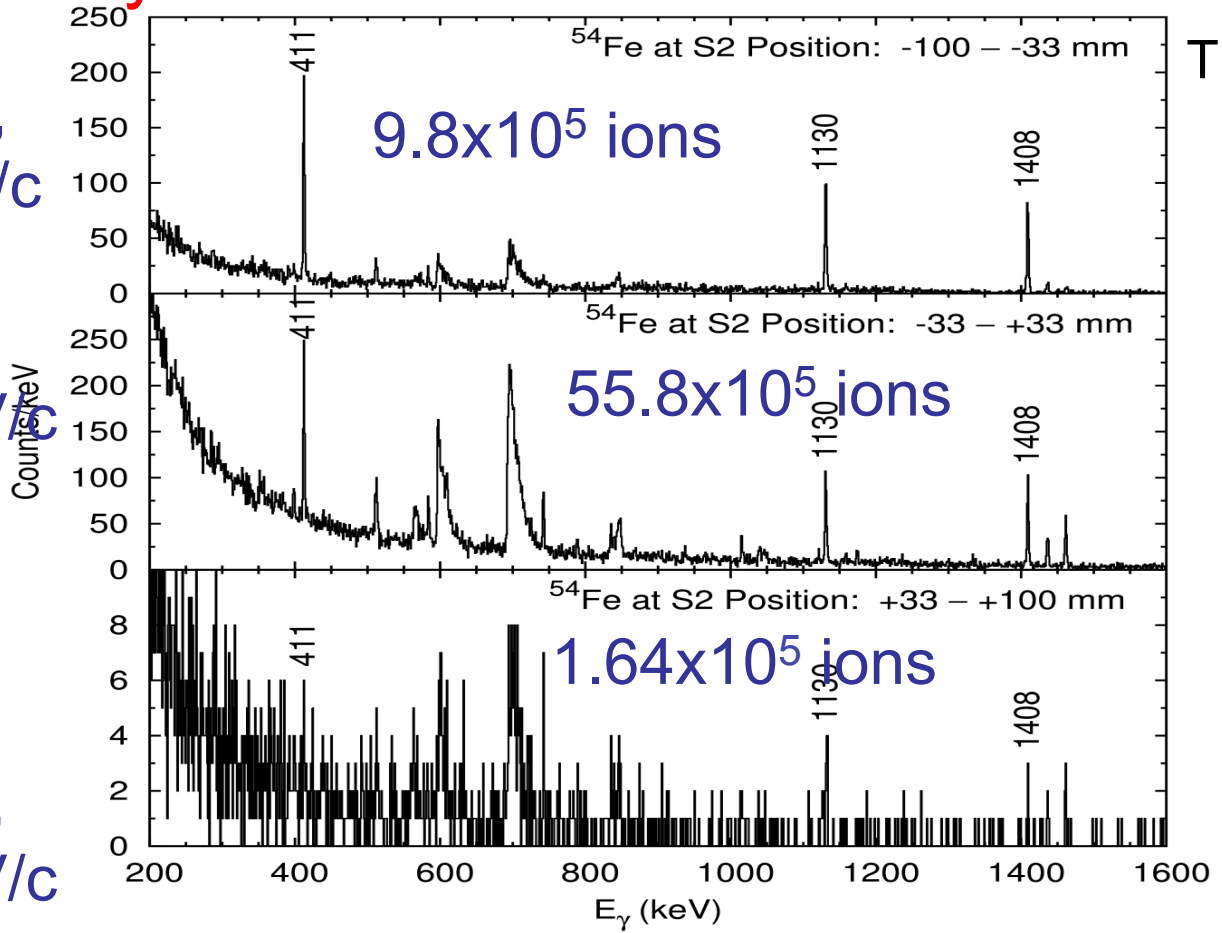


Decay of the $I^{\pi}=10^{+}$ metastable state in ^{54}Fe

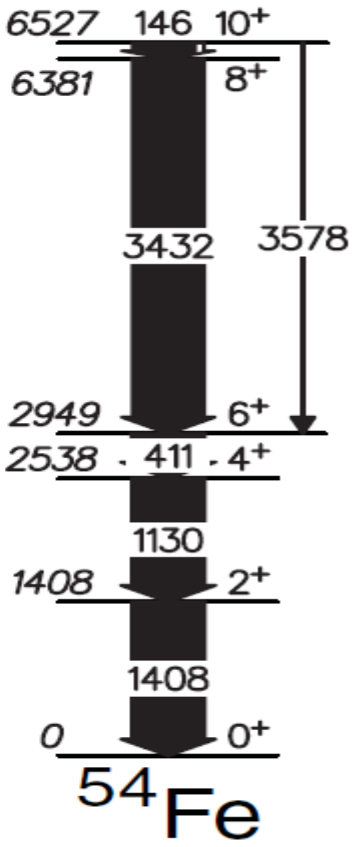
Δp = -750, -247 MeV/c

Δp= -247, +247 MeV/c

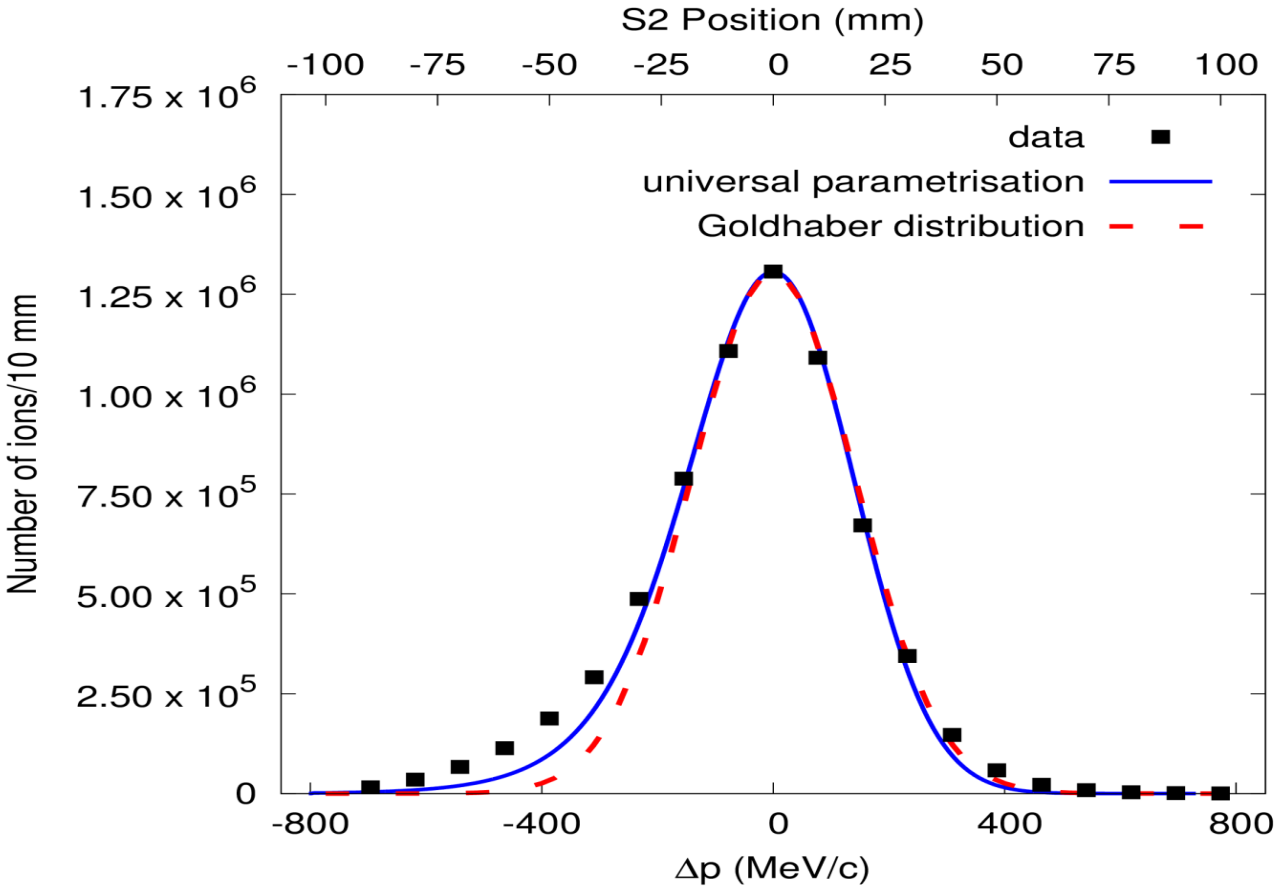
