

Low-energy & High-energy Super Gamow-Teller states formed on Cluster-core Nuclei

Yoshitaka FUJITA

RCNP & Dpt. Phys., Osaka Univ.

Developments of Physics of Unstable Nuclei (YKIS2022b)

Kyoto, Yukawa, May 23-27, 2022



1

Gamow-Teller transition

Caused by the spin-isospin operator

i.e., “sigma-tau ($\sigma\tau$)” operator

Between the initial & final states

→ no **spatial** wave-function change

is expected (no nuclear-shape change)

Change spin & isospin by one-unit

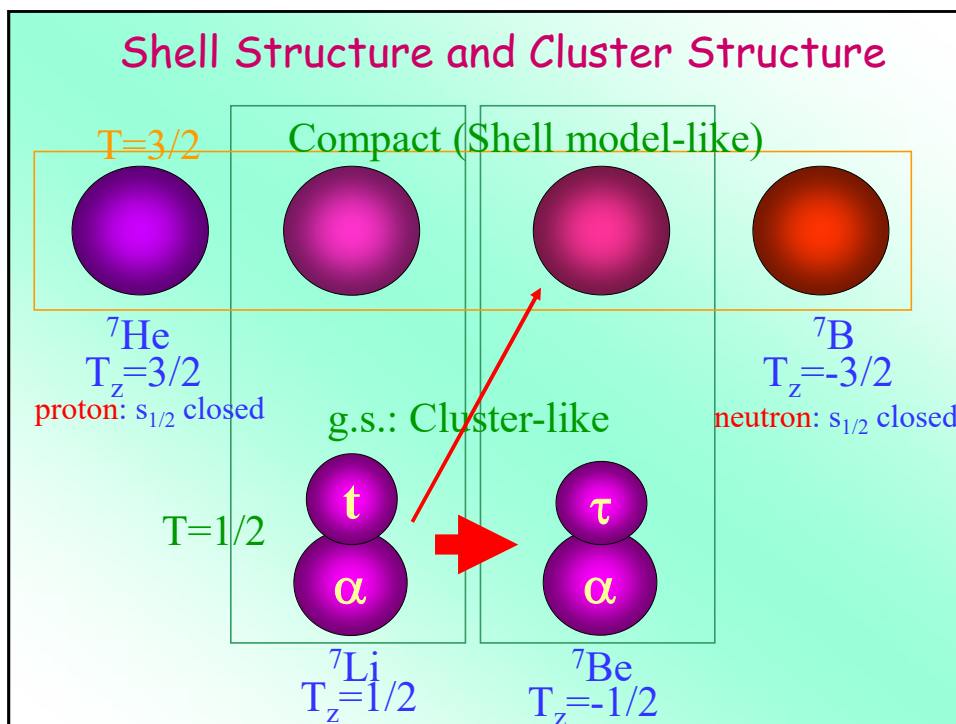
