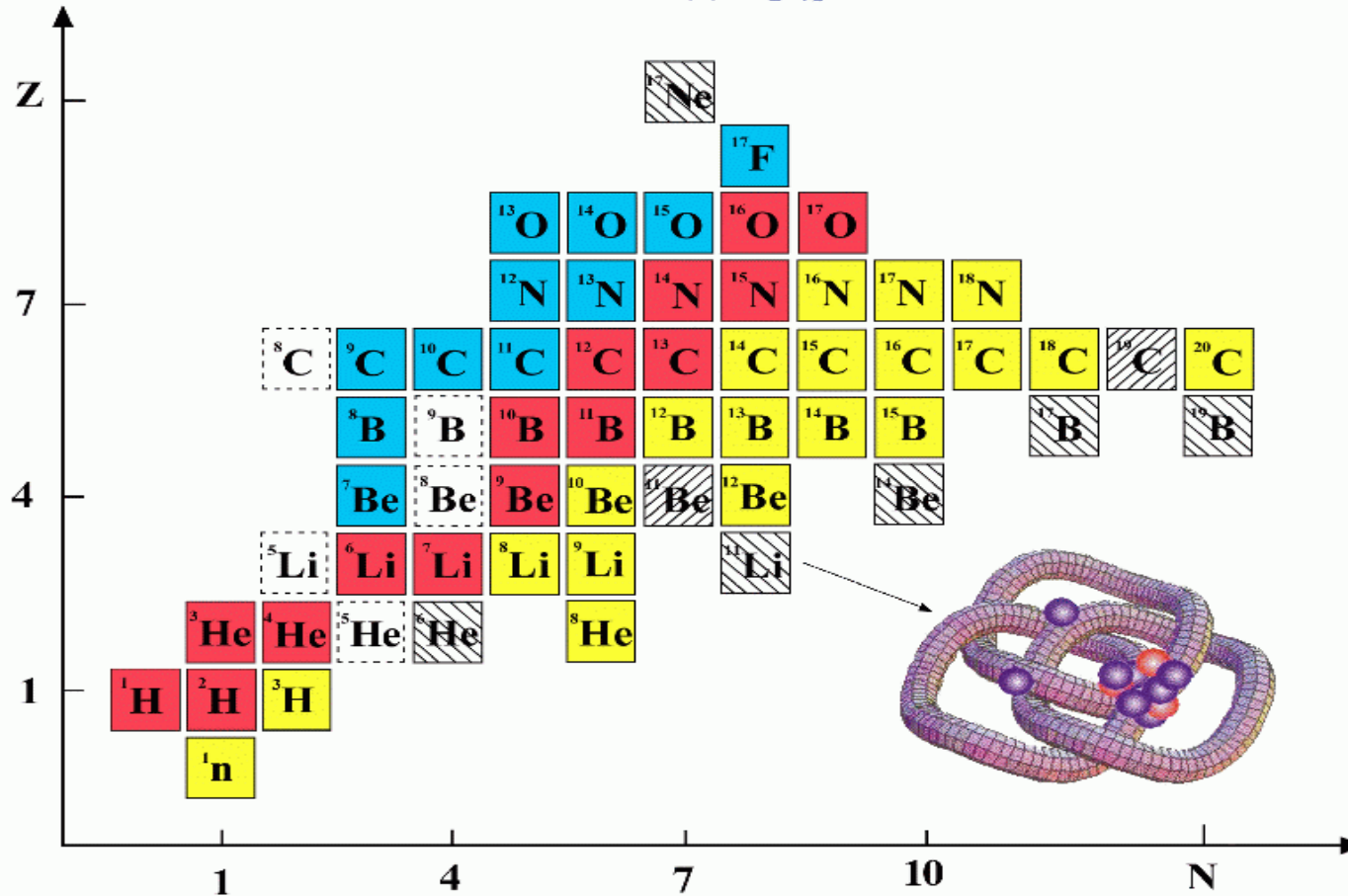


Dripline Phenomena in Light Nuclei: Halos



Neutron halo



Stable (~ 200)



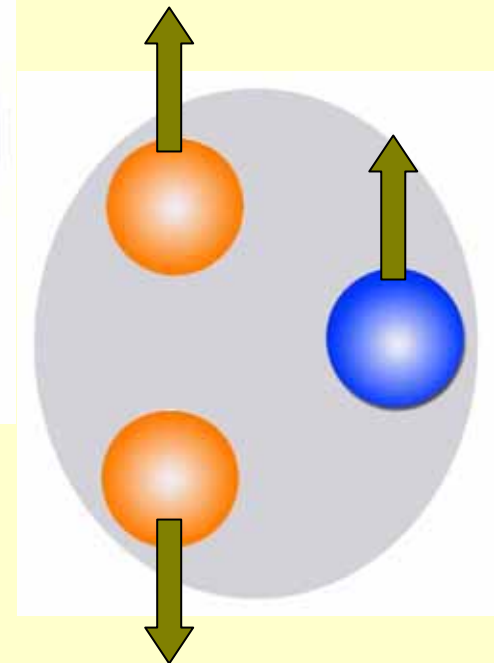
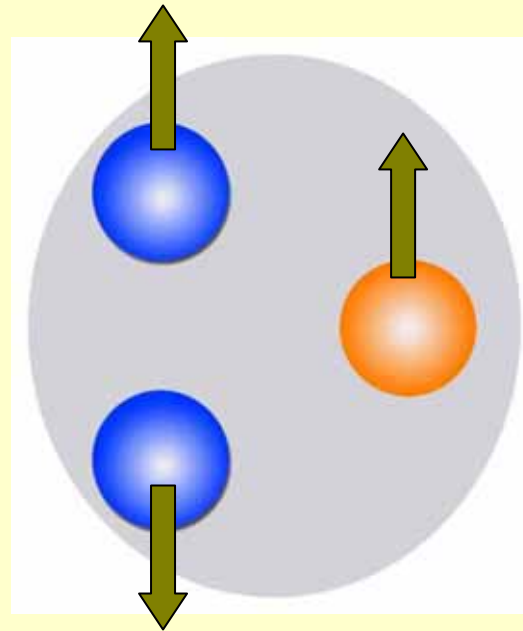
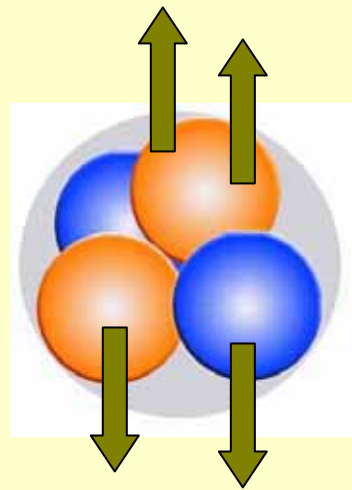
Borromean



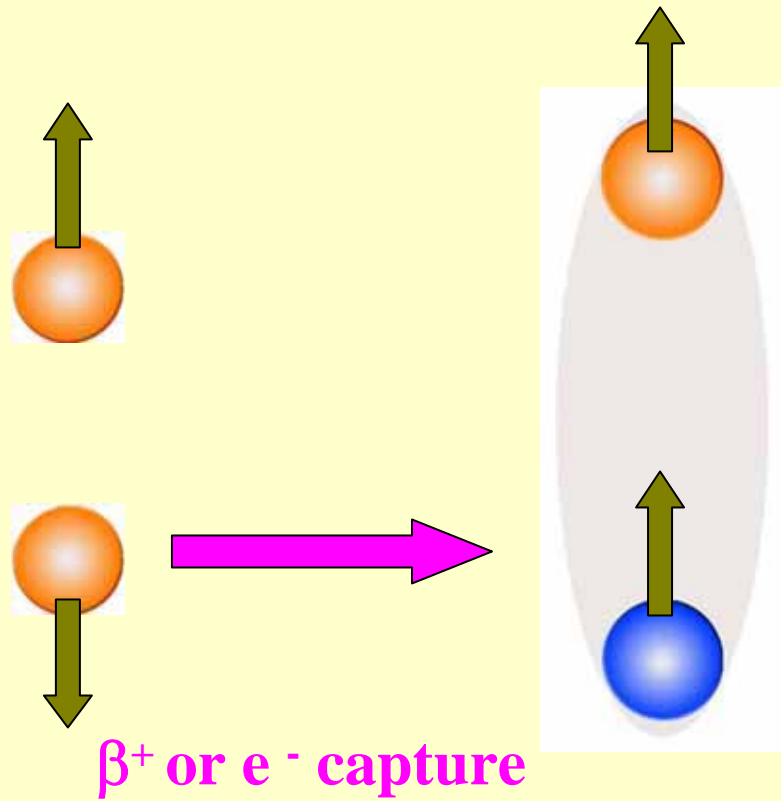
Unstable (> 6000)

Clustering building blocks:

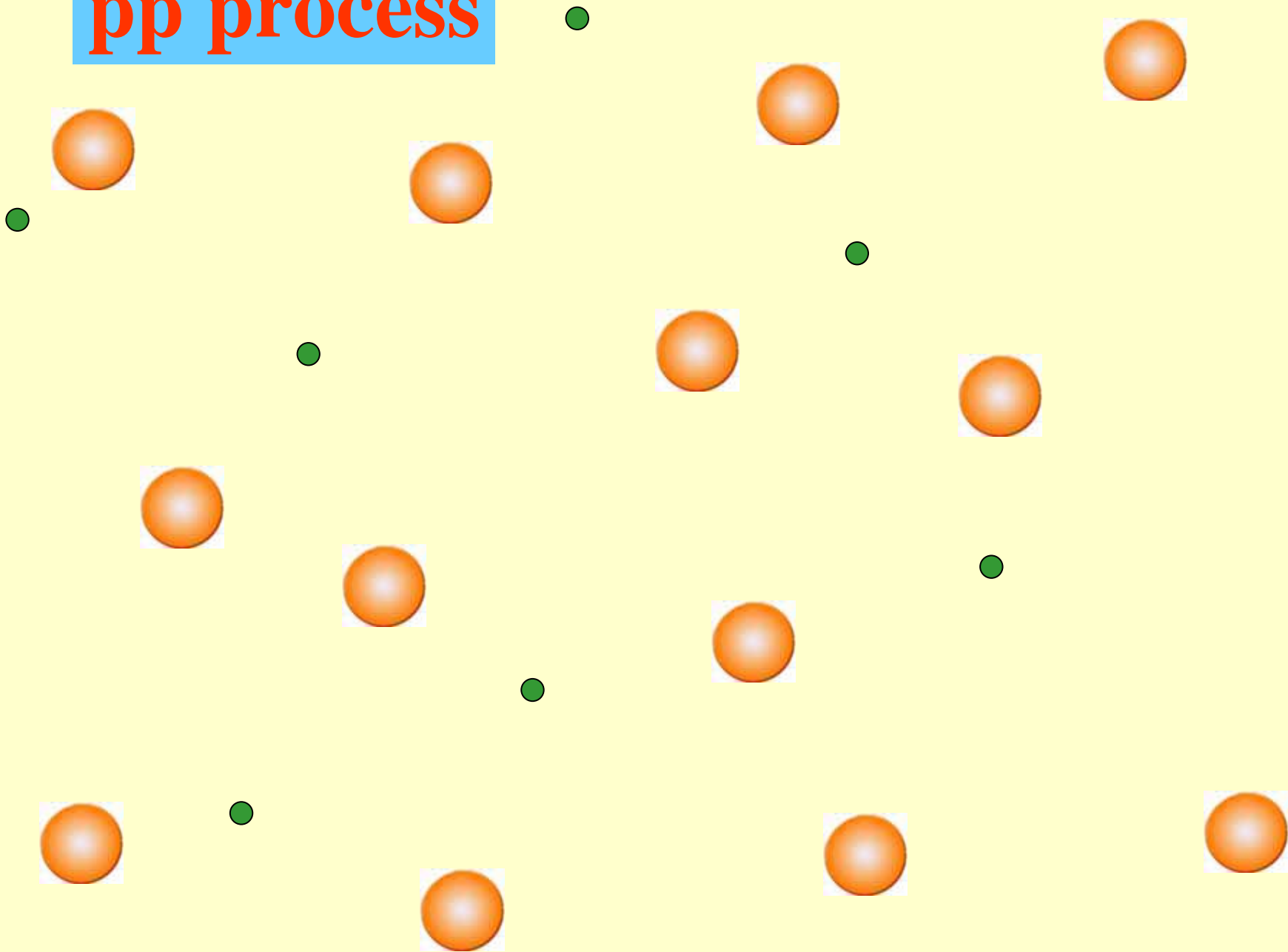
*more than one nucleon bound, stable & no excited states below particle decay thresholds –
deuteron, triton, ^4He , and ^3He nuclei*

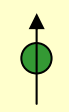
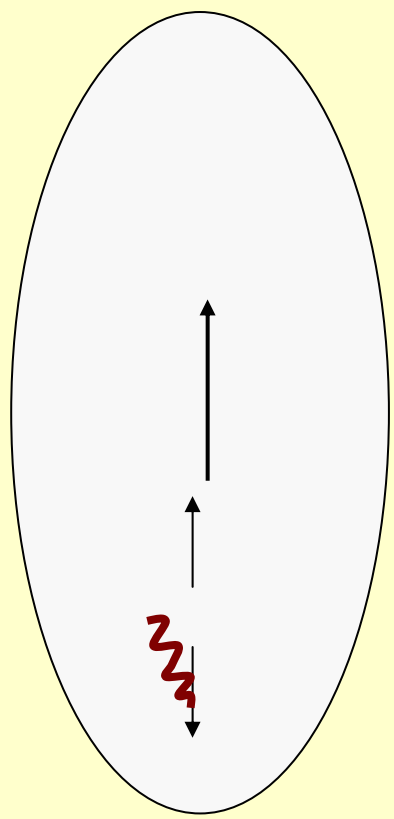
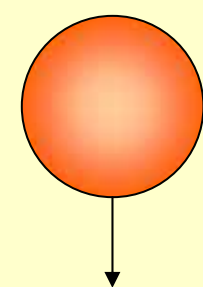
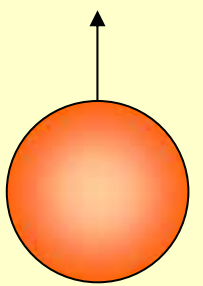


