Di-neutron correlations , CDCC theory

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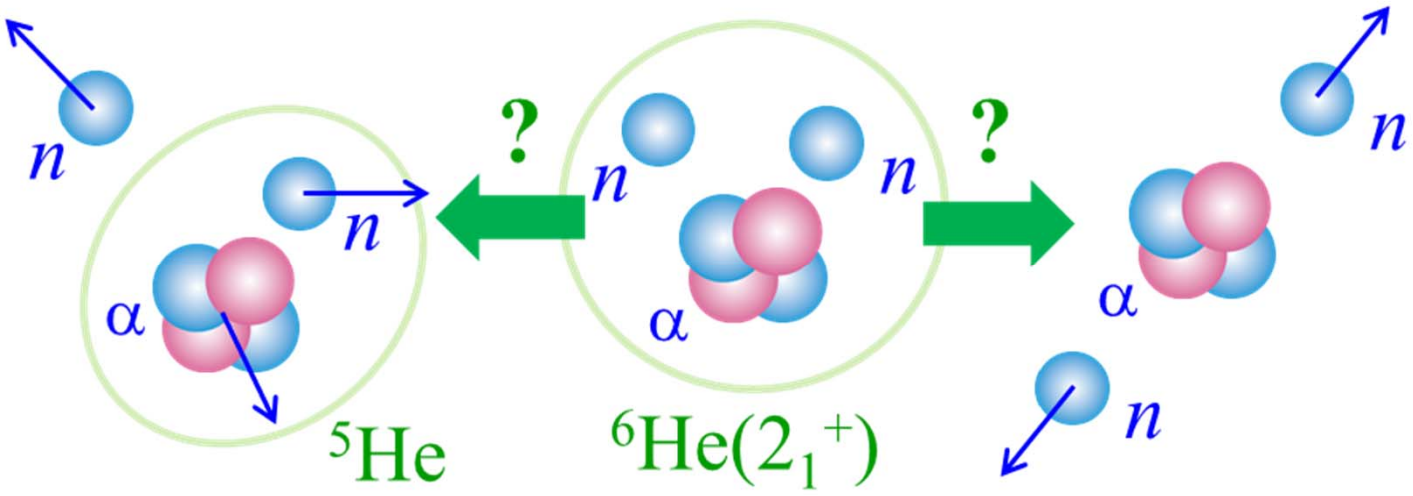
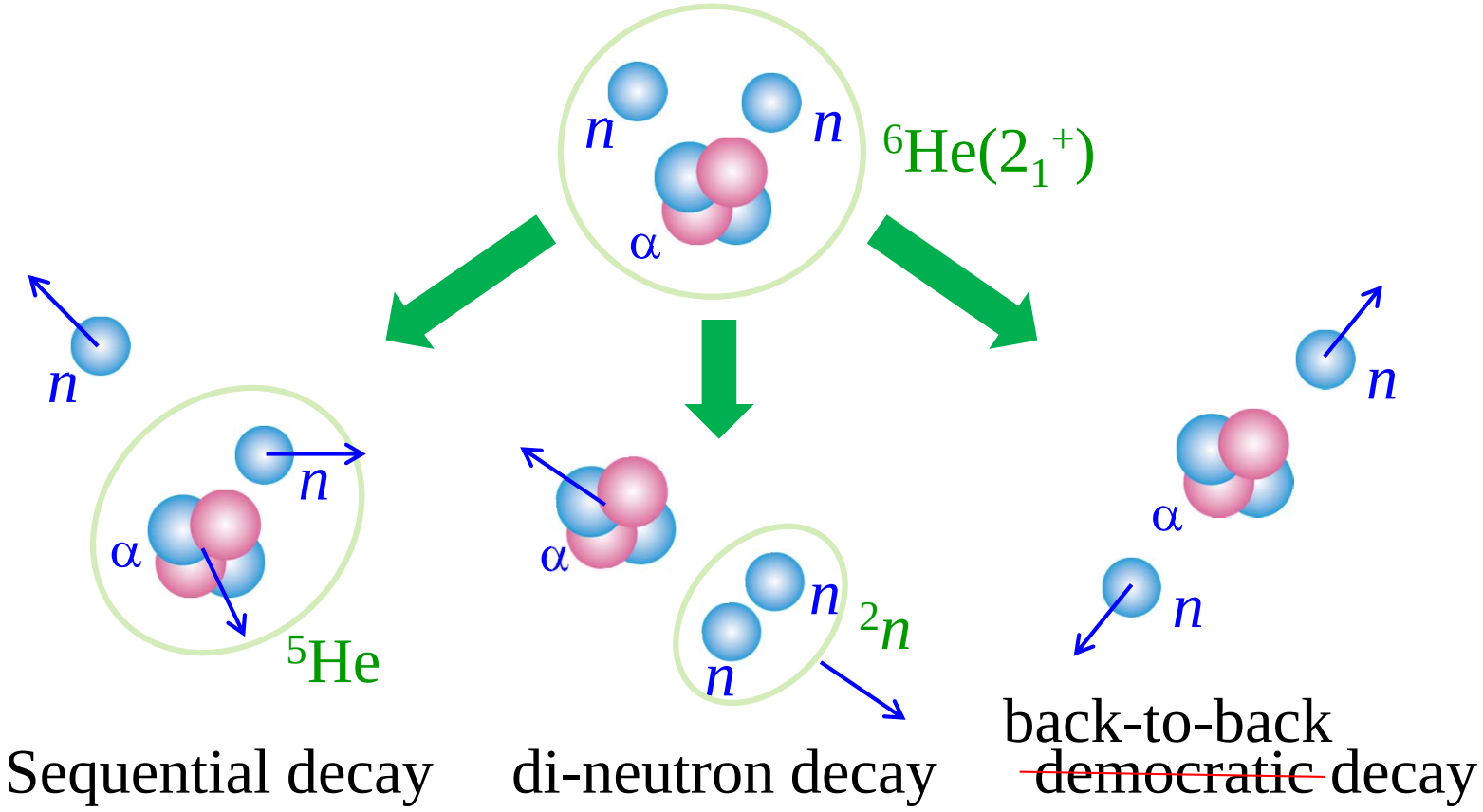