$$\Delta J^\pi = 0, +1, -1$$

$$\Delta T = 0, +1, -1 \quad (\Delta T_z = 0, +1, -1)$$

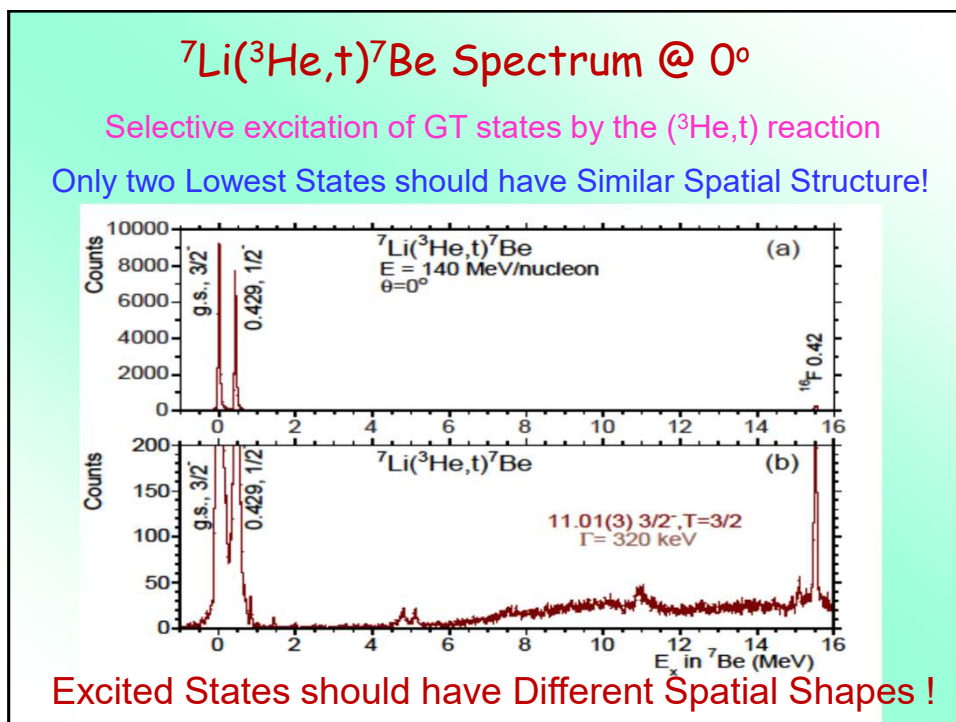
Studied by weak int. ; β -decay

by strong int. ; Charge-Exchange reactions

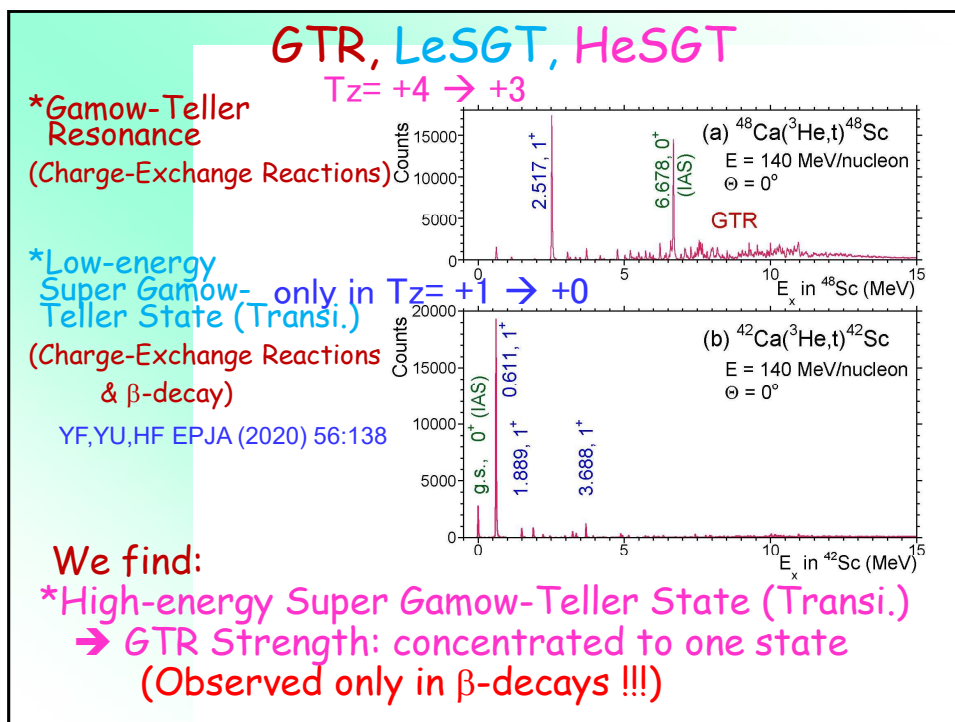
2



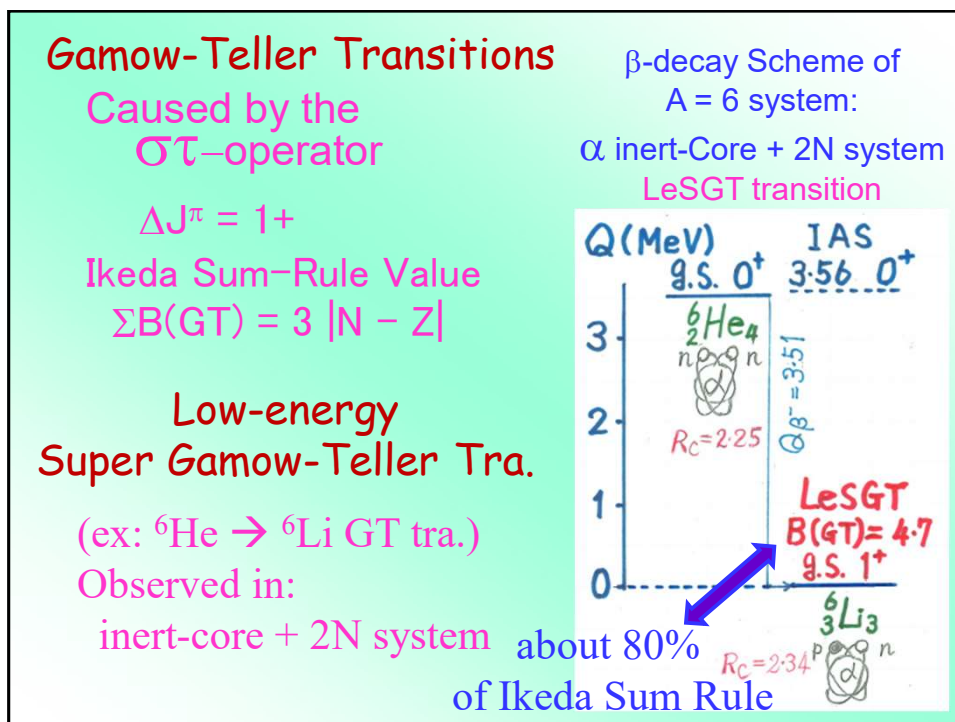