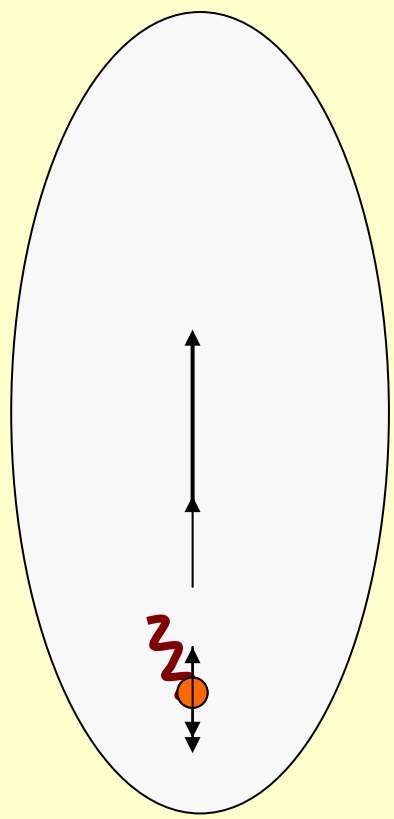
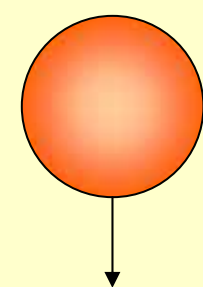
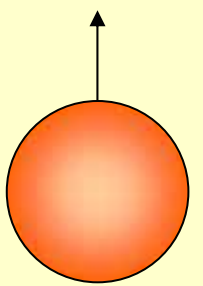
pp process

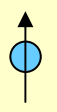
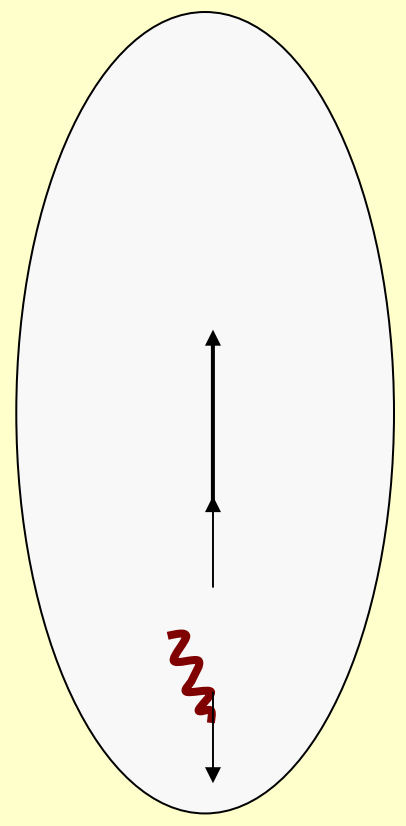
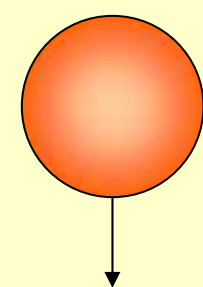
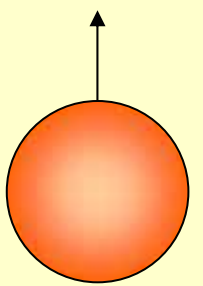


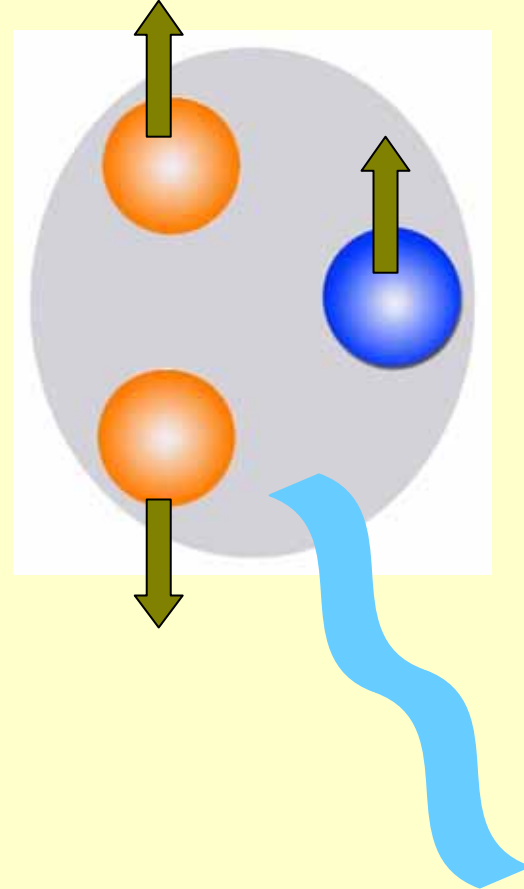
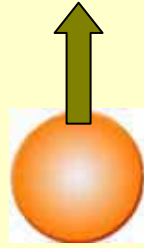
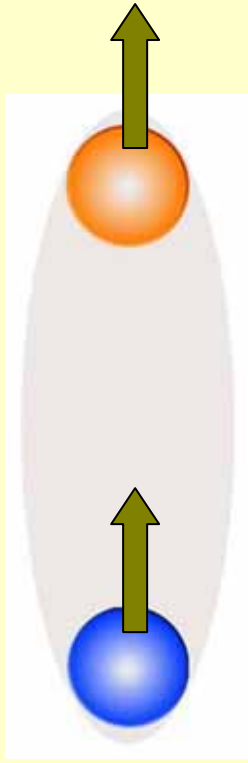
pp process



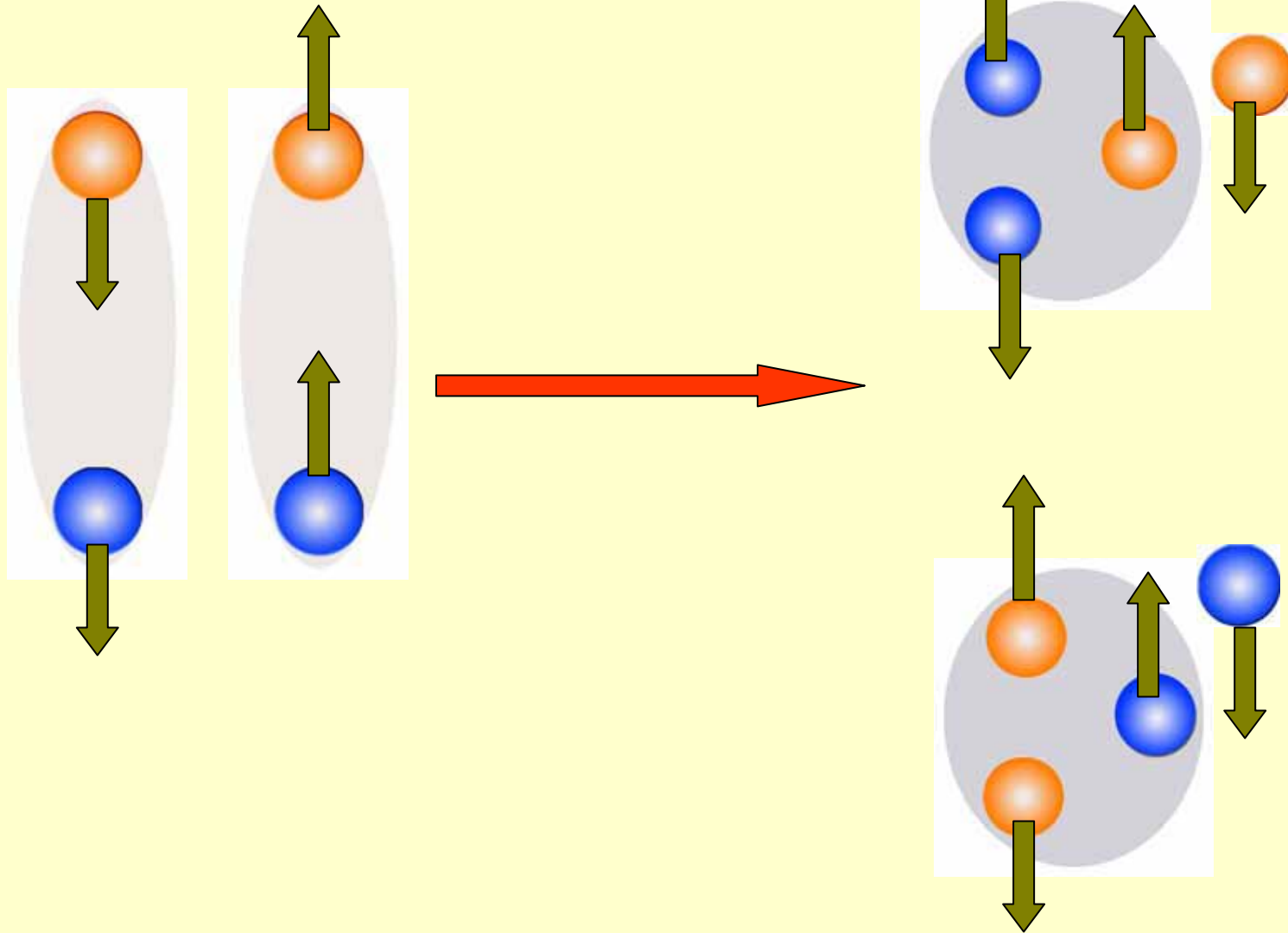




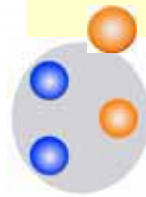
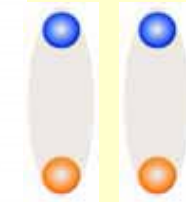
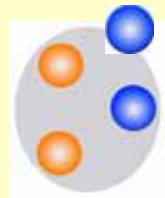
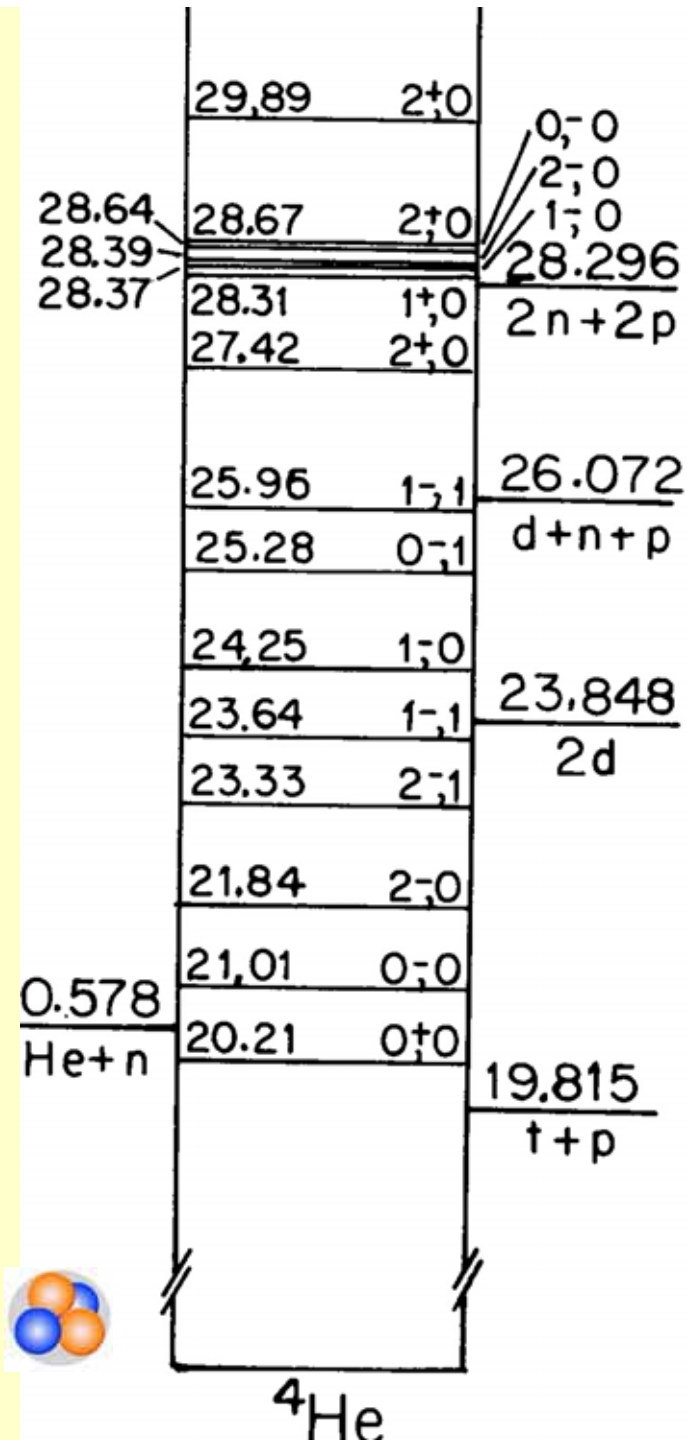