2nd topic (of my talk at ARIS2014)

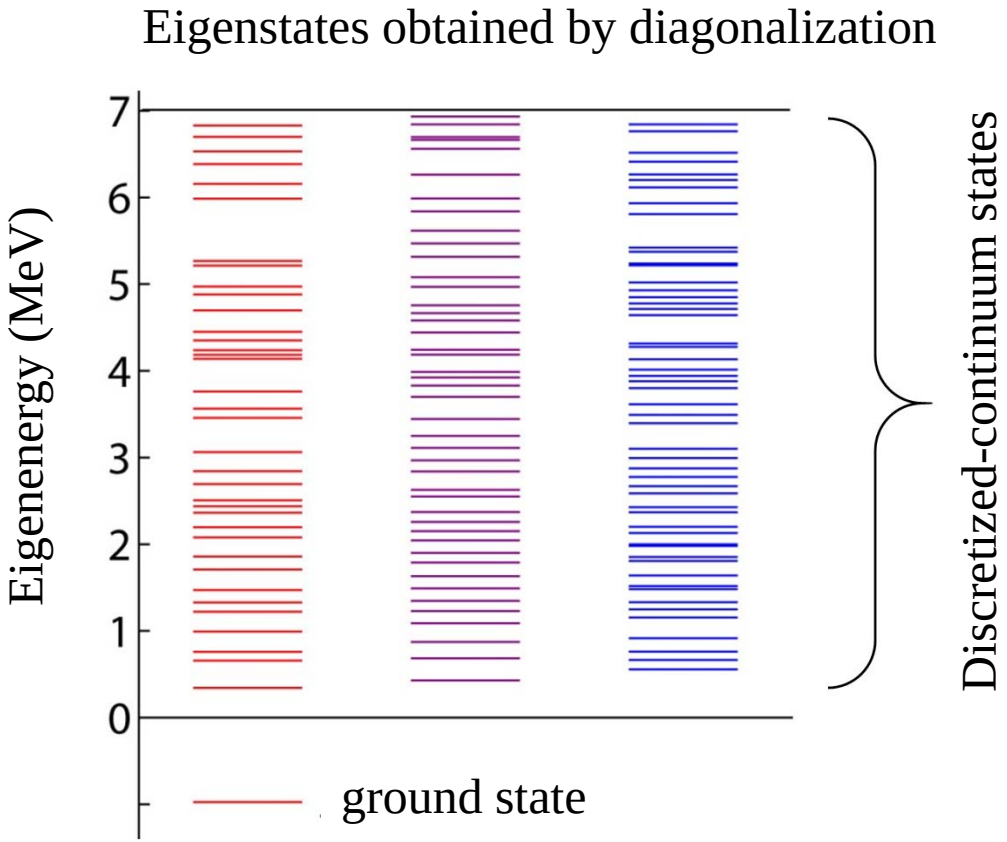
What is the decay mode of the 2_1^+ state of ^{6}He?