3



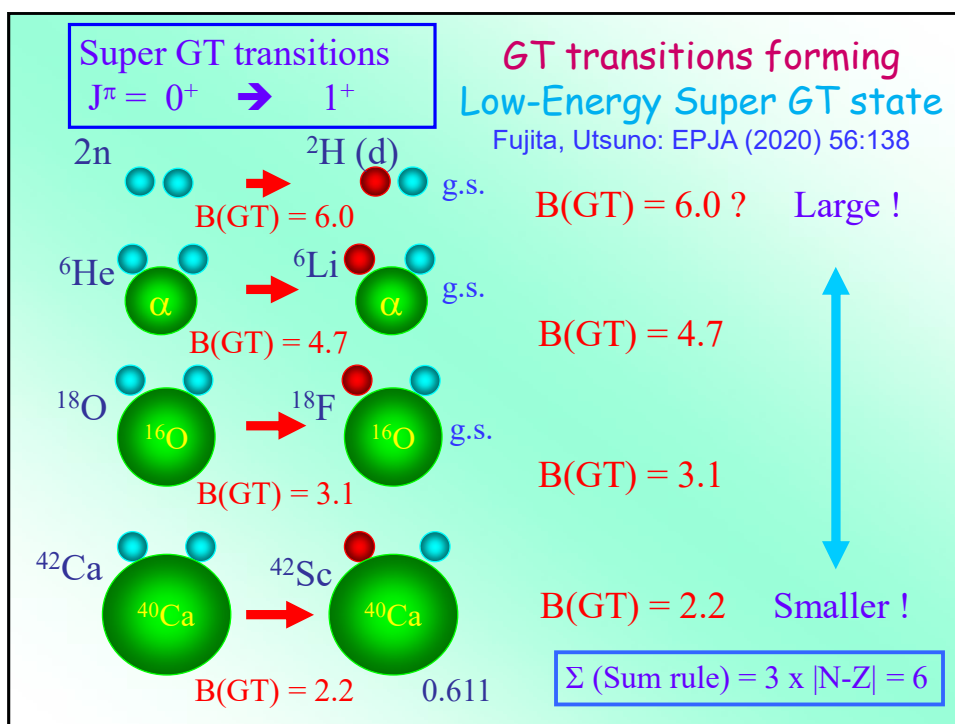
4



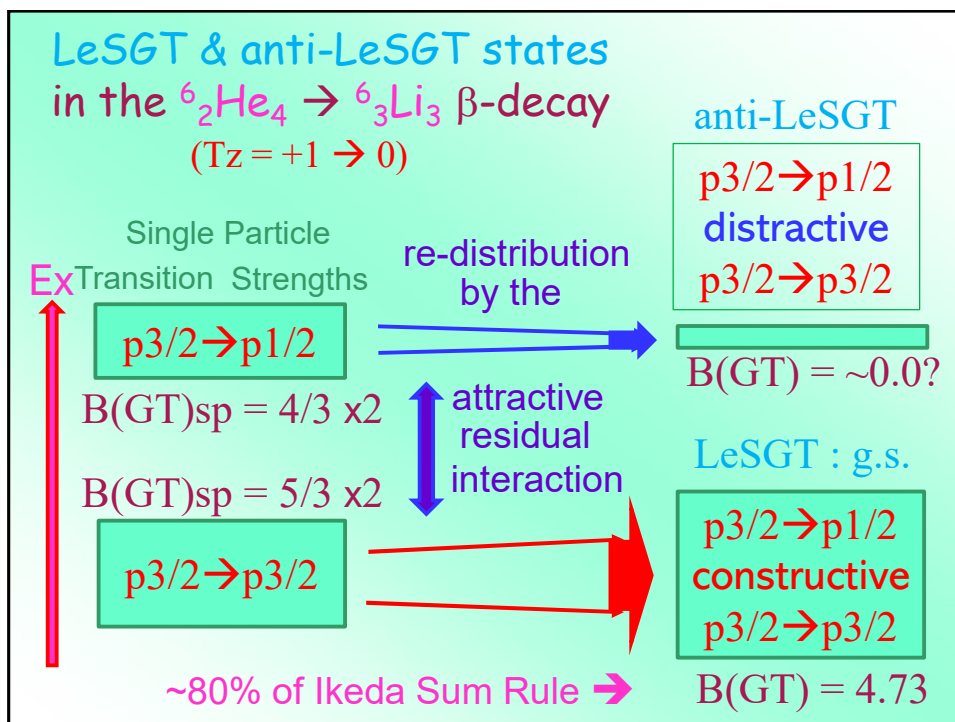
5



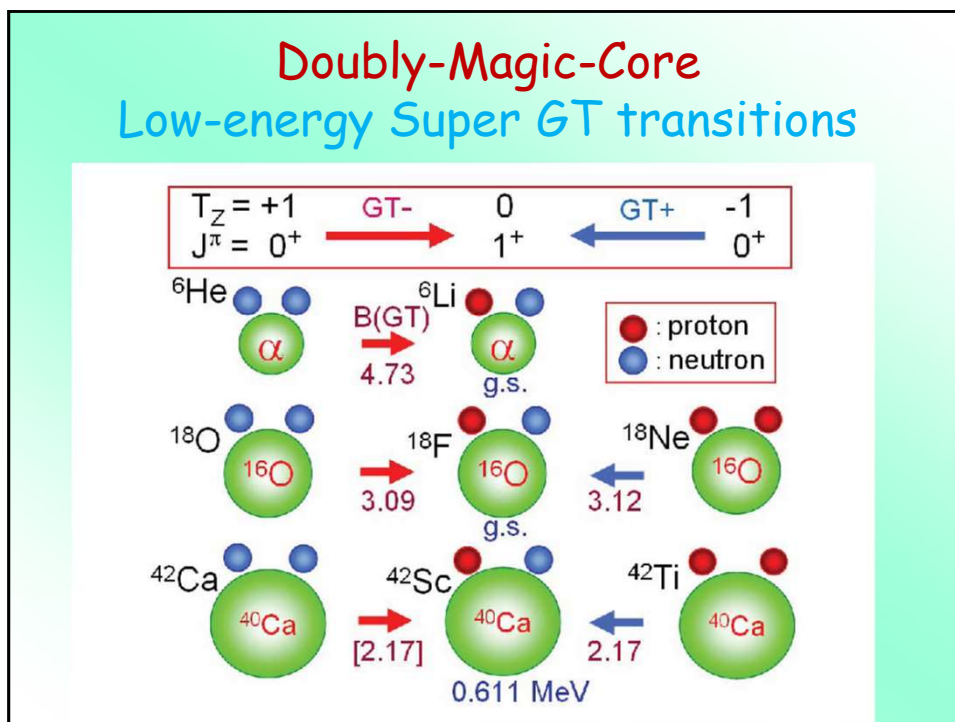
6



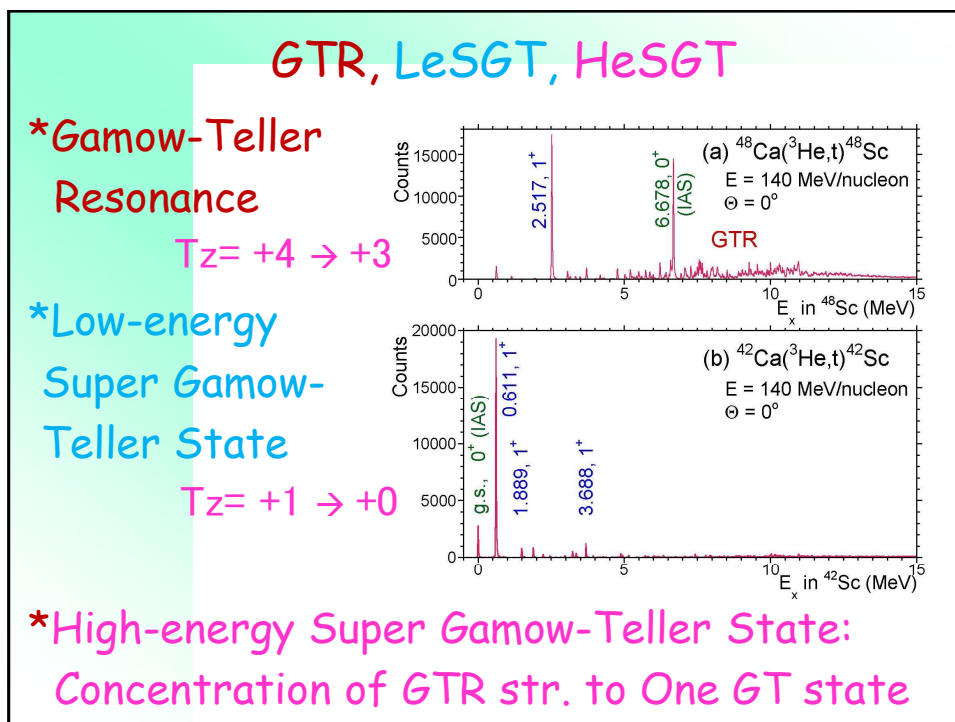
7



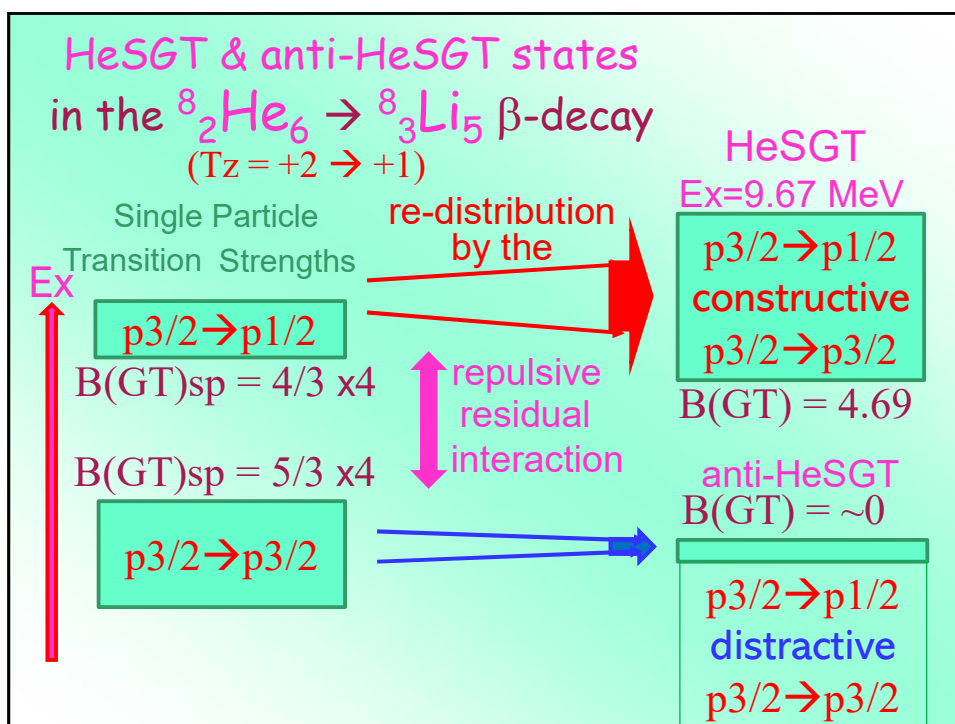
8



9



10



11