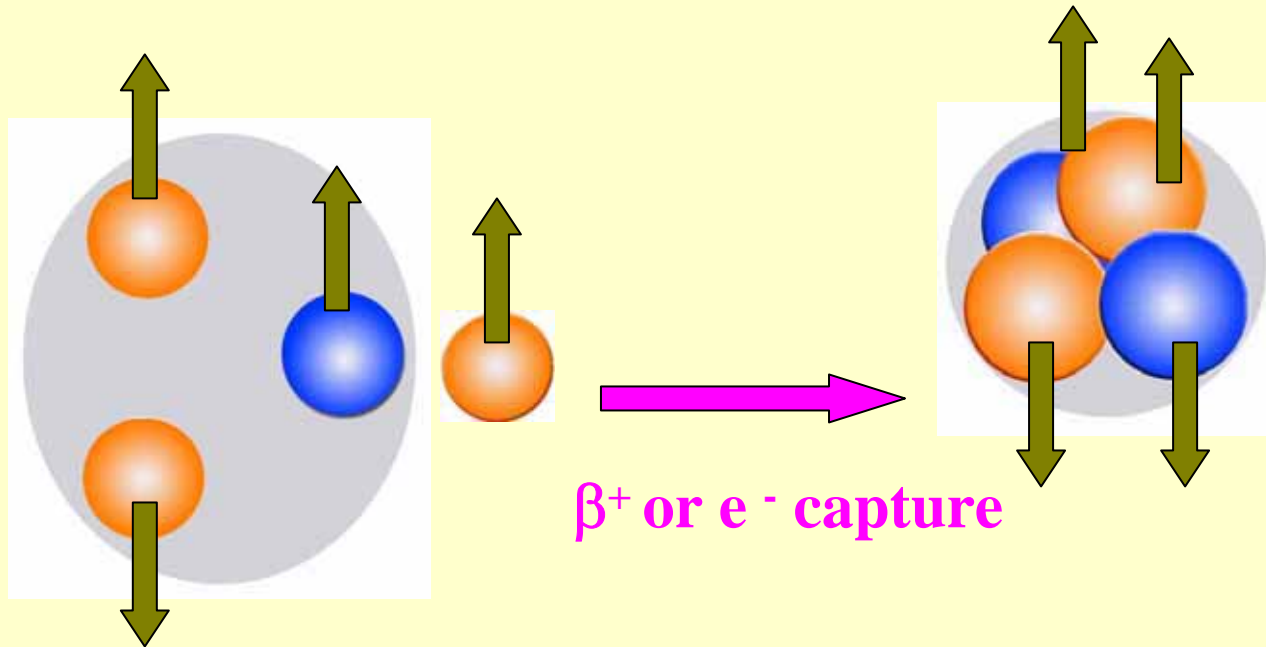
dd fusion



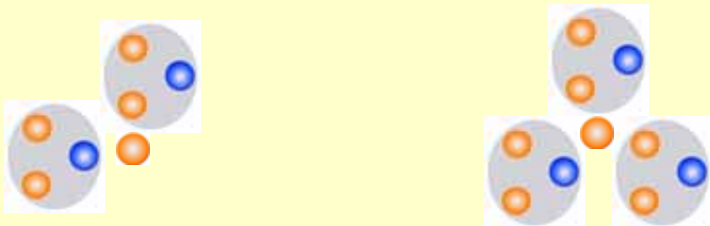
A = 4



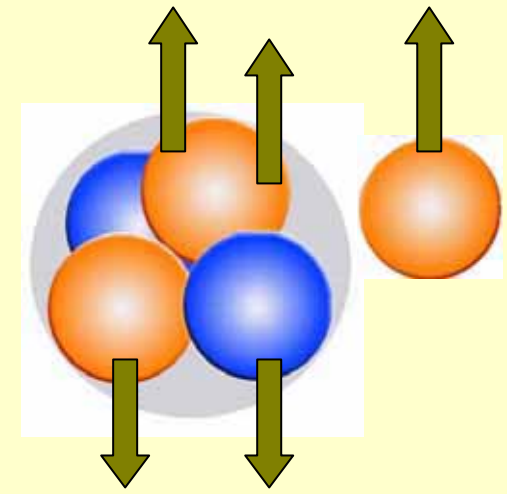
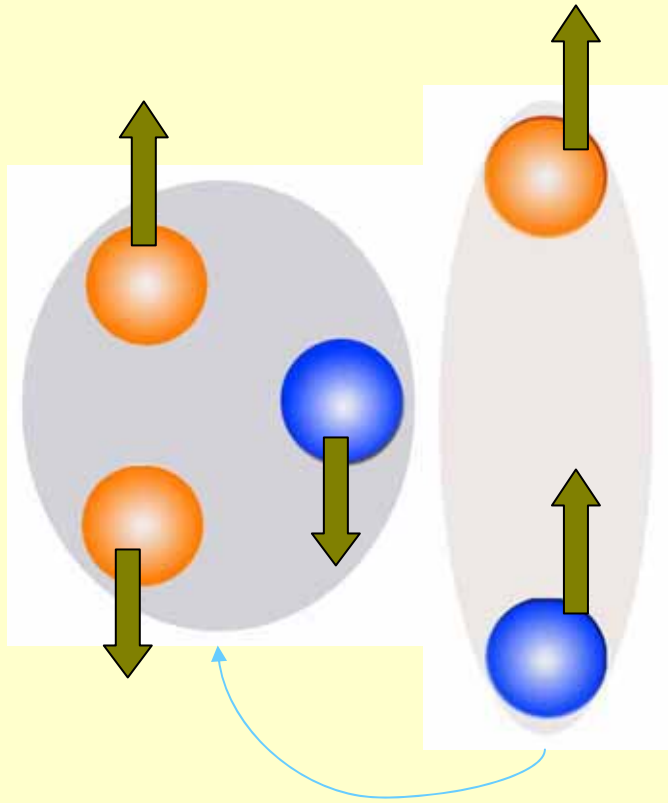
Hep Process



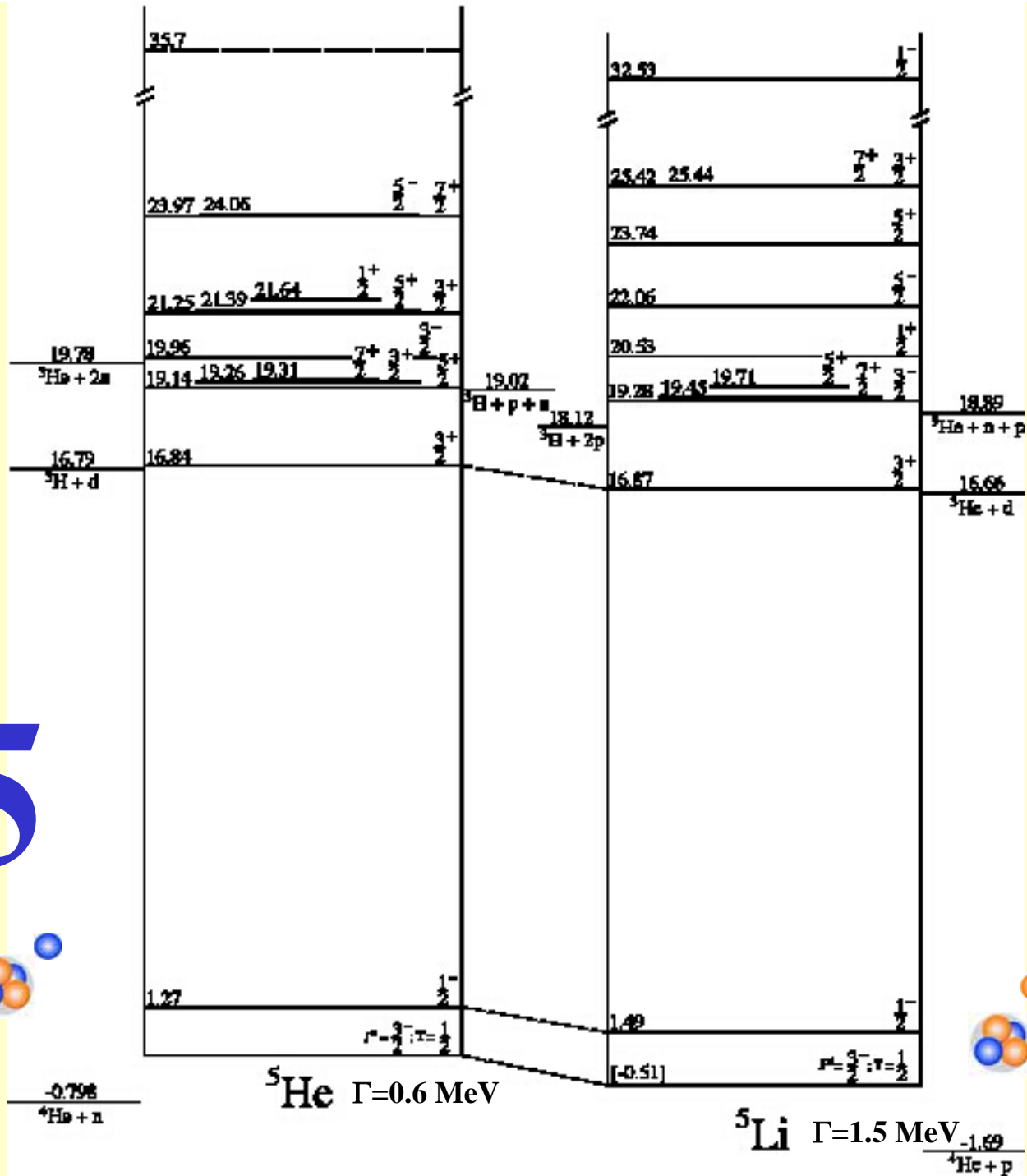
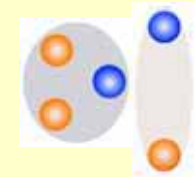
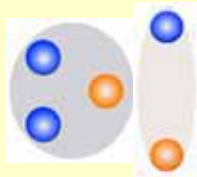
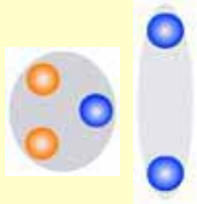
β^+ or e^- capture

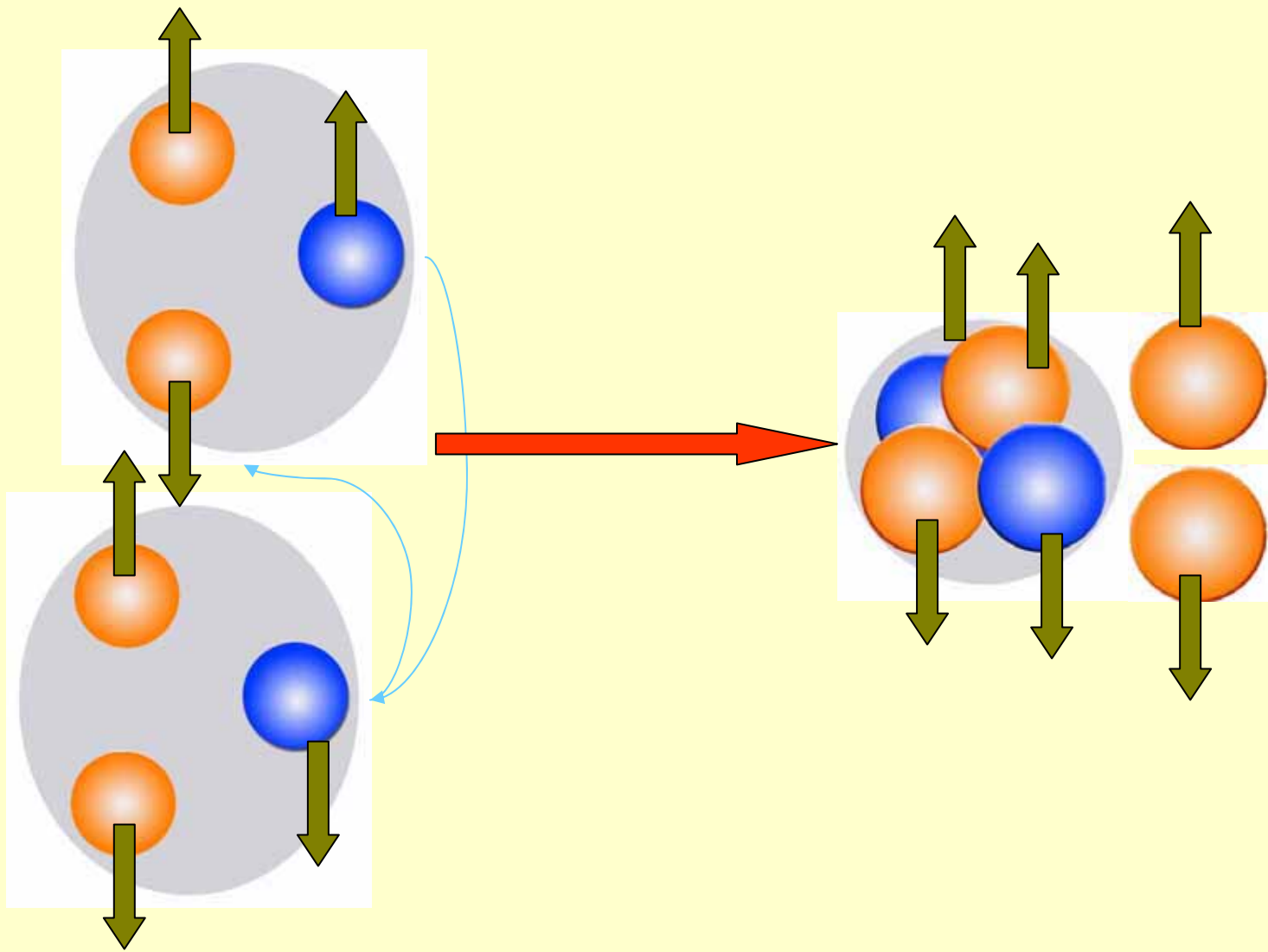


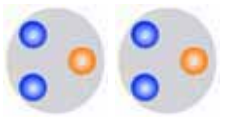
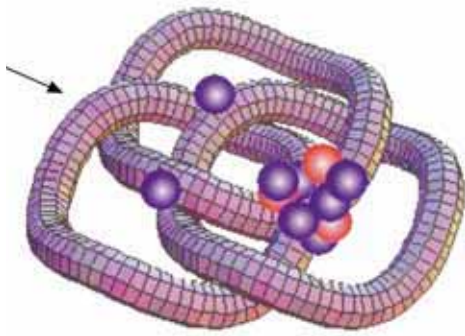
		27.00
26.21	1^-	$n+3p$
25.44	0^-	
		24.78
23.68	1^-	$d+2p$
23.36	2^-	
		19.29
${}^4\text{Li}$		${}^3\text{He}+p$