Δp= +247, +750 MeV/c



$T_{1/2}$=364(7) ns

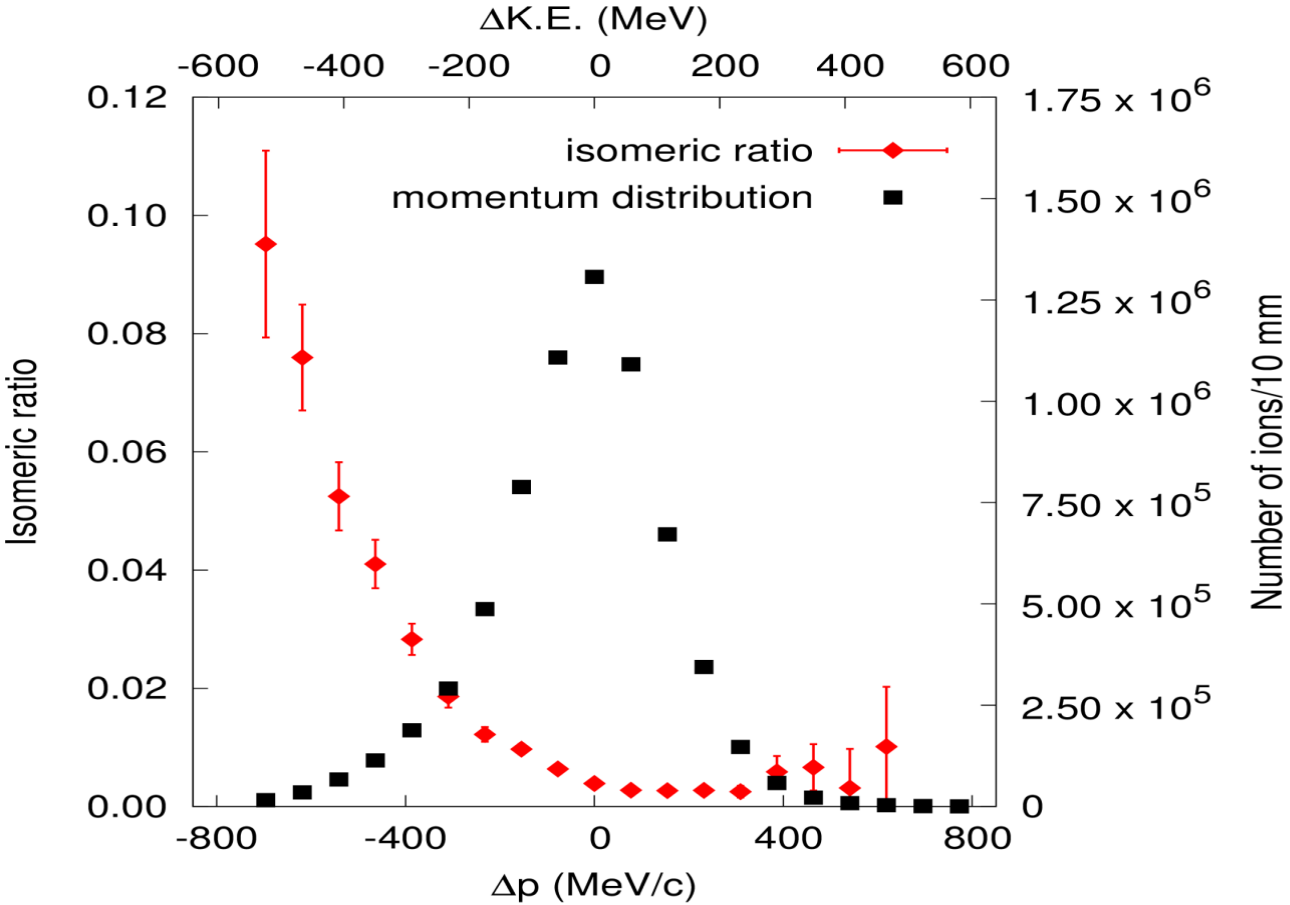


Momentum distribution of ^{54}Fe nuclei

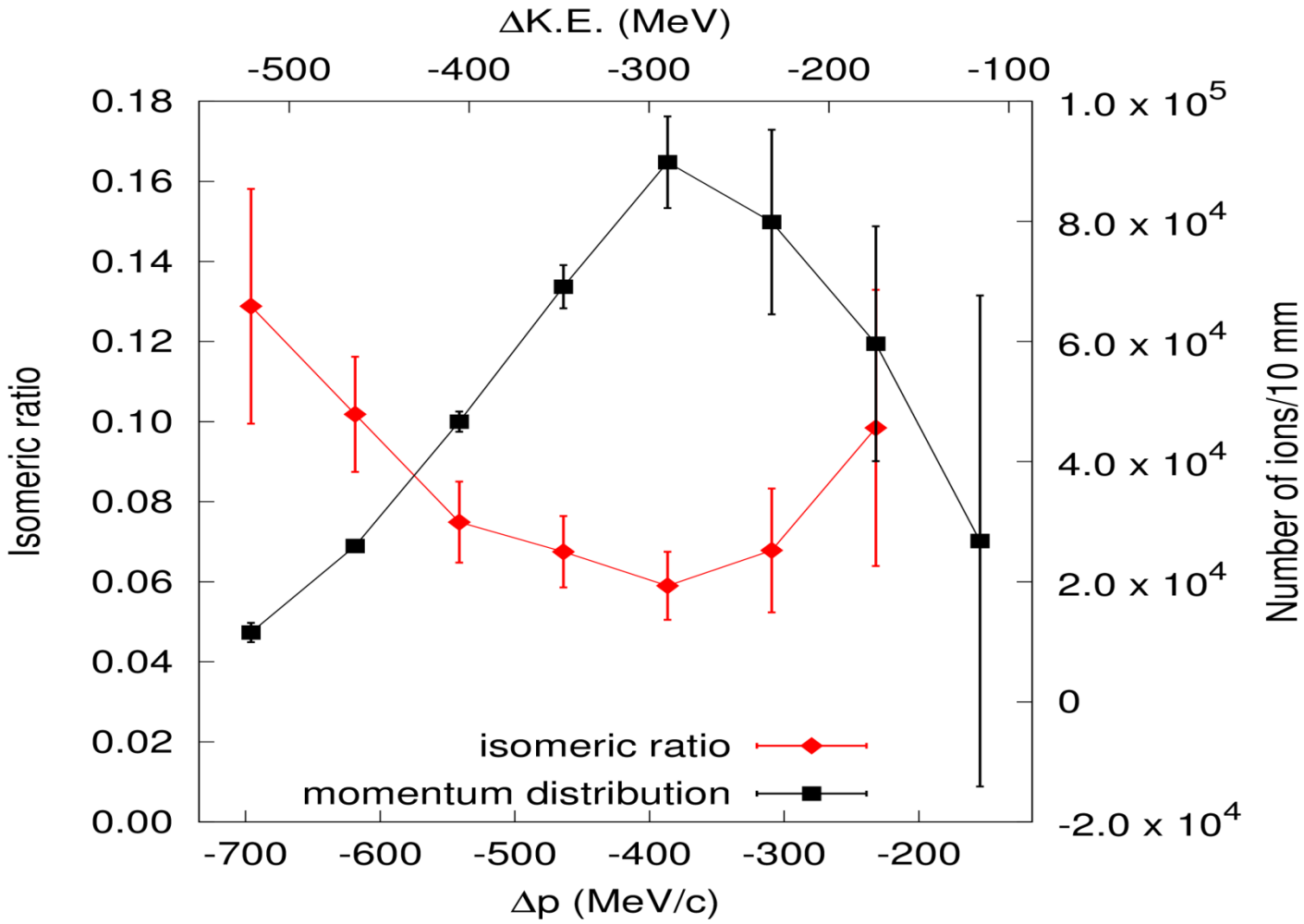


Not symmetric: tail at low momentum