Cluster-structure Nuclei
can also be the Core structure !

seeking for:

- A) Low-energy Super Gamow-Teller states
(LeSGT states)
formed on Cluster-core Nuclei
- B) High-energy Super Gamow-Teller states
(HeSGT states)
formed on Cluster-core Nuclei

Available β -decay data has been analyzed !

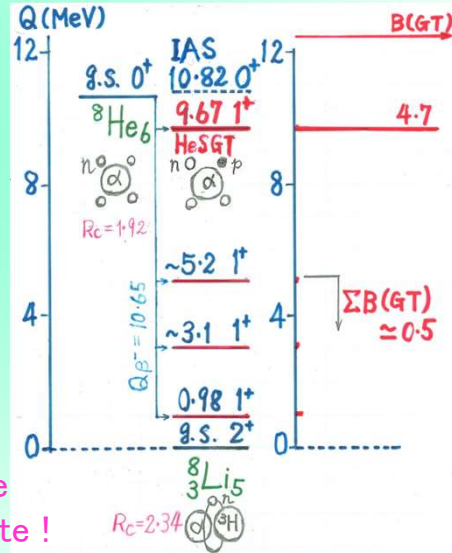
12

A=8 Cluster Structure (II)

$T_z = +2 \rightarrow +1$

HeSGT state
should have a similar
"spatial" structure
to the mother state !

We Now can Know
the Cluster Structure
of Highly Excited State !