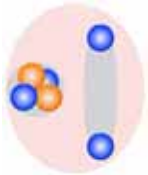
A=5



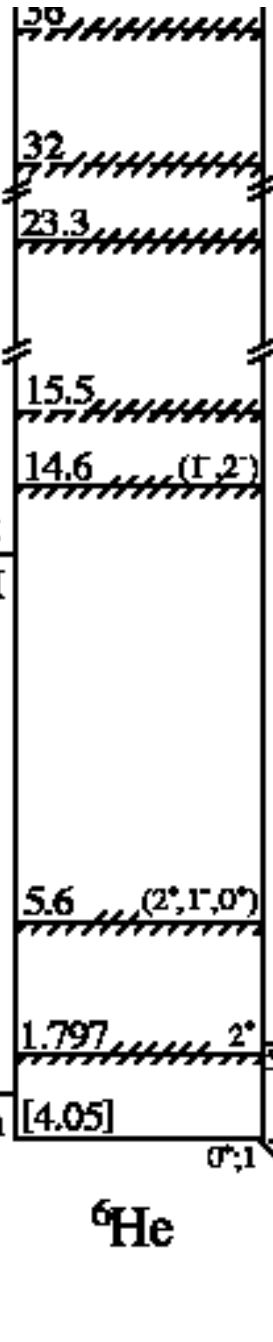




12.305
 ${}^3\text{H} + {}^3\text{H}$



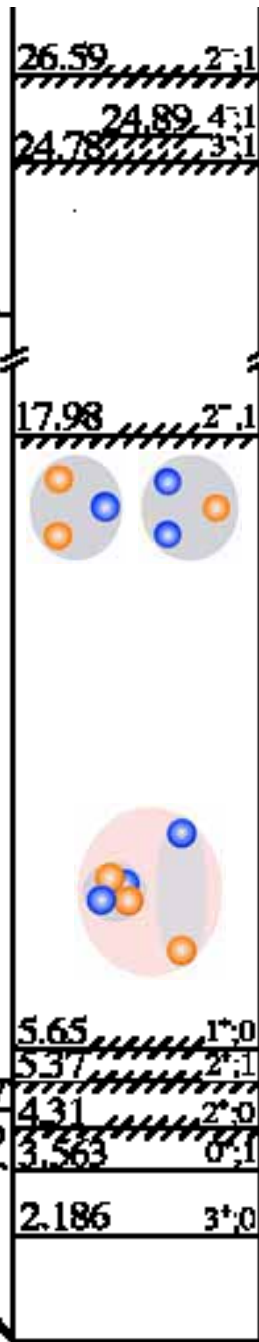
0.973
 ${}^4\text{He} + 2n$



${}^6\text{He}$

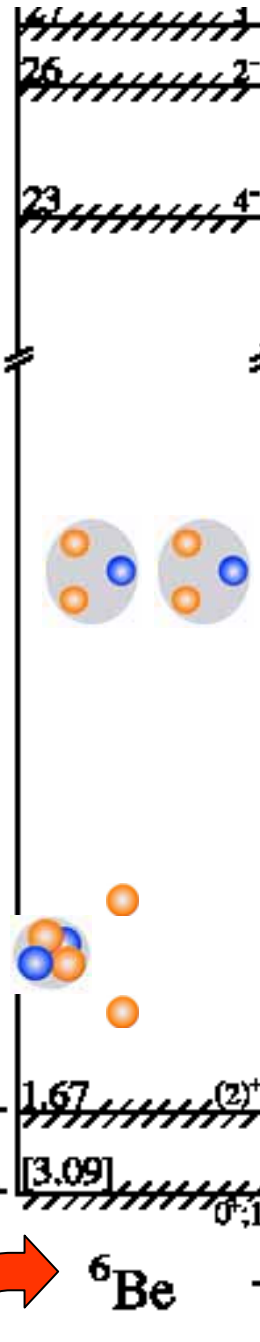
β^-

21.2881
 ${}^3\text{H} + d + p$



${}^6\text{Li}$

22.0518
 ${}^3\text{He} + d + n$



${}^6\text{Be}$

$\Gamma = 0.092 \text{ MeV}$

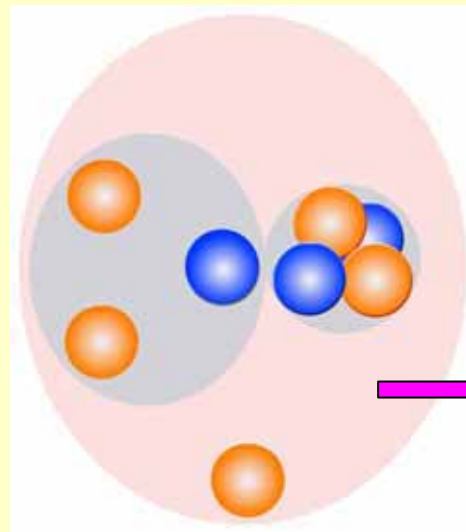
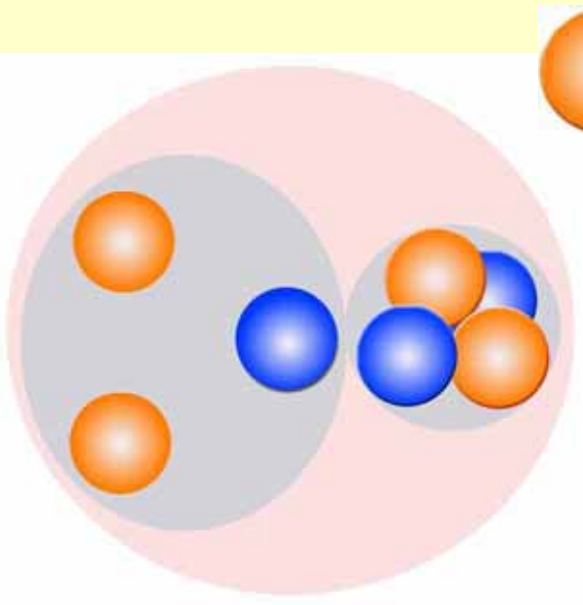
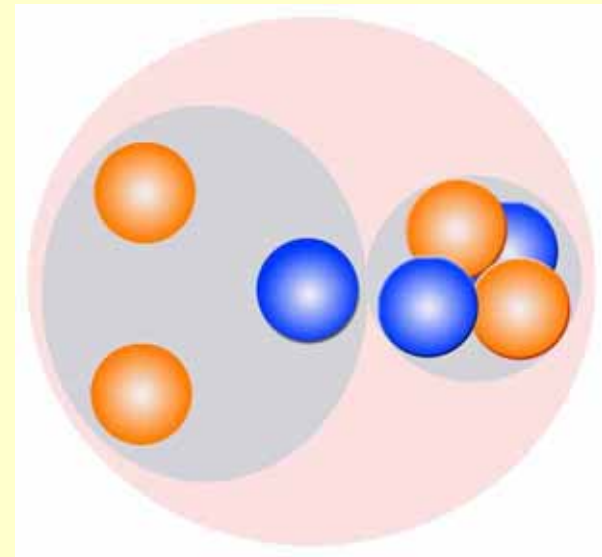
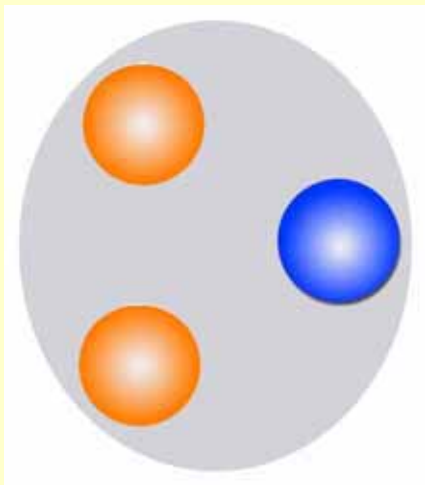
11.4884
 ${}^3\text{He} + {}^3\text{He}$

0.32
 ${}^5\text{Li} + p$

-1.3711
 ${}^4\text{He} + 2p$

A=6

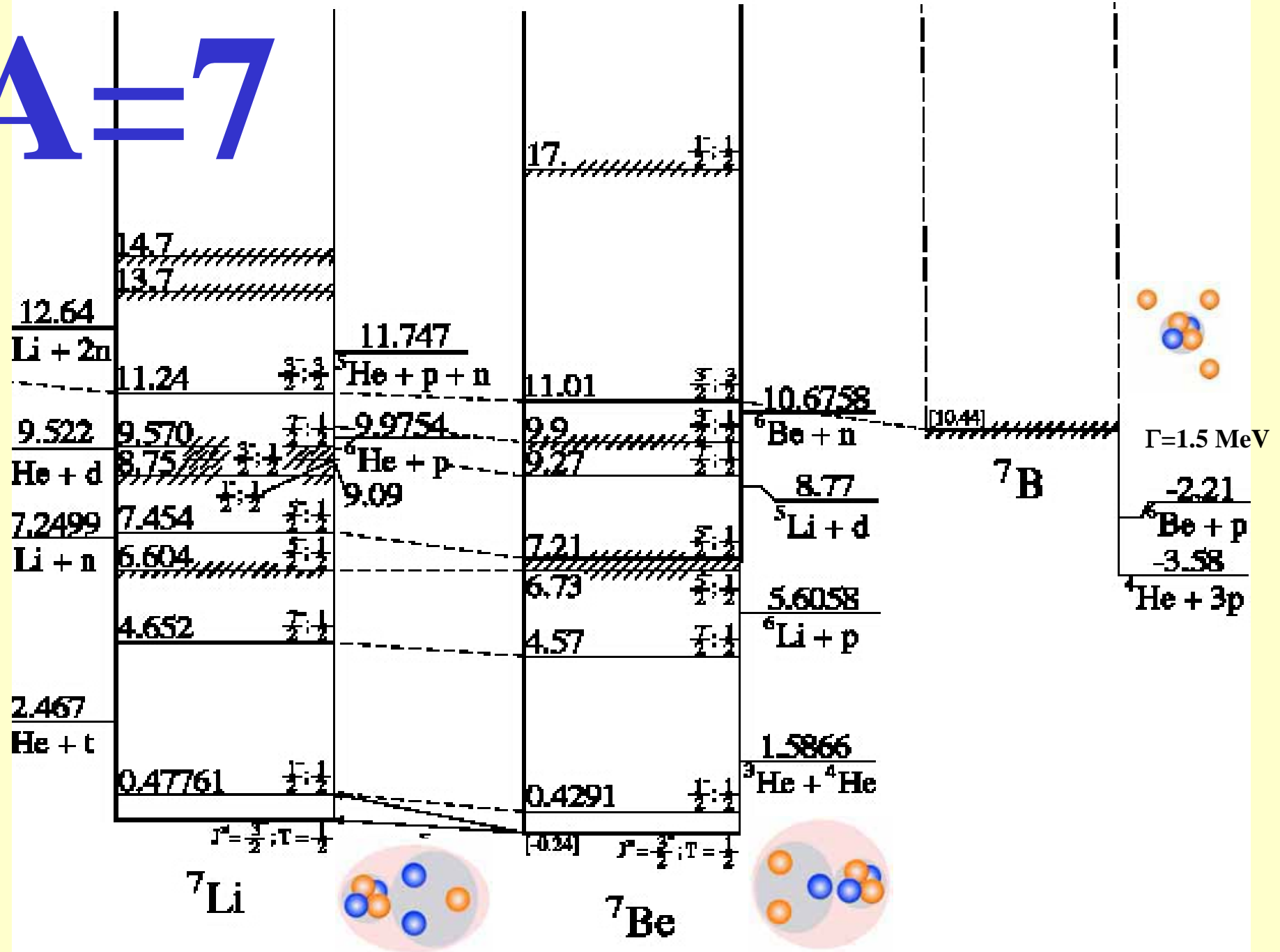
"Are you Boromean too?"