Y. Kikuchi, Matsumoto, Minomo, O, PRC**88**, 021602 (2013).



Four-body CDCC: ^{6}He+^{12}C at 250 A MeV

Pseudostate discretization



Set of the ^{22}C internal wave functions
(*basis functions* for the 4-body system)

$$\Psi^{\mathrm{CDCC}} = \sum_{i=0}^{i_{\max}} \hat{\phi}_i \hat{\chi}_i$$

Relative motion between ^{22}C and target
(*expansion coefficients*)

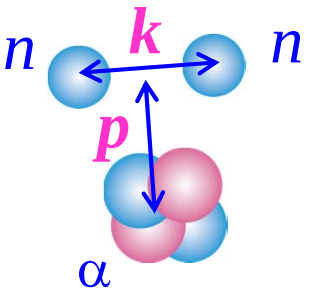
Details of four-body CDCC:

T. Matsumoto *et al.*, PRC **70**, 061601(R) (2004); ibid. 73, 051602(R) (2006).

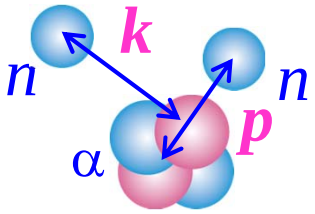
M. Rodriguez-Gallardo *et al.*, PRC **80**, 051601 (2009).

CDCC-CSLS

✓ The method of Complex-Scaled solutions of the Lippmann-Schwinger Eq.



or



Y. Kikuchi, Myo, Takashina, Kato, Ikeda, PTP**122**, 499 (2009).

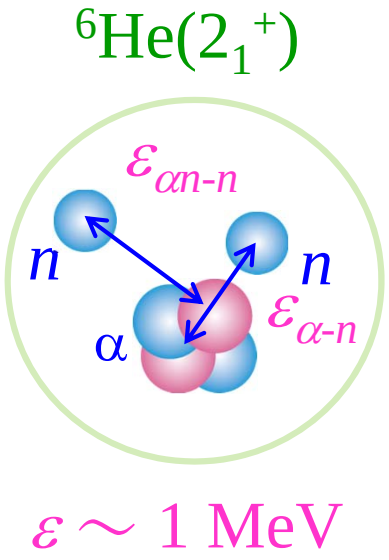
$$T(\boldsymbol{p},\boldsymbol{k}) = \sum_n \left\langle \Phi^{(-)}(\boldsymbol{p},\boldsymbol{k}) \middle| \Phi_n \right\rangle T_n^{\mathrm{CDCC}}$$