Isomeric ratio of the 10^+ isomer

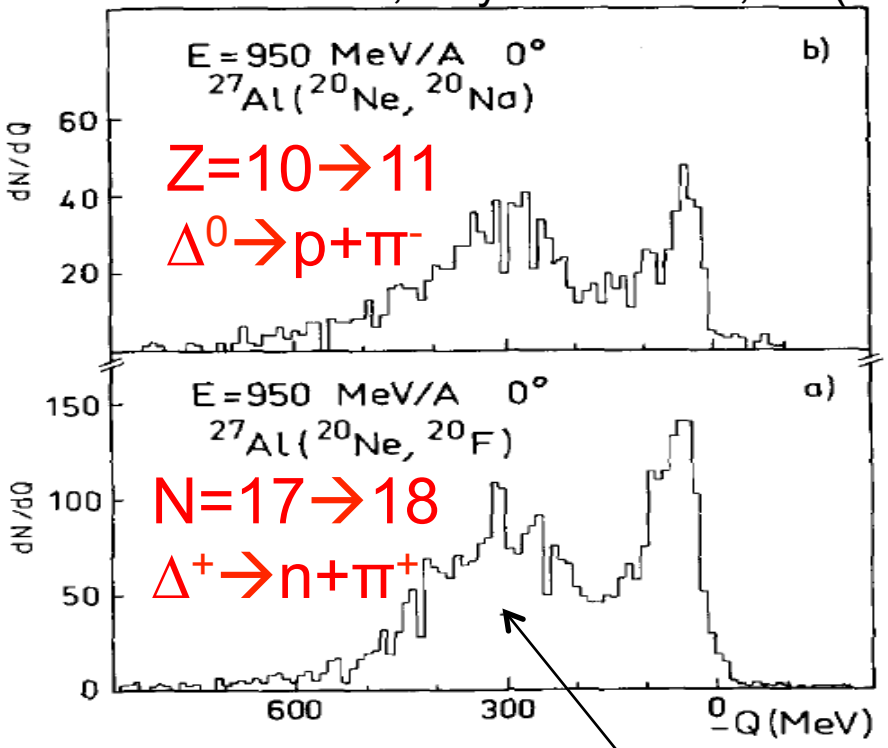


=> the isomer is produced in the low momentum tail


ΔK.E. (MeV)
-500
-400
-300
-200
-100
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Isomeric ratio
1.0 x 10^5
8.0 x 10^4
6.0 x 10^4
4.0 x 10^4
2.0 x 10^4
0
-2.0 x 10^4
Number of ions/10 mm
isomeric ratio
momentum distribution
-700
-600
-500
-400
-300
-200
Δp (MeV/c)