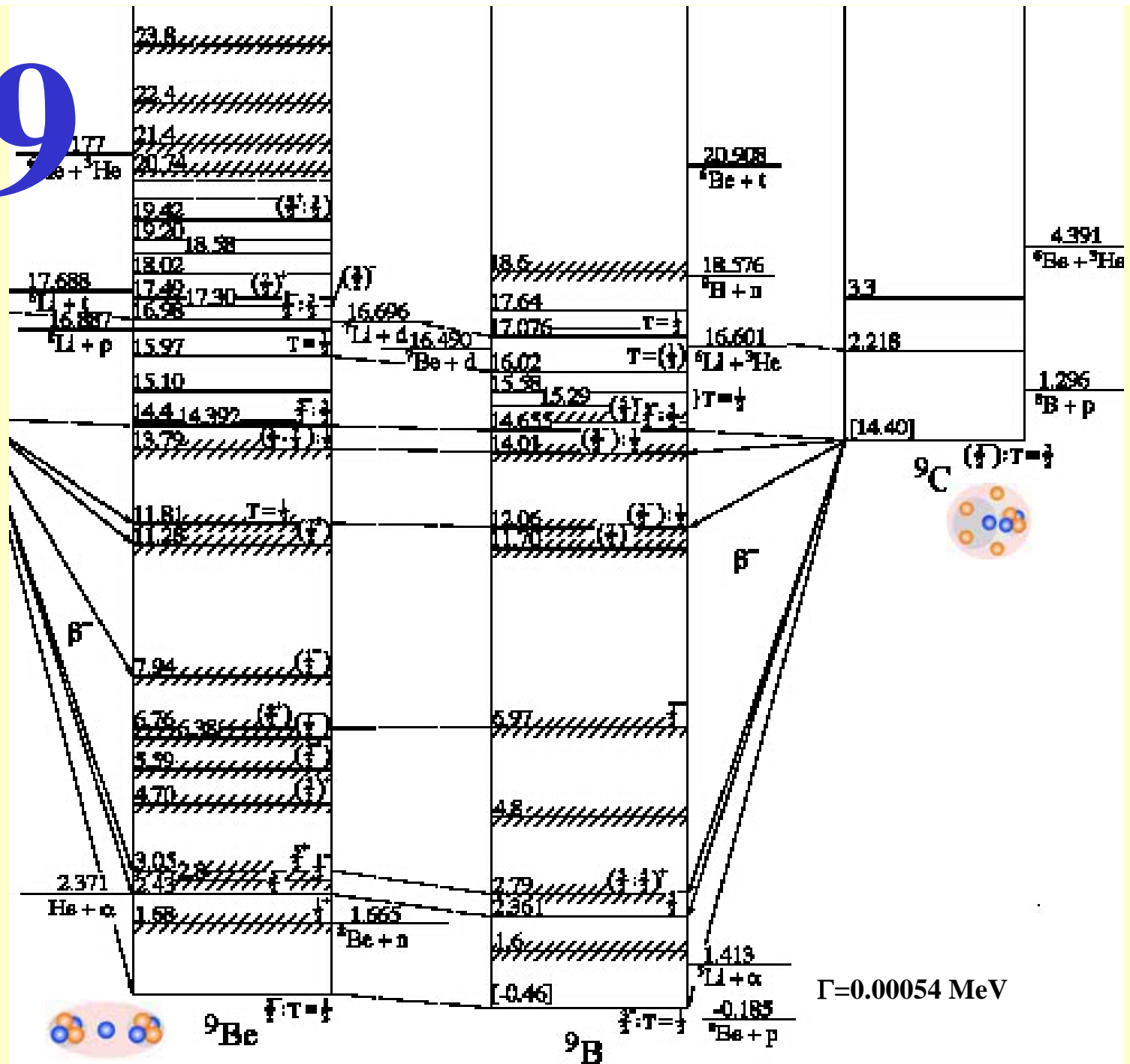
β^+



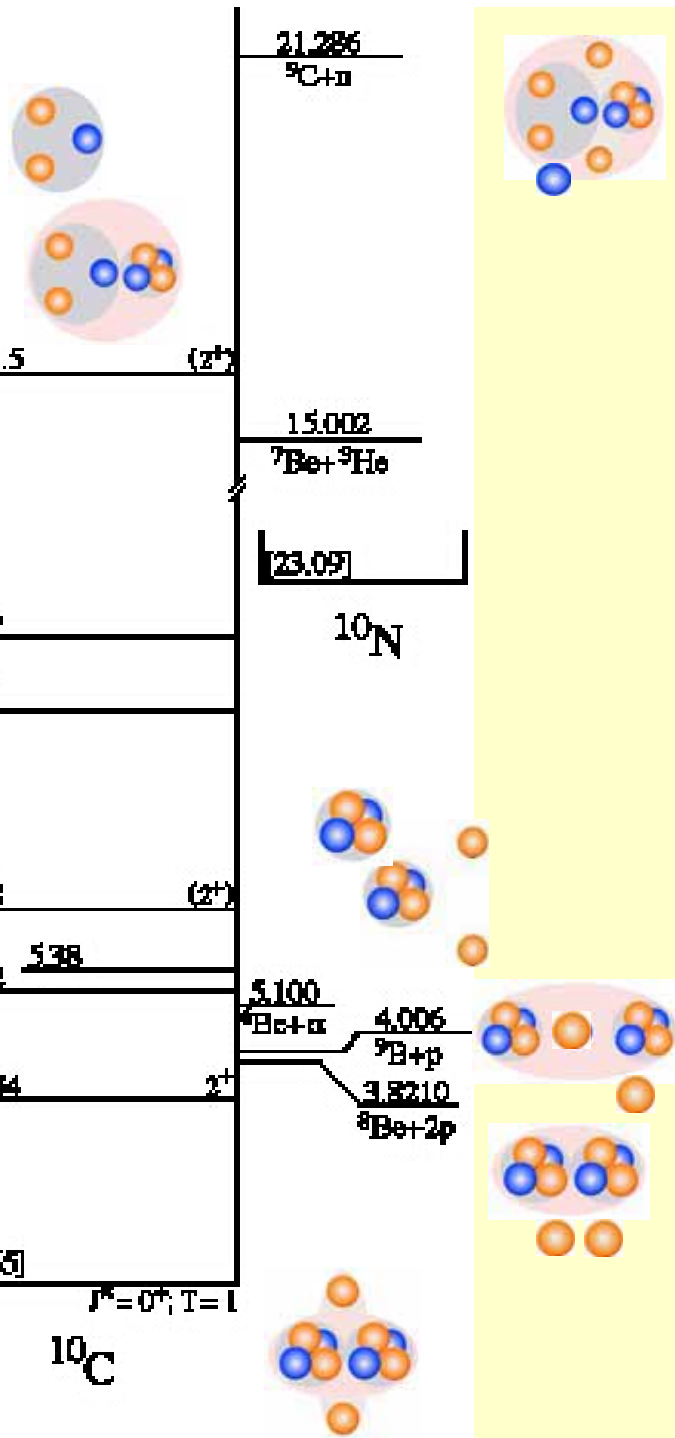
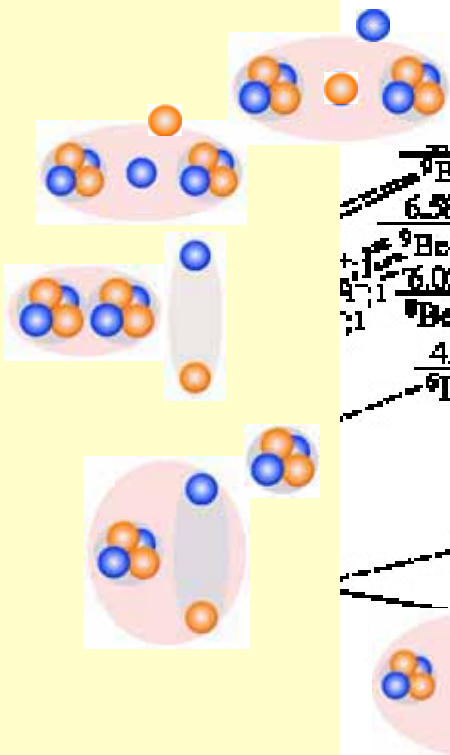
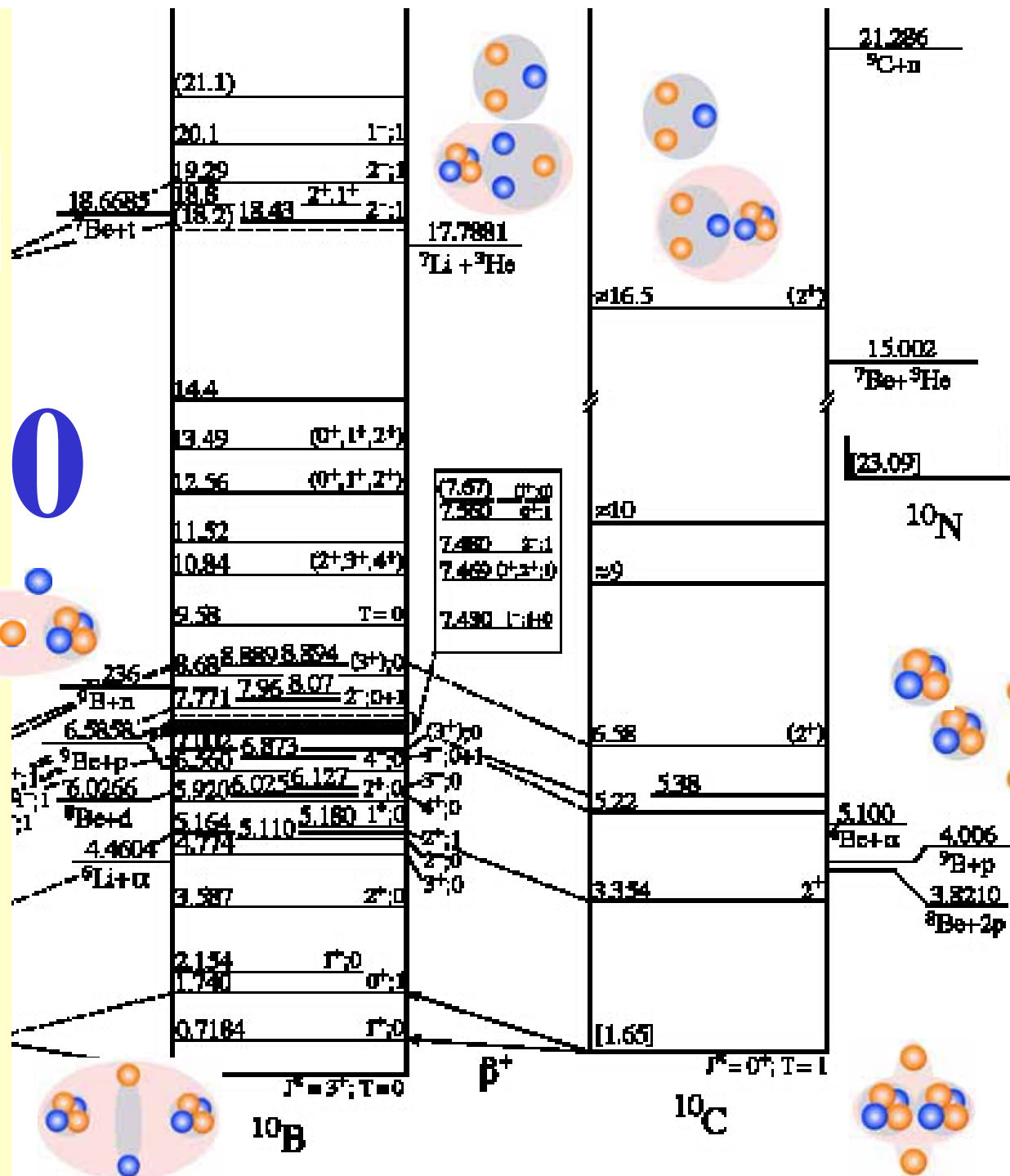
A=7