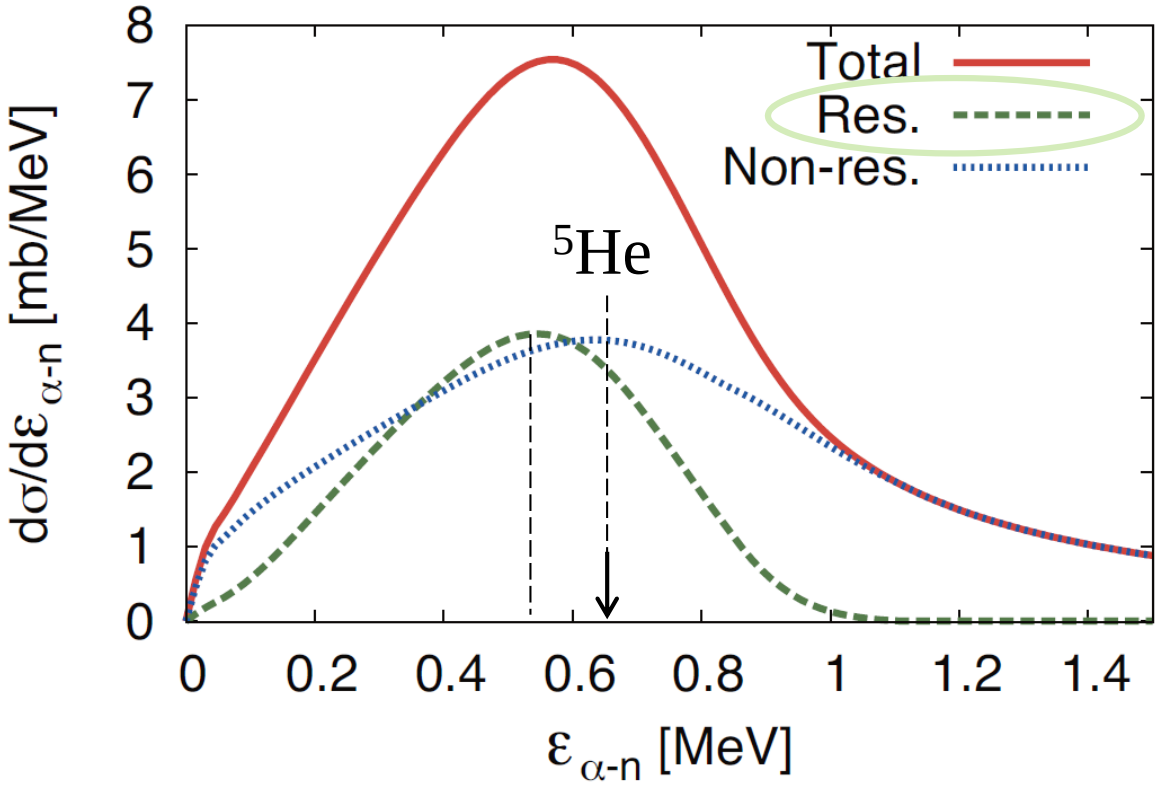
$$\equiv \sum_n f_n(\boldsymbol{p},\boldsymbol{k})\, T_n^{\mathrm{CDCC}}$$

$$f_n(\boldsymbol{p},\boldsymbol{k}) = \left\langle \varphi_{\mathrm{free}}(\boldsymbol{p},\boldsymbol{k}) \middle| \Phi_n \right\rangle + \sum\!\!\!\!\!\!\int_i \left\langle \varphi_{\mathrm{free}}(\boldsymbol{p},\boldsymbol{k}) \middle| V_{\alpha nn} C^{-1}(\theta) \middle| \phi_i^\theta \right\rangle$$

$$\times \frac{1}{\varepsilon - \varepsilon_i^\theta} \left\langle \tilde{\phi}_i^\theta \middle| C(\theta) \middle| \Phi_n \right\rangle$$