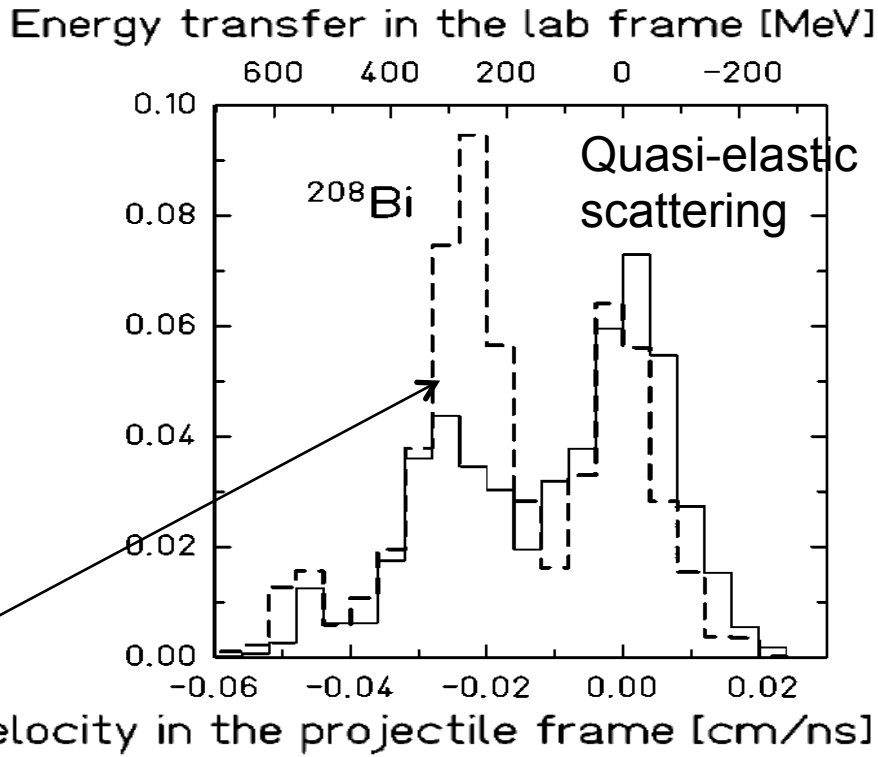
FIRST OBSERVATION OF THE Δ RESONANCE IN RELATIVISTIC HEAVY-ION CHARGE-EXCHANGE REACTIONS

D. Bachelier et al., Phys. Lett. 172, 23 (1986)



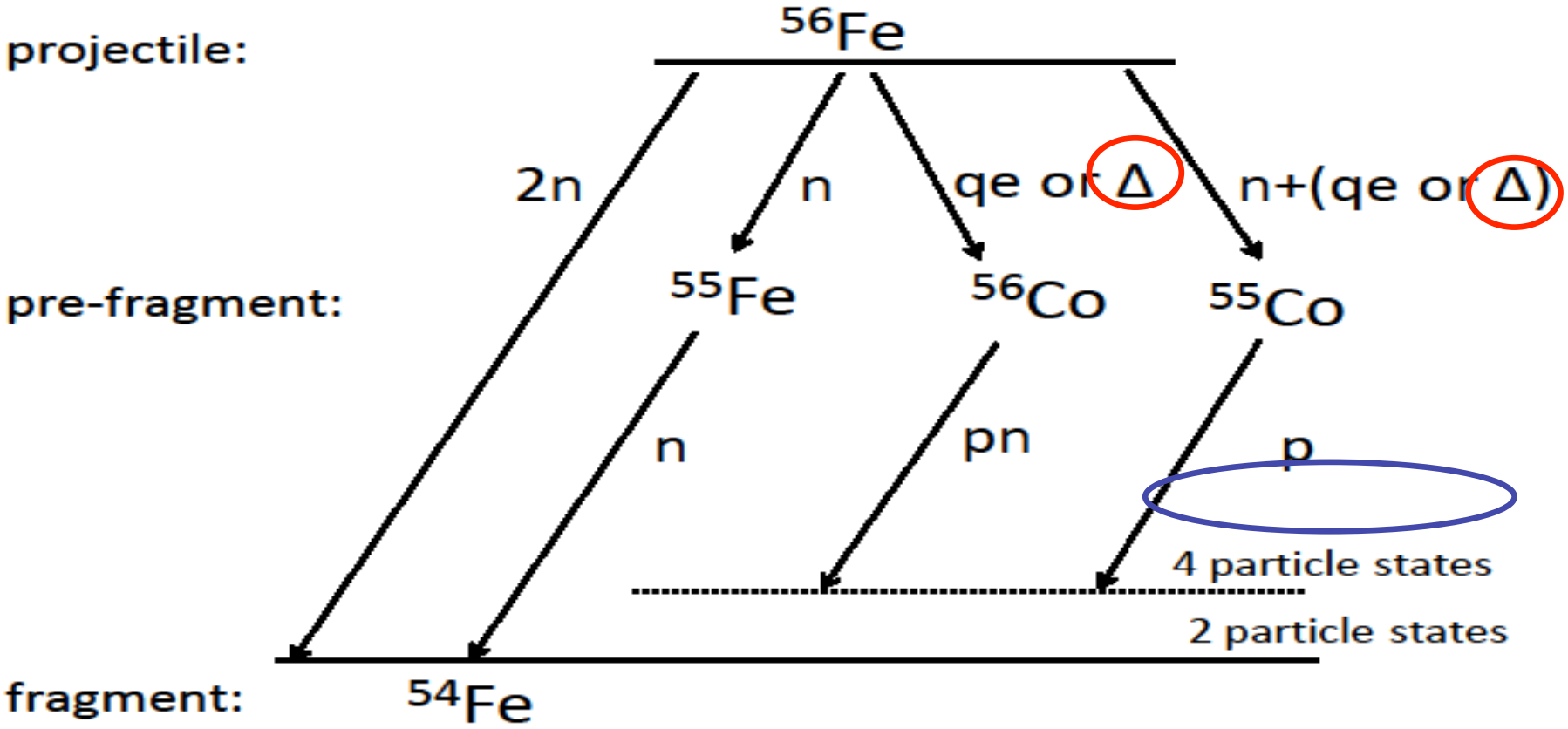
Δ(1232) resonance excitation

208Pb+H
--208Pb+Ti



A. Kelic et al., Phys. Rev. C 70, 064608 (2004)

$^{56}Fe \rightarrow {}^{54}Fe$



qe=quasielastic

If Δ => kinetic energy/momentum shift

Conclusions

The 10^+ isomer in ^{54}Fe populated from ^{56}Fe at E/A=500 MeV
The 10^+ state is a four particle state
10^+ populated mainly at negative momentum transfer