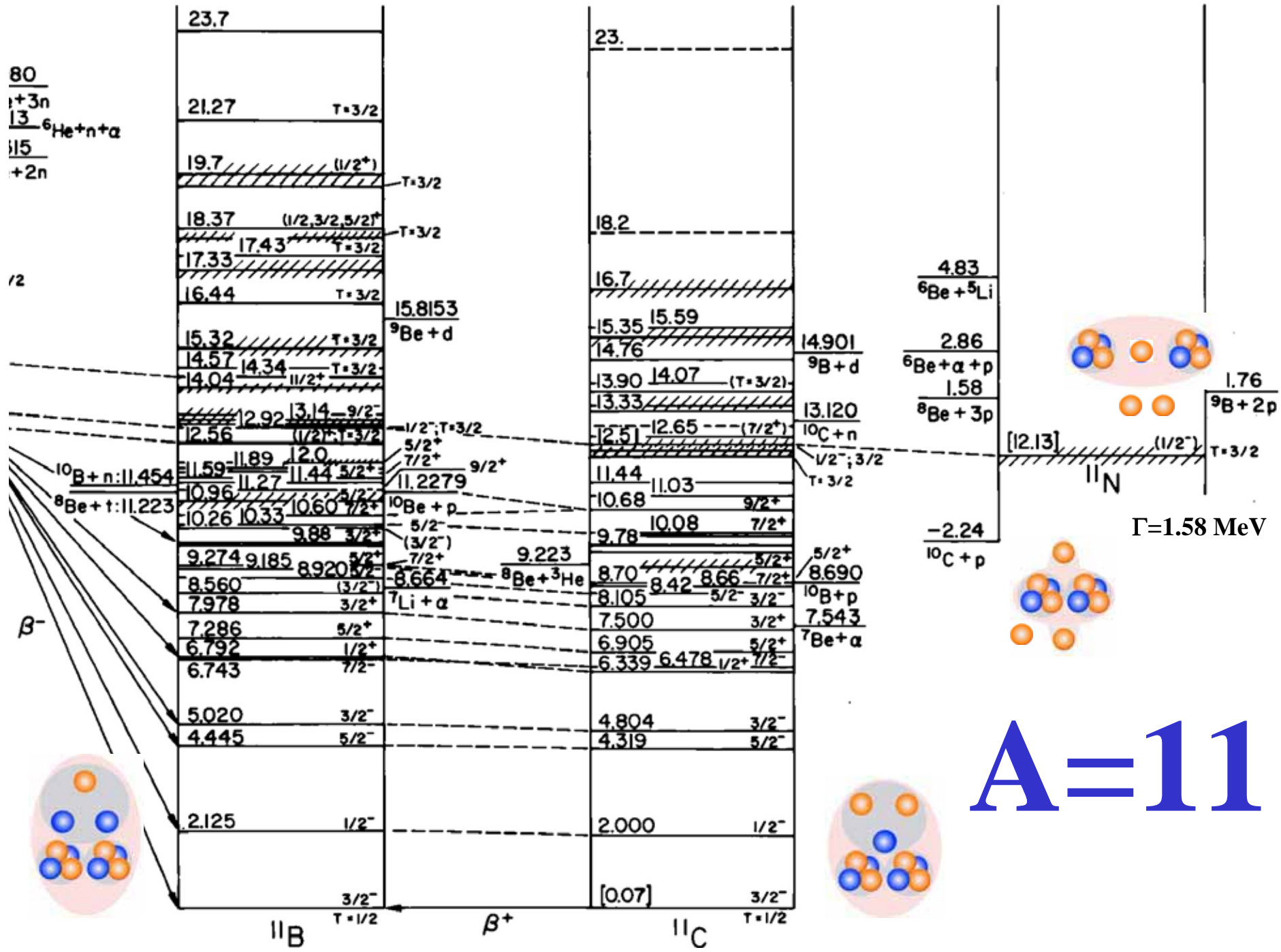


A=9

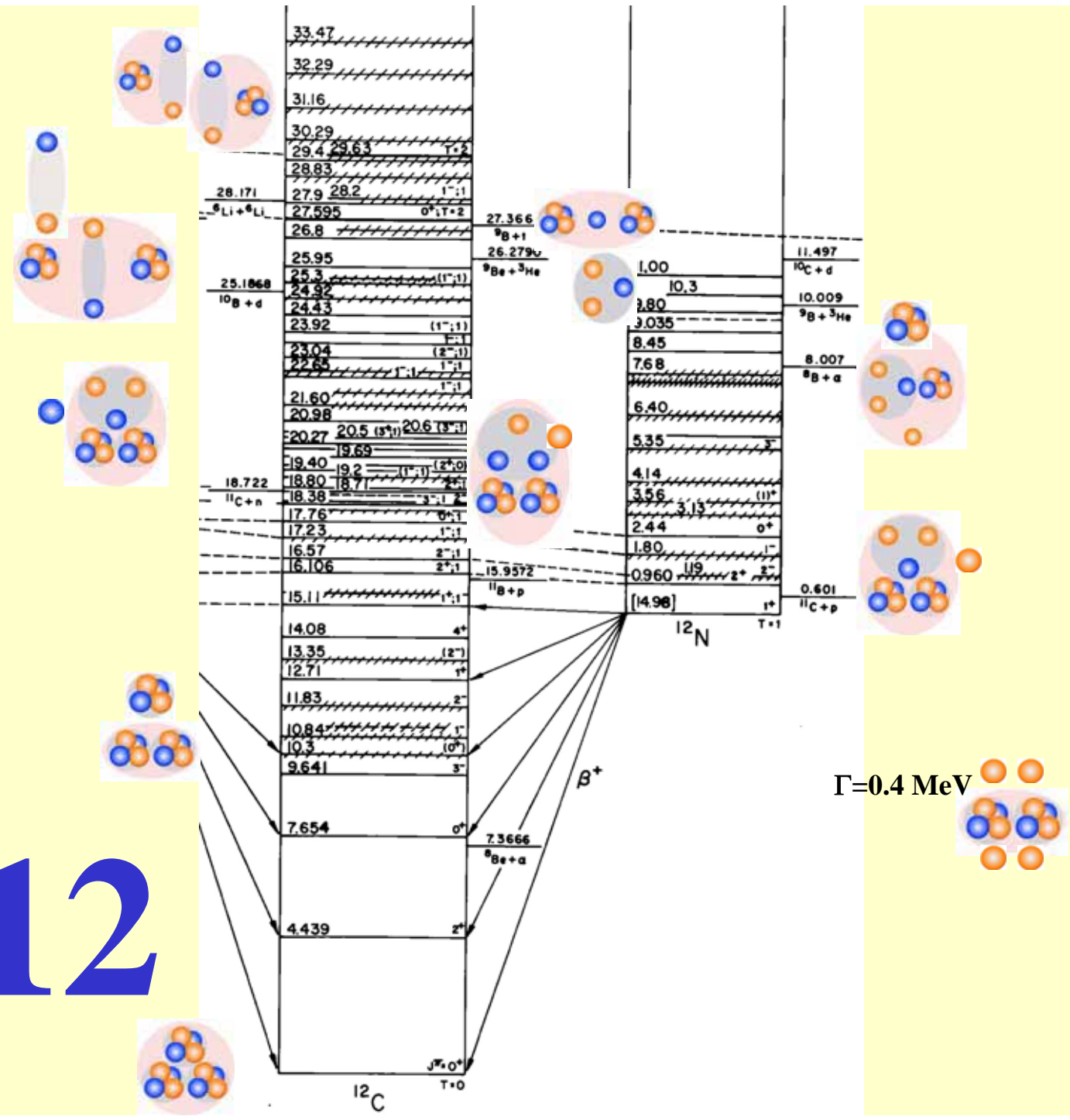


A=10



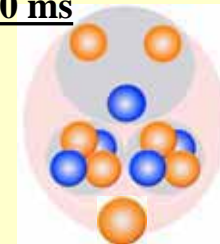


A=12

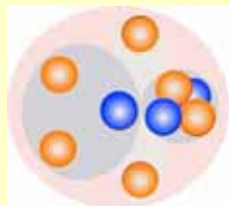


Ground states – lowest excitations

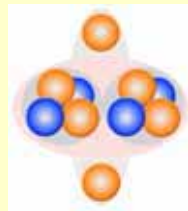
^{12}N 11.0 ms



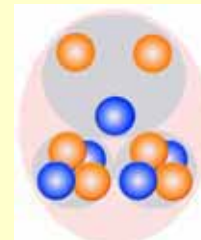
^9C 0.1265 s



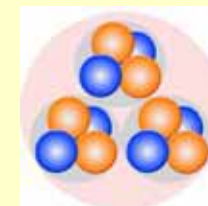
^{10}C 19.2 s



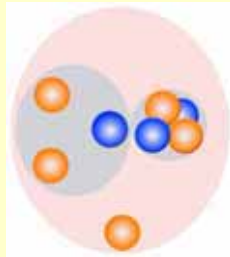
^{11}C 20.38 m



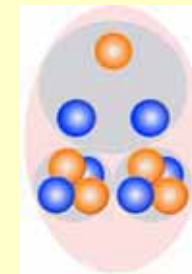
^{12}C 98.89 %



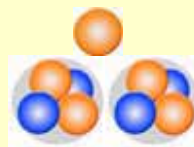
^8B 0.769 s



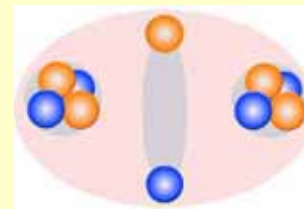
^{11}B 80.2 %



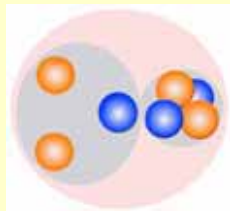
^9B 540 eV



^{10}B 19.8%



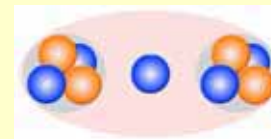
^7Be 53.3 d



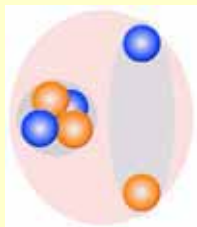
^8Be 6.8 eV



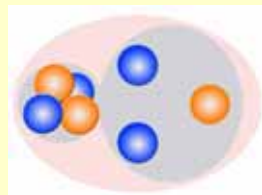
^9Be 100%



^6Li 7.5 %



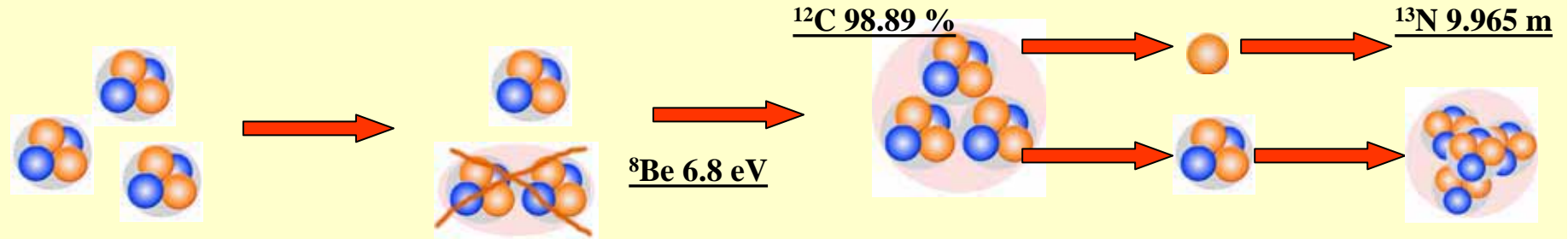
^7Li 92.5 %



“3He Process: pure isotope fusion”

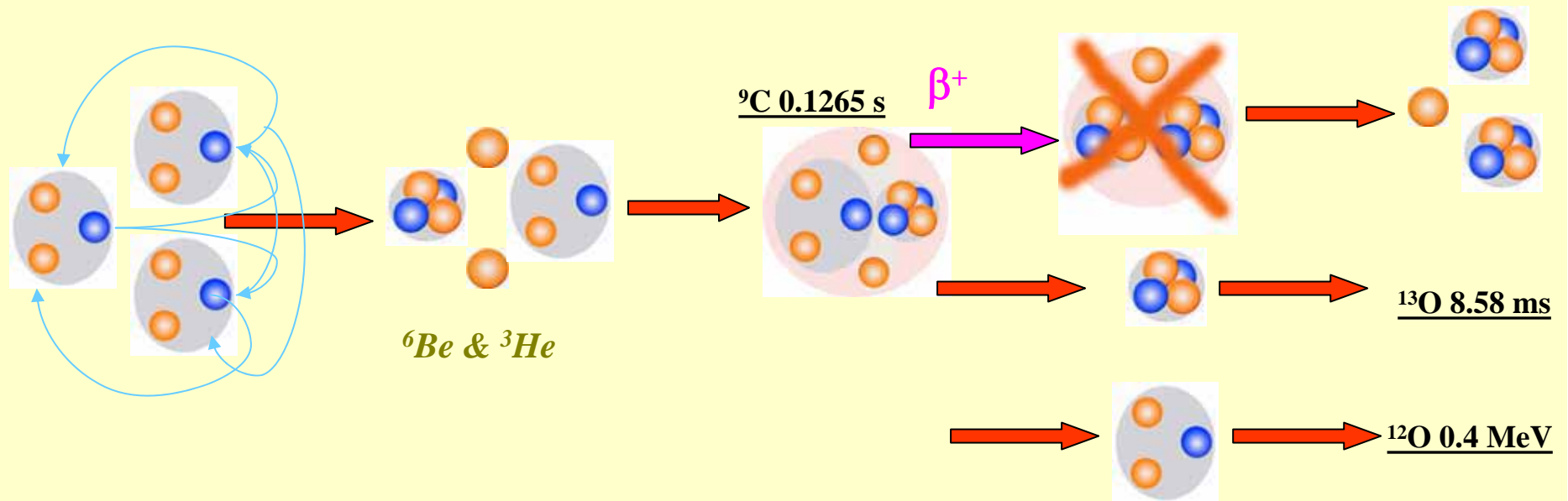
Triple α process: ^{12}C & 7.27 MeV at the output

Toward CNO cycle & α burning



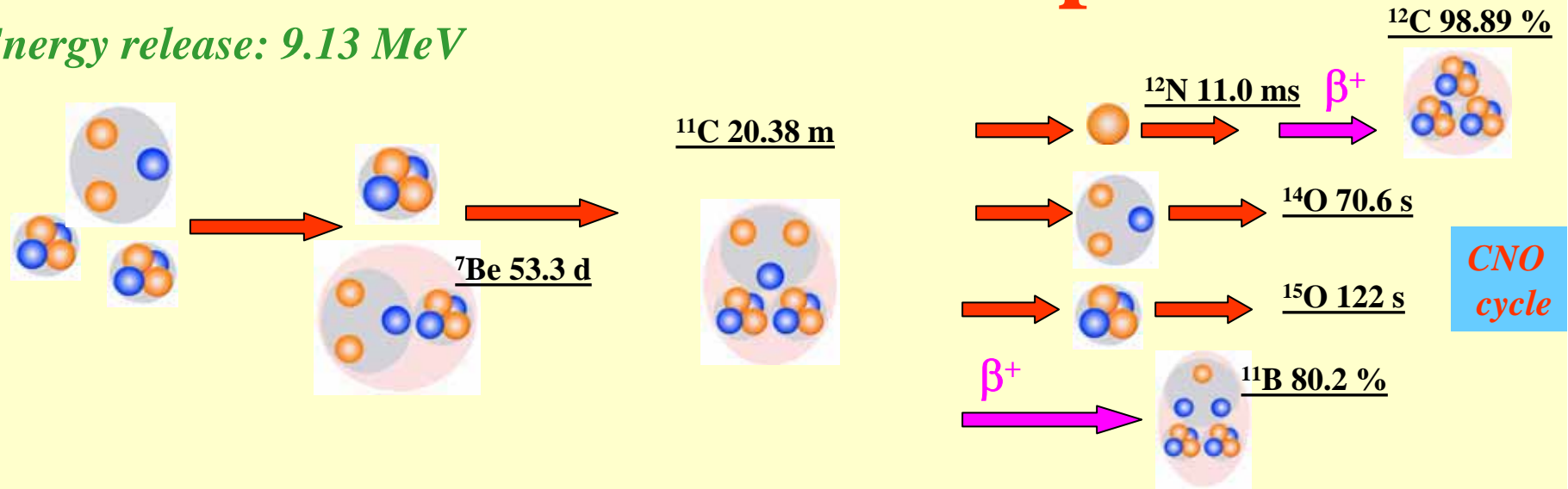
Triple ^3He process: $2\ ^4\text{He}$ & 15.88 MeV at the output

^9B 540 eV

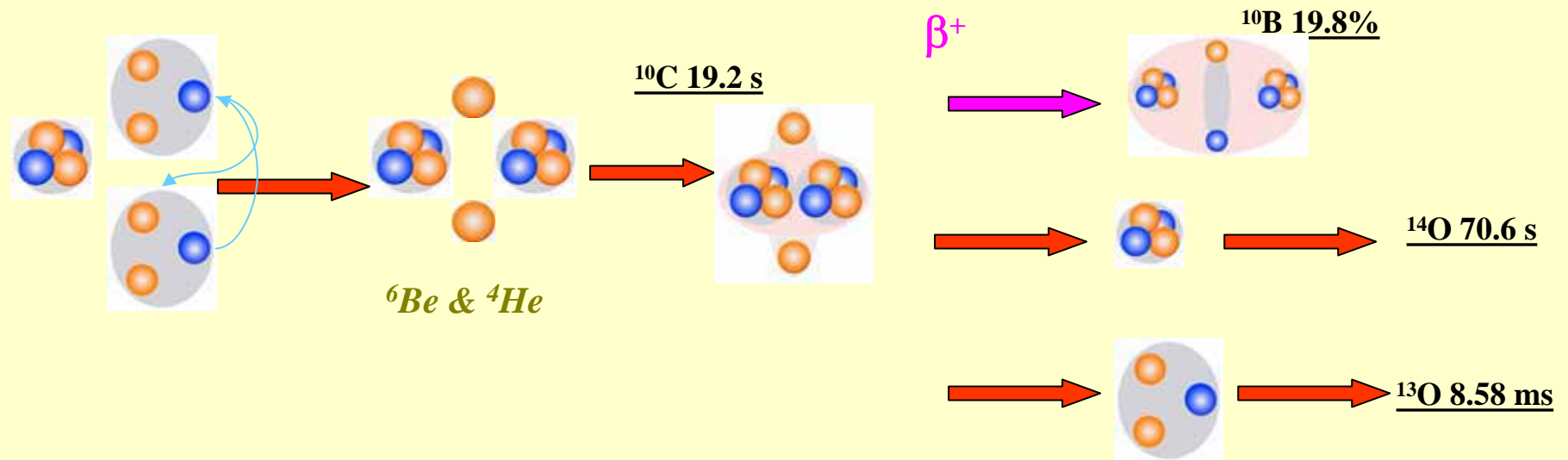


“3He Process: mixed isotope fusion”

Energy release: 9.13 MeV



Energy release: 16.59 MeV

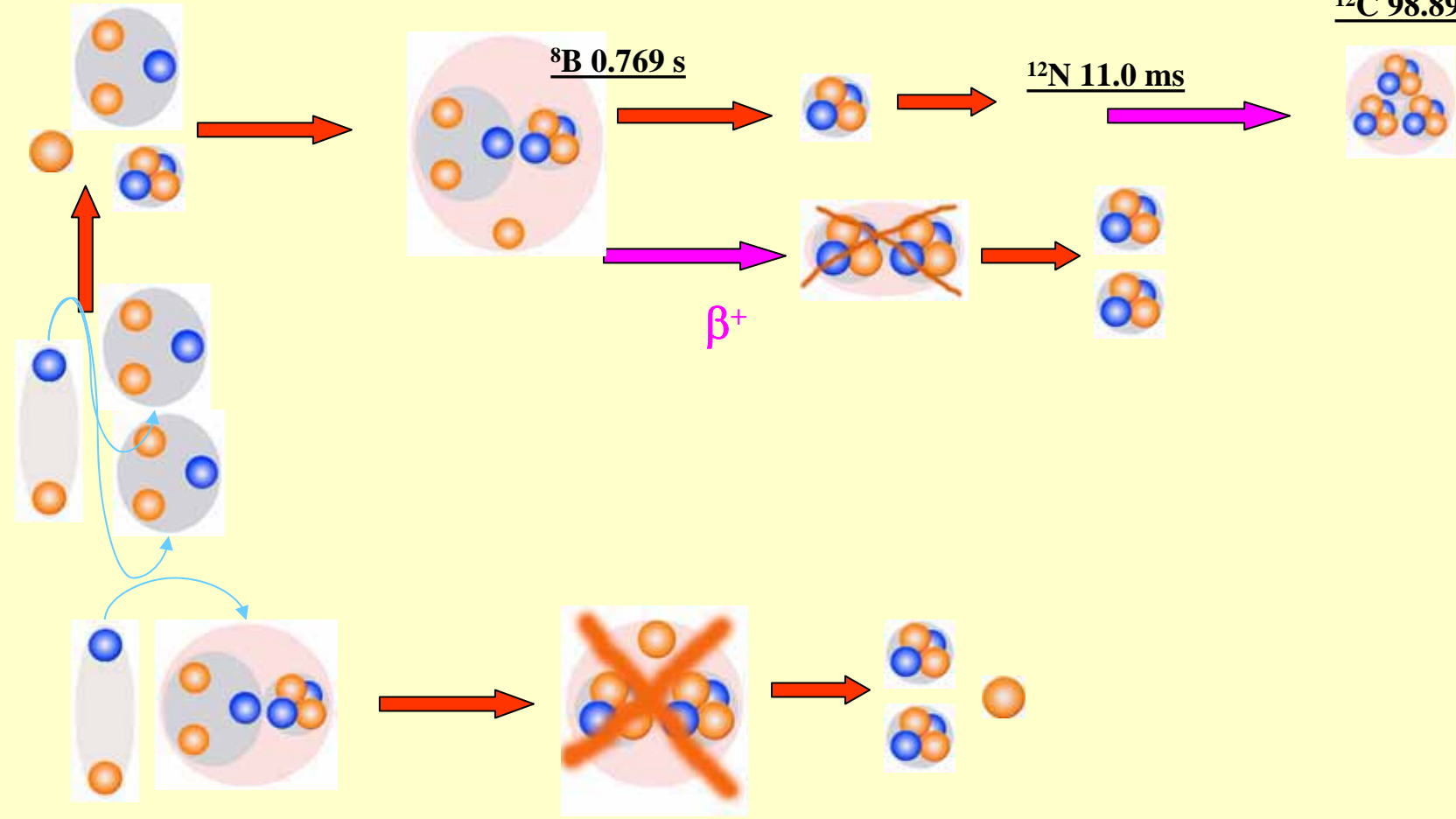


“3 H&He Process: mixed isotope fusion”