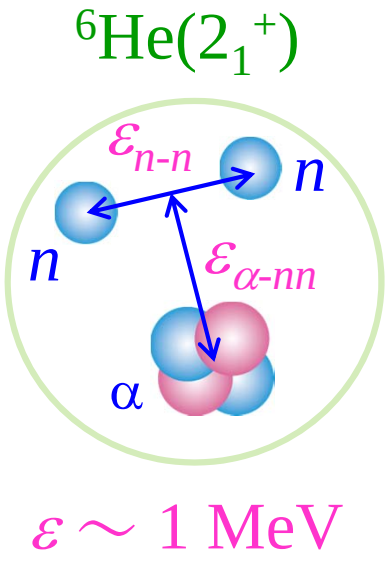
Sequential decay quenched

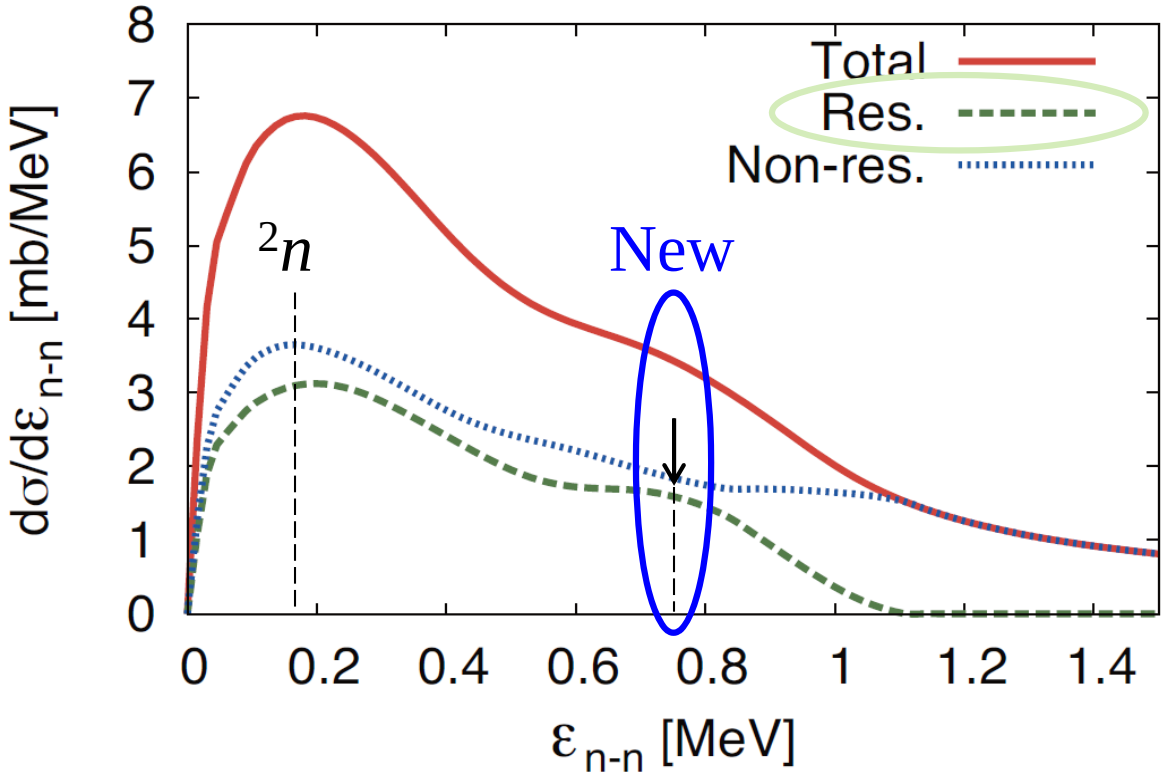




- ✓ When $\varepsilon \sim 1$ MeV and $\varepsilon_{\alpha\text{-}n} \sim 0.7$ MeV, the other neutron (~ 0.3 MeV) hardly penetrates the centrifugal barrier (*p*-wave).
- ✓ The peak of the green line suggests the di-neutron decay or the democratic decay.

Coexistence of two decay modes





✓ The lower peak suggests the di-neutron decay due to the Fin. State Int. (FSI).

✓ The higher peak indicates the democratic decay.

➡ Decay of a di-neutron in the 2_1^+ state not due to the FSI.

Summary of the 2nd topic

What is the decay mode of the 2_1^+ state of ^{6}He?

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