=> It is populated via the Δ resonance

Role of the Δ resonance in the population of a four-nucleon state in the ^{56}Fe $\rightarrow$ ^{54}Fe reaction at relativistic energies

Zs. Podolyák,[1] C.M. Shand,[1] N. Lalović,[2,3] J. Gerl,[3] D. Rudolph,[2] T. Alexander,[1] P. Boutachkov,[3] M.L. Cortés,[3,4] M. Górska,[3] I. Kojouharov,[3] N. Kurz,[3] C. Louchart,[4] E. Merchán,[4] C. Michelagnoli,[5] R.M. Pérez-Vidal,[6] S. Pietri,[3] D. Ralet,[4,3] M. Reese,[4] H. Schaffner,[3] Ch. Stahl,[4] H. Weick,[3] F. Ameil,[3] G. de Angelis,[7] T. Arici,[3,8] R. Carroll,[1] Zs. Dombrádi,[9] A. Gadea,[6] P. Golubev,[2] M. Lettmann,[4] C. Lizarazo,[4,3] J. Mahboub,[10] H. Pai,[4] Z. Patel,[1] N. Pietralla,[4] P.H. Regan,[1] L.G. Sarmiento,[2] O. Wieland,[11] E. Wilson,[1] B. Birkenbach,[12] B. Bruyneel,[13] I. Burrows,[14] L. Charles,[15] E. Clément,[5] F. C. L. Crespi,[16,11] D.M. Cullen,[17] P. Désesquelles,[18] J. Eberth,[12] V. González,[19] T. Habermann,[4,3] L. Harkness-Brennan,[20] H. Hess,[12] D.S. Judson,[20] A. Jungclaus,[21] W. Korten,[13] M. Labiche,[14] A. Maj,[22] D. Mengoni,[23,24] D. R. Napoli,[7] A. Pullia,[16,11] B. Quintana,[25] G. Rainovski,[26] P. Reiter,[12] M.D. Salsac,[13] E. Sanchis,[19] and J.J. Valiente Dóbon[7]