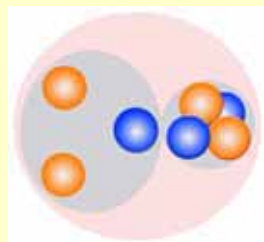
More paths to ^{12}C and ^4He production

Toward CNO cycle & α burning

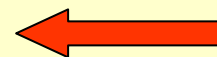
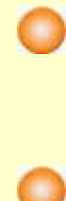
^{12}C 98.89 %



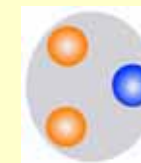
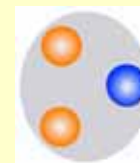
^7Be , stable



^6Be , 0.092 MeV

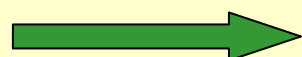
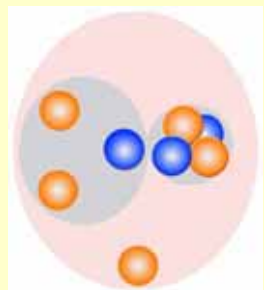


**$^6\text{Be} \rightarrow \text{pp}^4\text{He}$
-1.372 MeV**

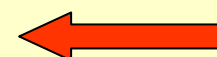
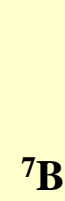
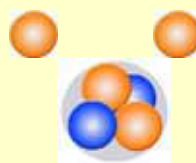


**$^6\text{Be} \rightarrow ^3\text{He}^3\text{He}$
+11.48 MeV**

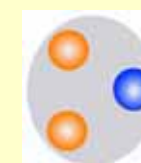
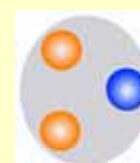
^8B , 770 ms



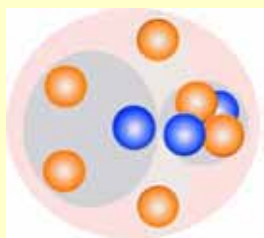
^7B , 1.4 MeV



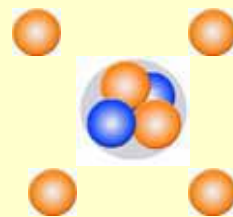
**$^7\text{B} \rightarrow \text{p}^6\text{Be}$
-2.21 MeV**



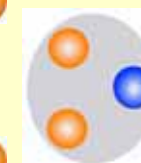
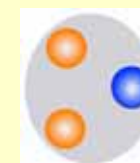
^9C , 126.5 ms



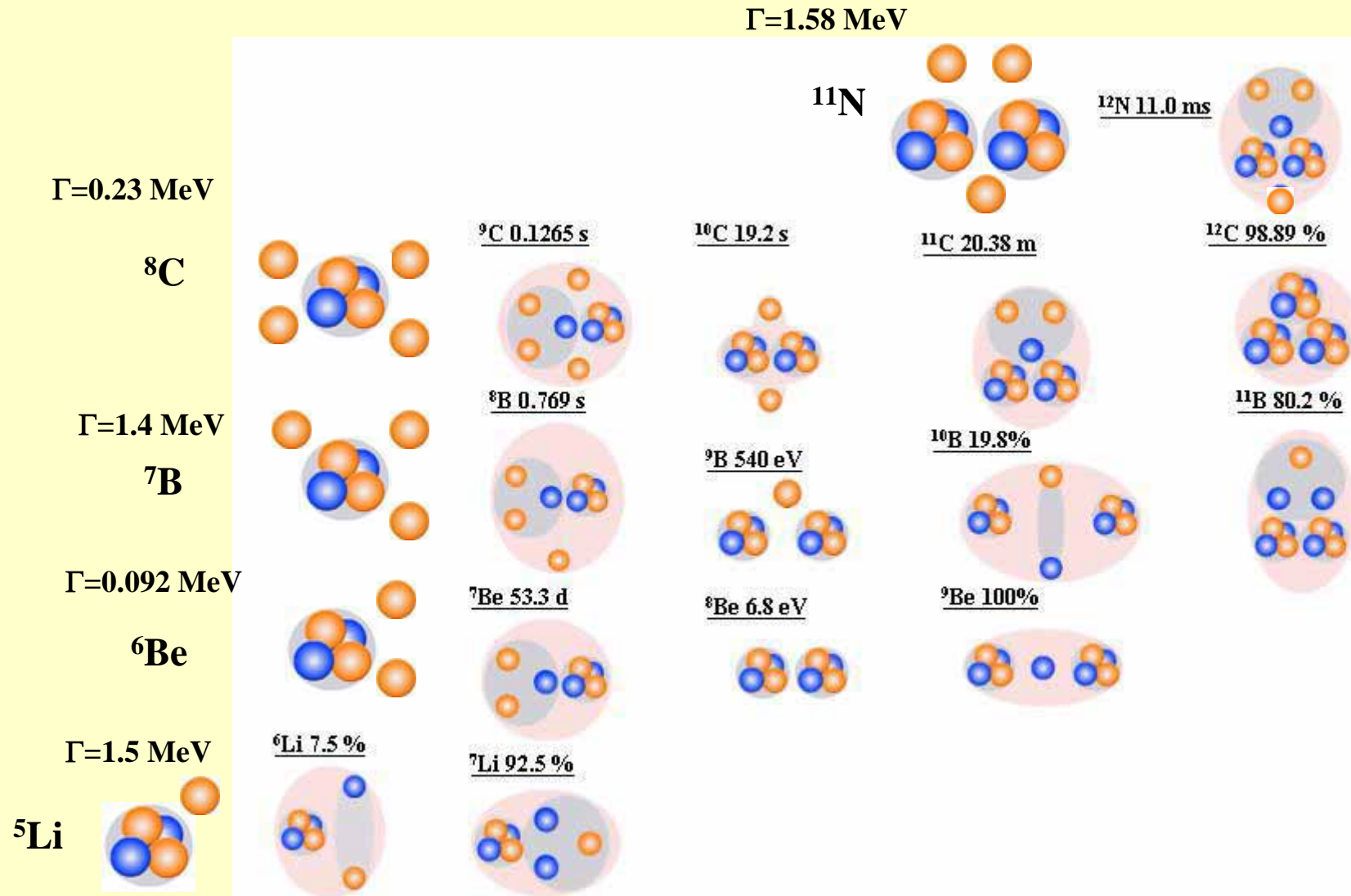
^8C , 0.23 MeV



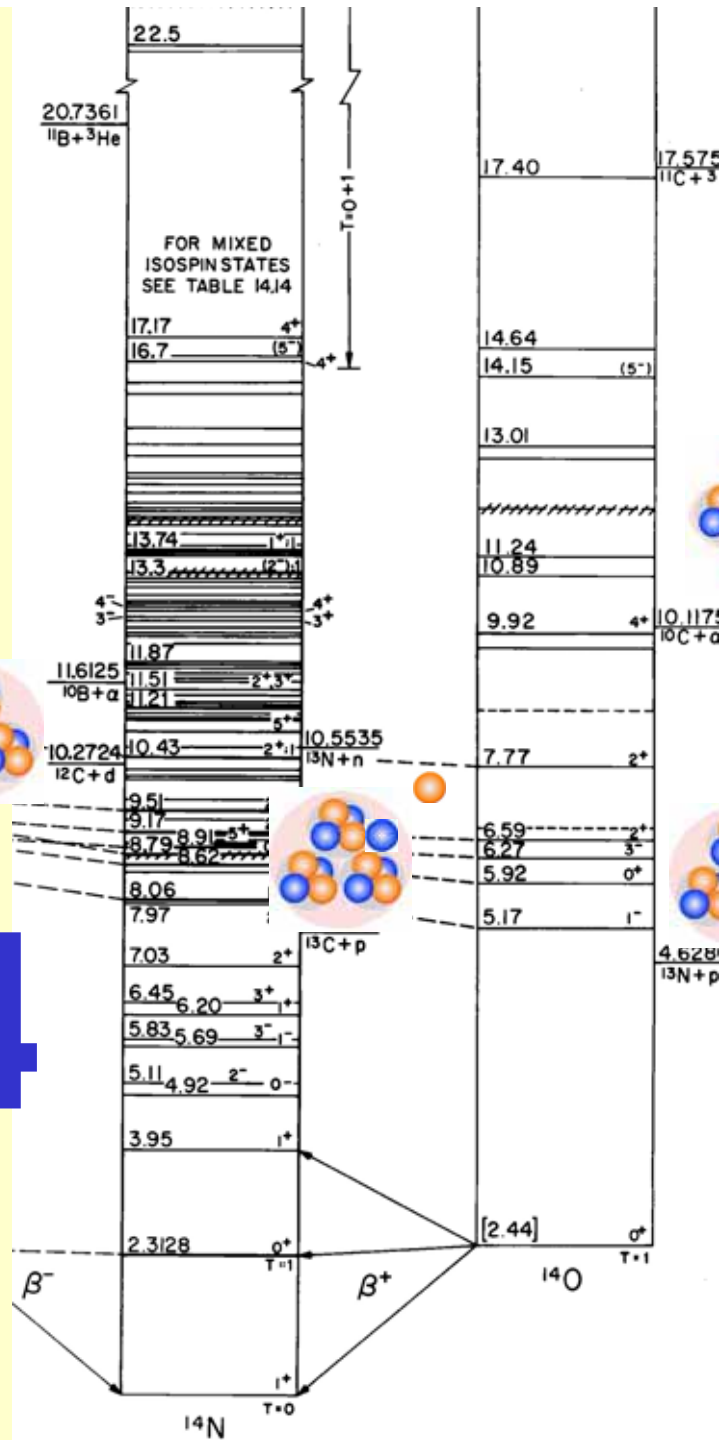
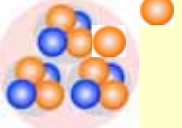
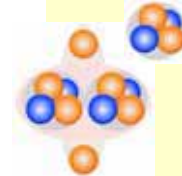
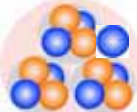
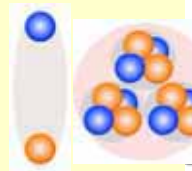
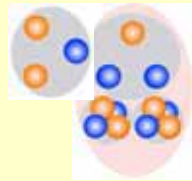
**$^8\text{C} \rightarrow \text{pp}^6\text{Be}$
-2.14 MeV**