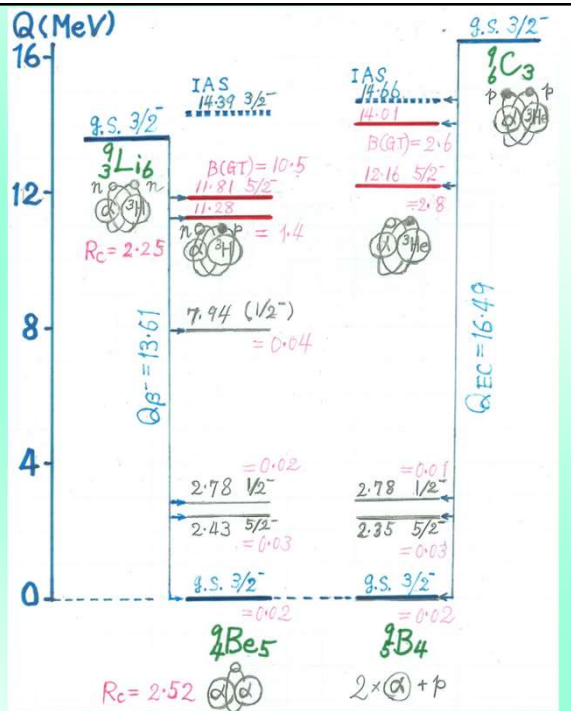


13

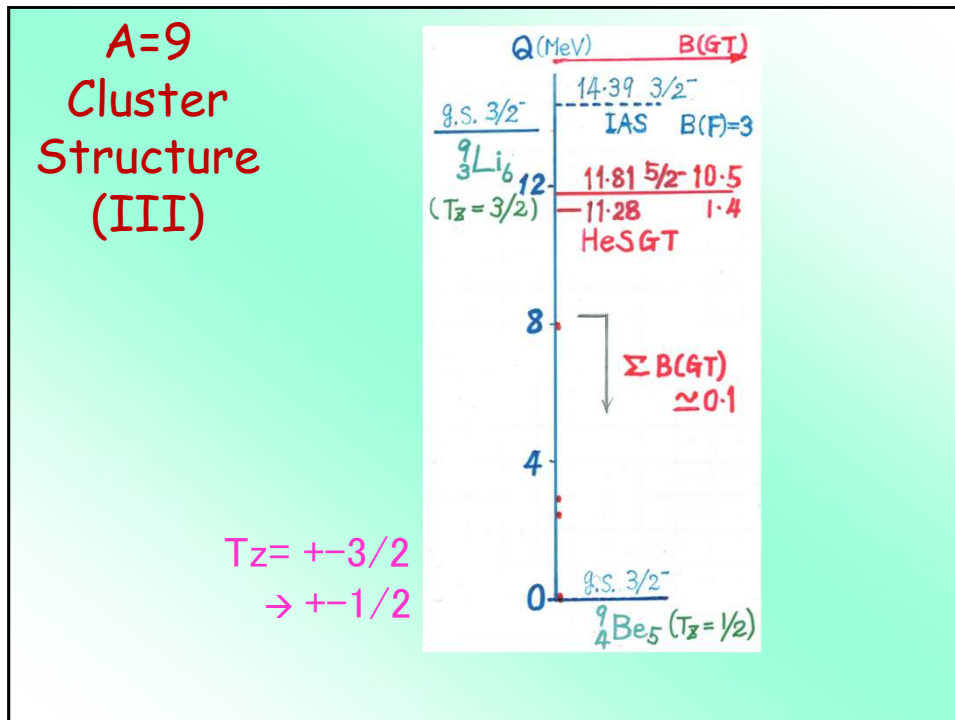
A=9 Cluster Structure (II)

$T_z = +-3/2$
 $\rightarrow +-1/2$

HeSGT state
should have a similar
"spatial" structure
to the mother state !



14



15

SUMMARY

- * **Gamow-Teller transitions**
- Caused by the $\sigma \tau$ spin-isospin operator
i.e., “sigma-tau ($\sigma \tau$)” operator
- # Between the initial & final states
 - no change of **spatial** wave-function is expected (no nuclear-shape change)
 - Similarity or difference of “SHAPES” of the initial and final states are studied.
- Cluster Structures are deduced for the Highly Excited GT States !

16