PRESPEC-AGATA campaign

Thanks

END

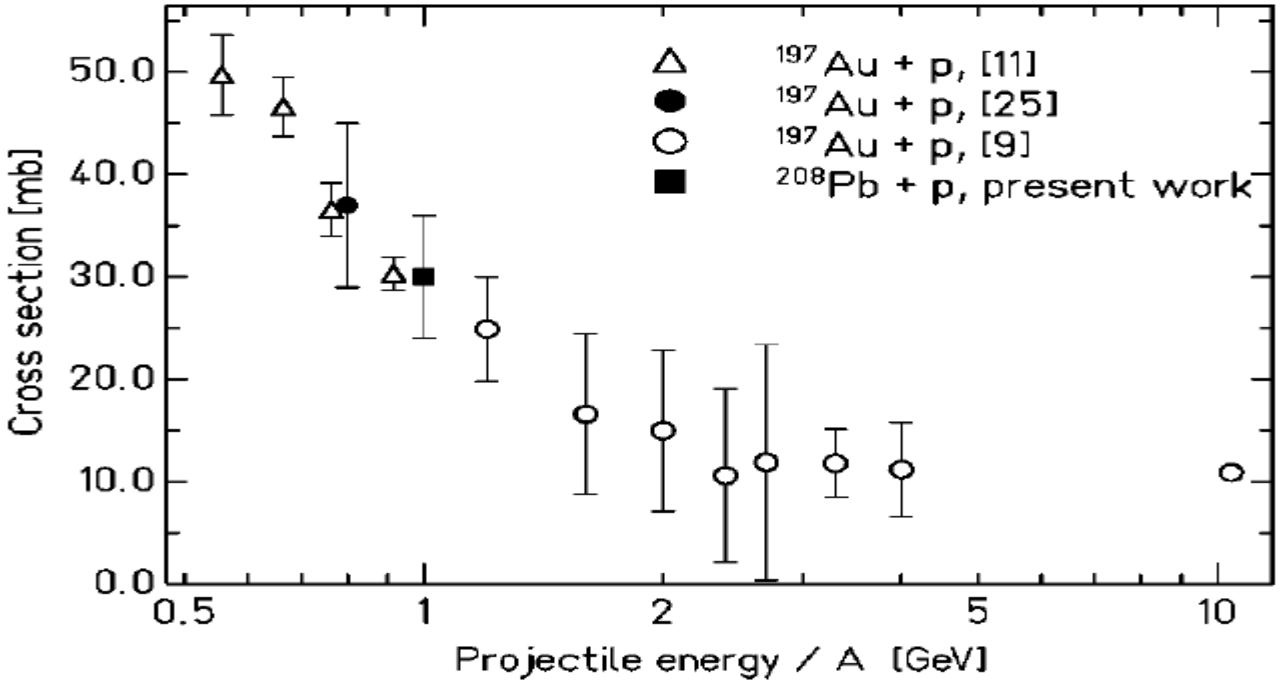
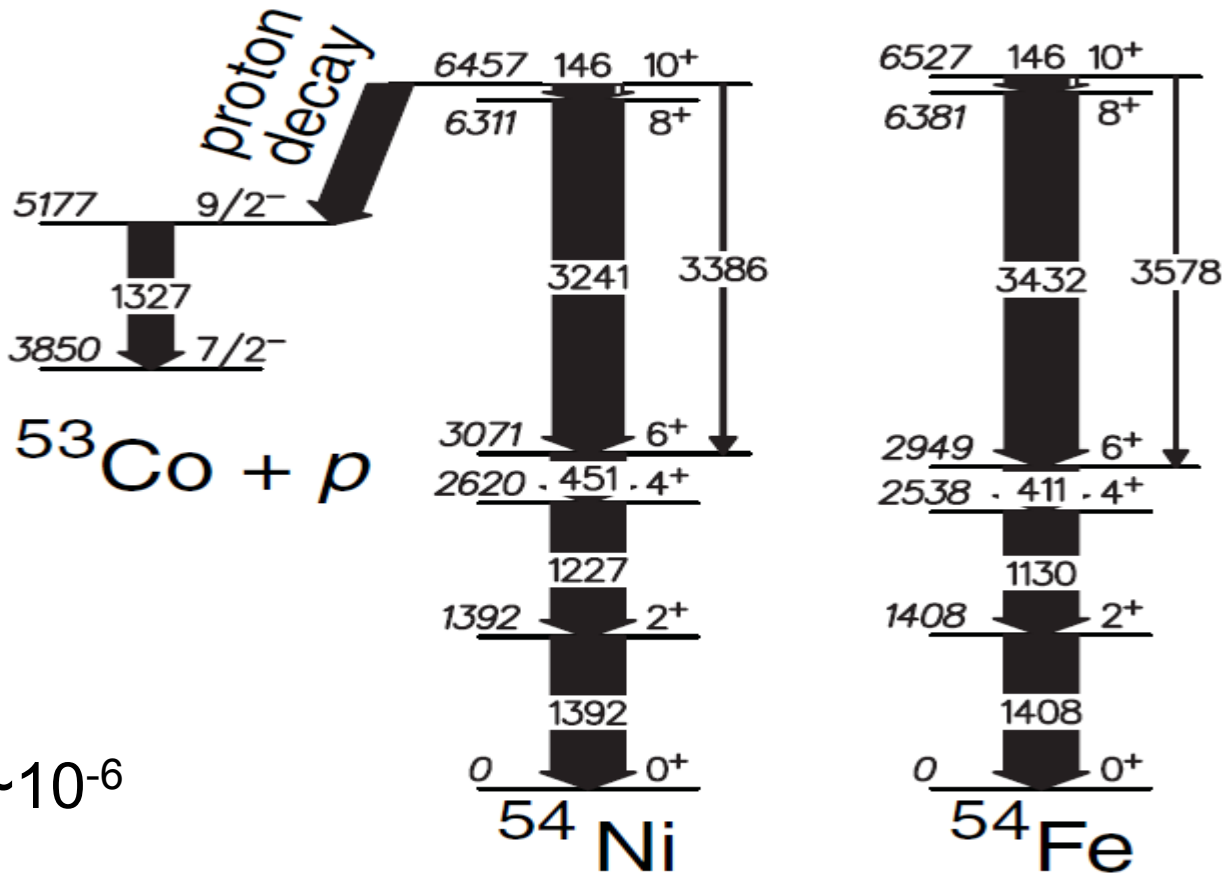


FIG. 8. Total charge-pickup cross section as a function of the projectile energy per nucleon: open triangles, ^{197}Au+^{1}H [11]; full dot, ^{197}Au+^{1}H [25]; full square, ^{208}Pb+^{1}H from the present work; and open dots, ^{197}Au+^{1}H [9]. The data from Refs. [9,11] were extracted from measurements performed with CH_2 and C targets.