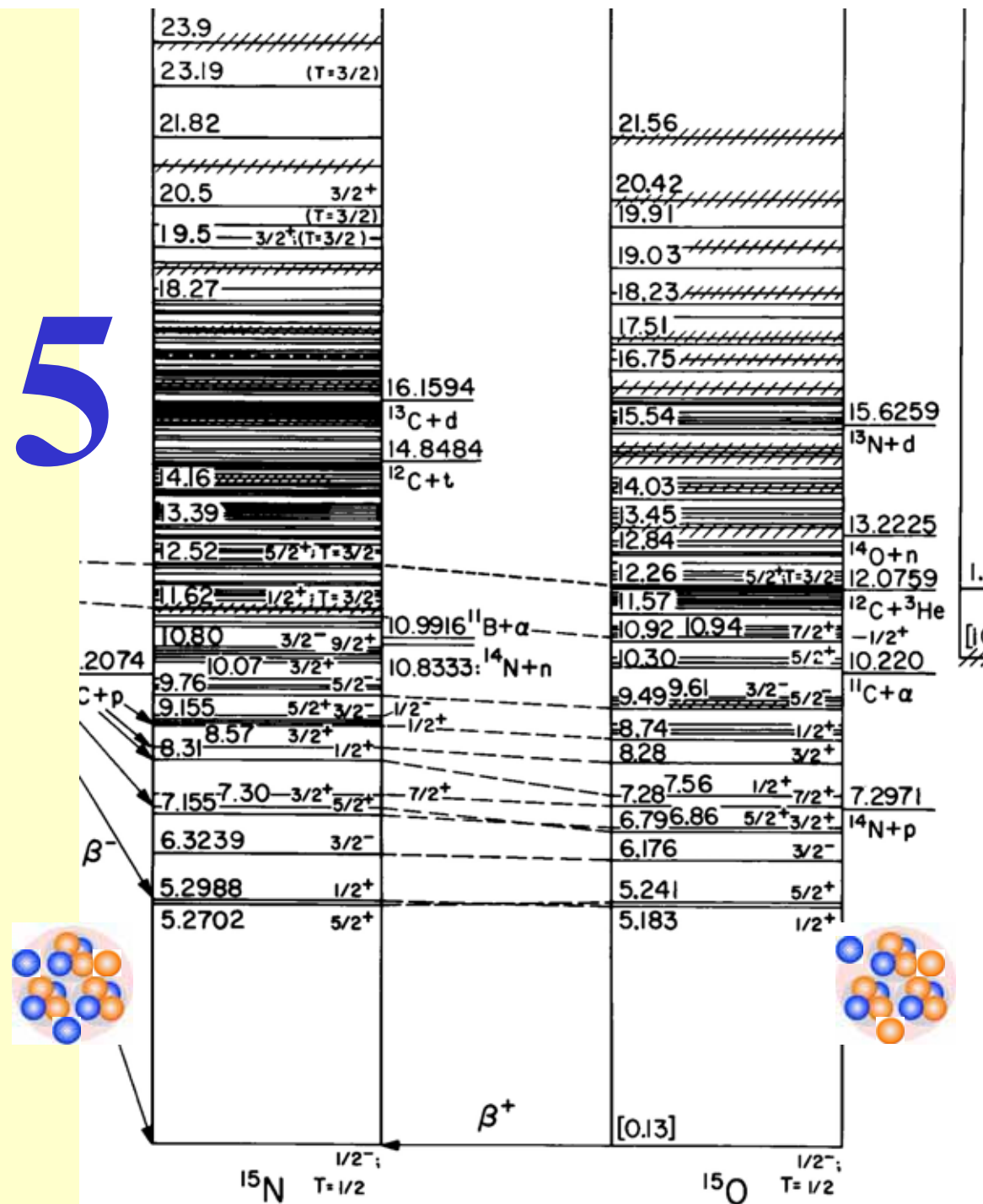
Crossing proton stability frontier



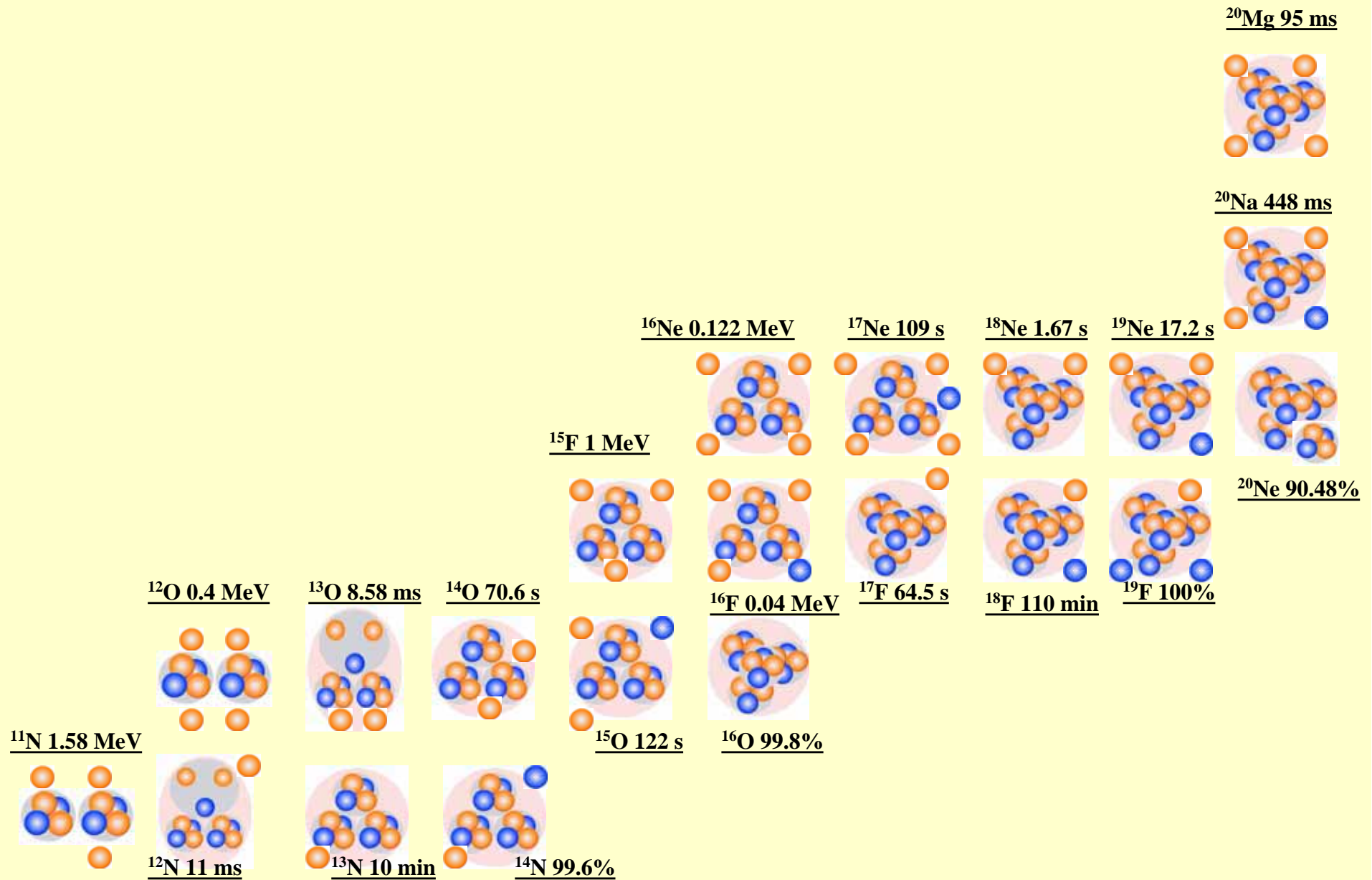
A=14



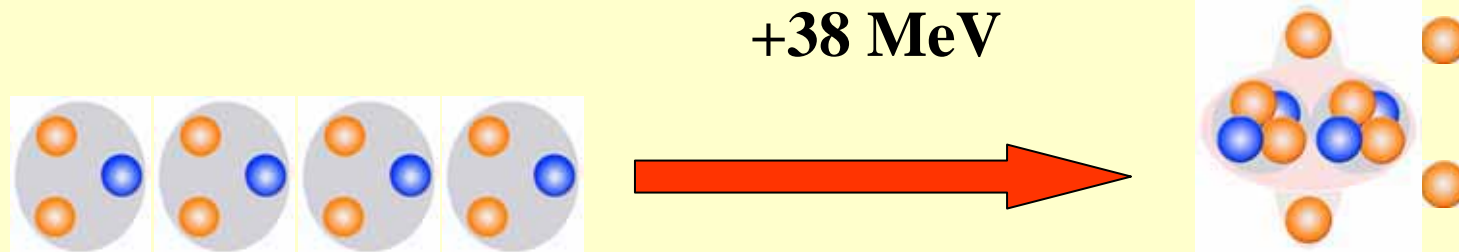
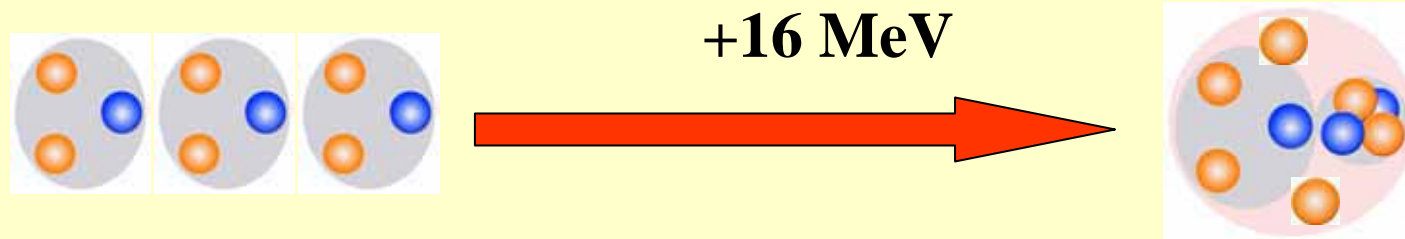
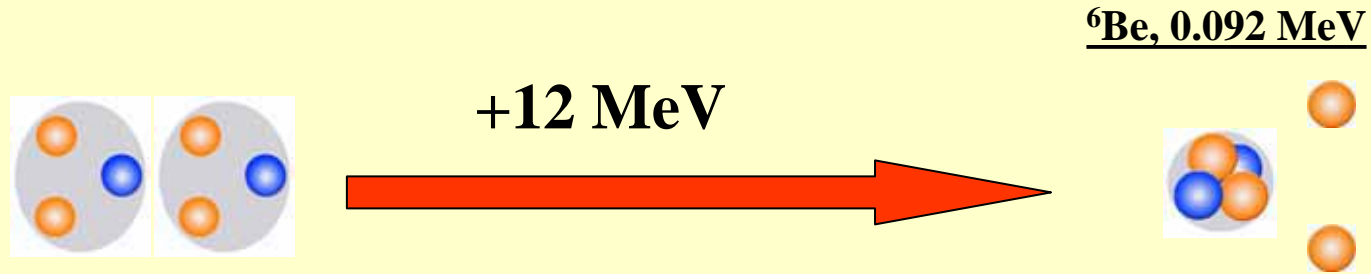
A=15



Walking along proton stability line

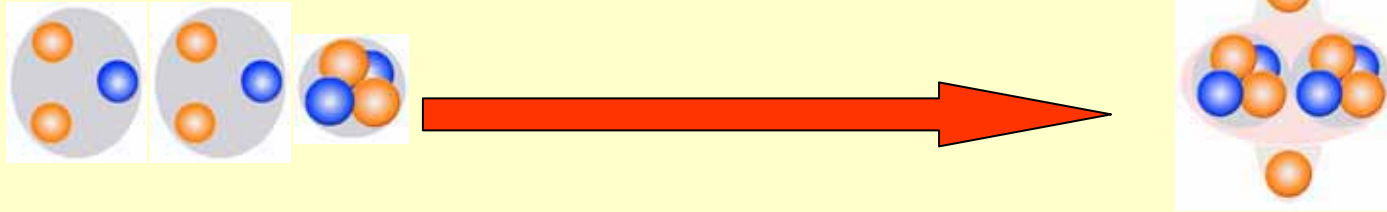


Multifragmentation in H&He



Multifragmentation in H&He

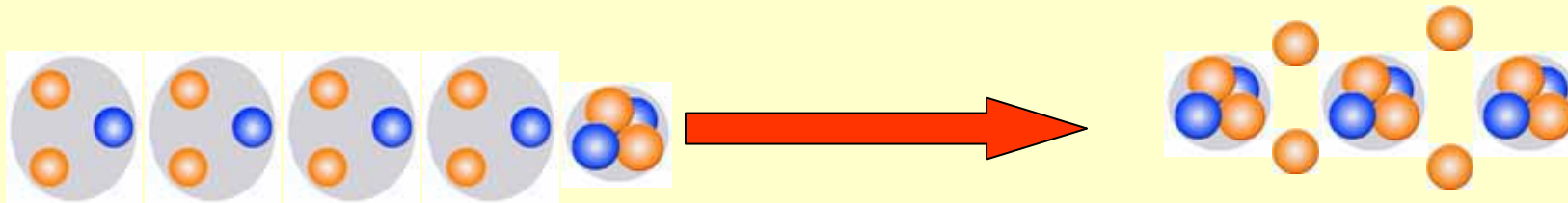
^{10}C 19.2 s



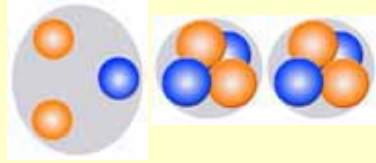
^{13}O 8.58 ms



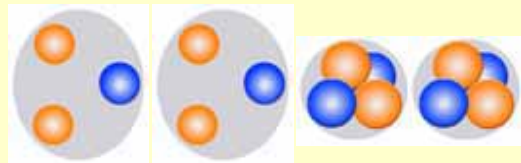
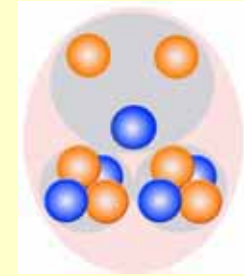
^{16}Ne 0.122 MeV



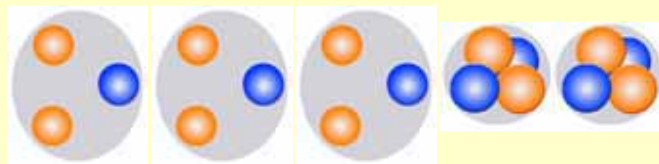
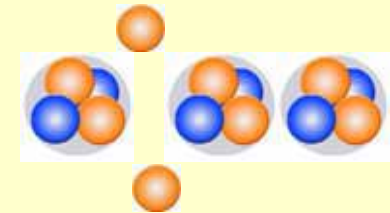
Multifragmentation in H&He



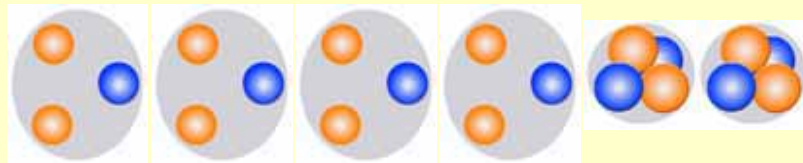
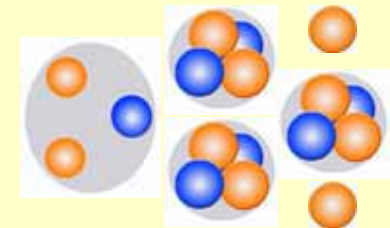
^{11}C 20.38 m



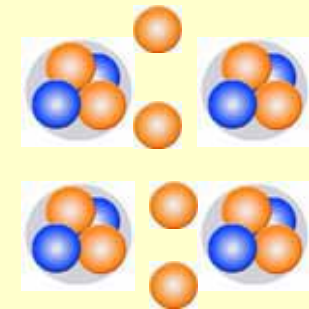
^{14}O 70.6 s



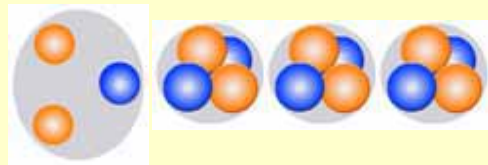
^{17}Ne 109 s



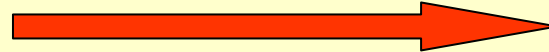
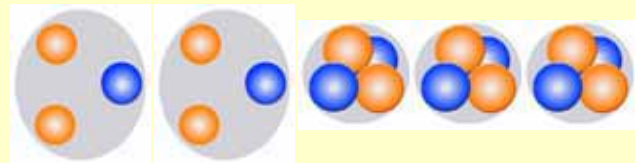
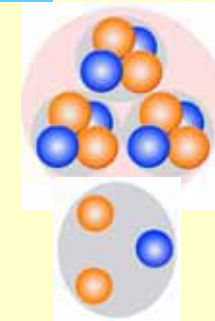
^{20}Mg 95 ms



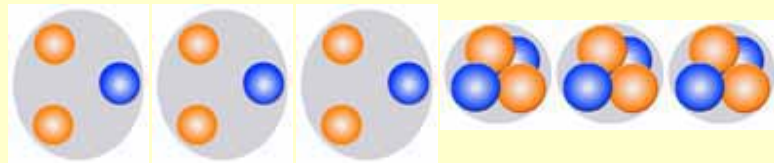
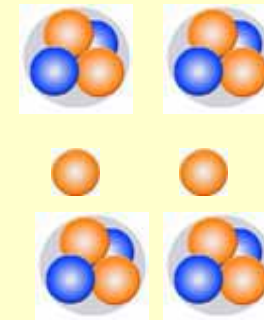
Multifragmentation in H&He



^{15}O 122 s



^{18}Ne 1.67 s



^{21}Mg 122 ms