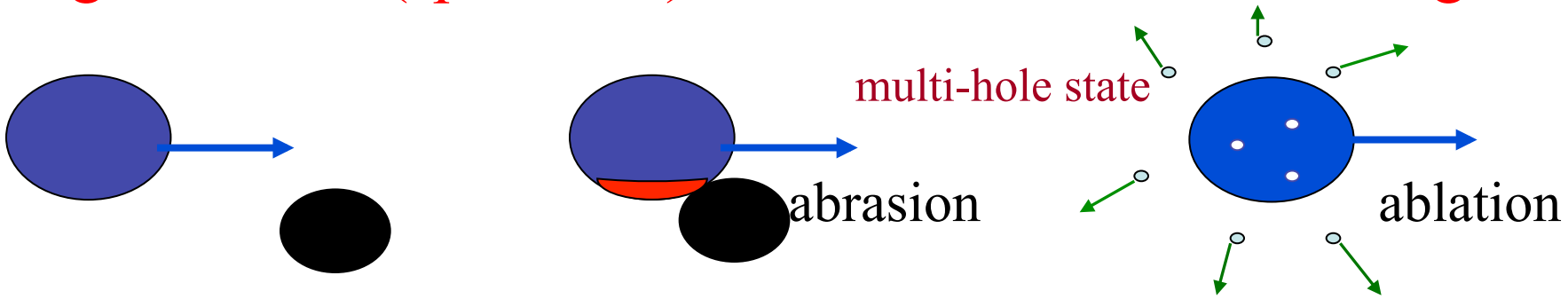
l=5 proton decay

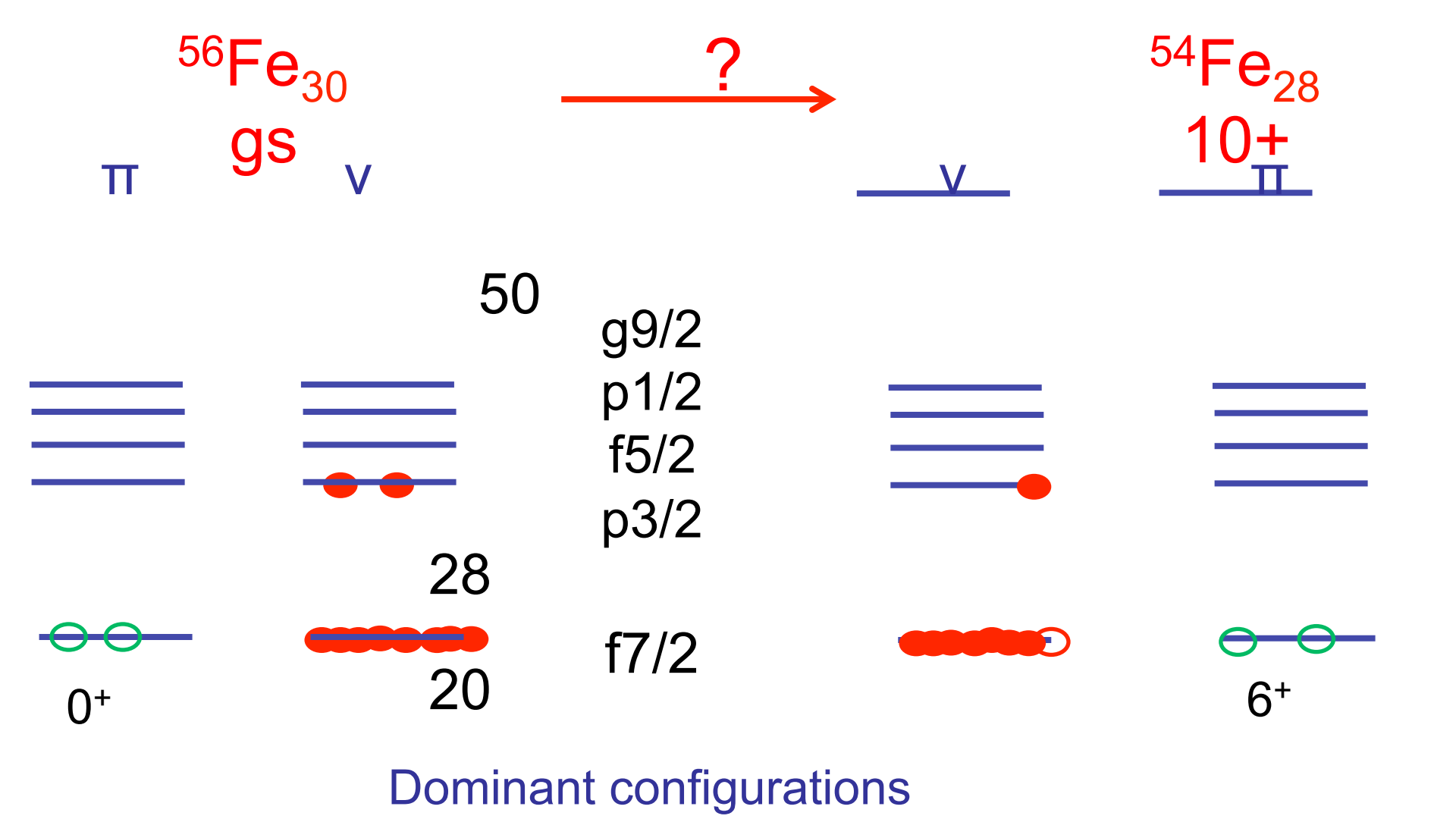
$h^2_{11/2}$ component ~10^{-6}



D. Rudolph *et al.*, Phys. Rev. C78, 021301(R) (2008).

Fragmentation (spallation) reactions at relativistic energies





Dominant configurations