Microscopic description of many-body tunneling with Time-Dependent Generator Coordinate Method

Naoto Hasegawa

Nuclear theory group, D2

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Goal

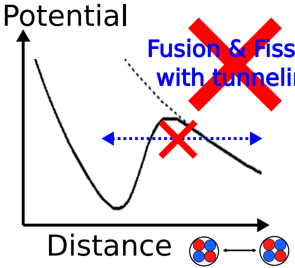
Microscopic description of many-body tunneling

Problem

mean-field

$$\Psi(t) = \Phi(t) = \mathcal{A}\left[\phi_1(x_1,t)\phi_2(x_2,t)\cdots\phi_A(x_A,t)\right]$$

Fluctuation missing



Solusion

Beyond mean-field

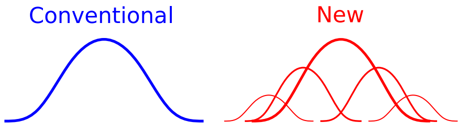
$$\Psi(t) = \int da\, f_a(t)\Phi_a(t)$$

Restore fluctuation

Time-Dependent Generator Coordinate Method

$$\delta \int dt \frac{\langle\Psi|H - i\hbar\partial_t|\Psi\rangle}{\langle\Psi|\Psi\rangle} = 0$$

Nucleus wave function



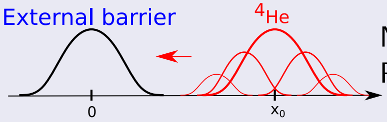
Plan of my research

1st year

- **Construct new theory for nuclear reaction**

2nd year (here now)

- **Test new theory in 1D** (Collide $^4\mathrm{He}$ to external barrier)



The paper is published

N. H., K. Hagino, Y. Tanimura, Phys. Lett. B 808, 135693 (2020)

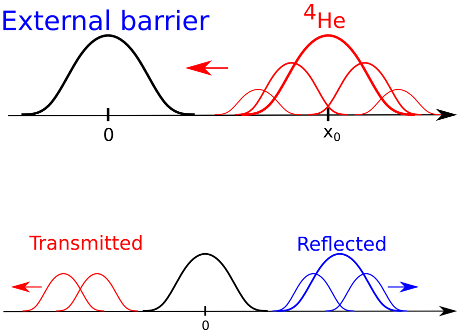
3rd year

- **Extension to 3D and realistic case**

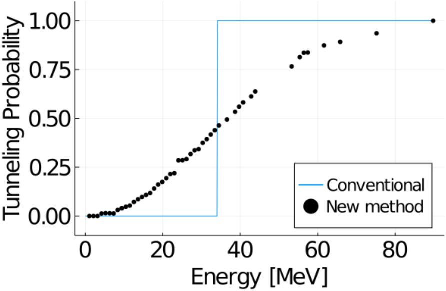
Current status

Collide ^{4}He to Gaussian barrier

$\Psi = \int da f_a \Phi_a$ $\quad$ a : Initial CM position & momentum



Result : Describe continuous tunneling probability



Plan of GPPU duty

Seminar point (DONE)

GSP 17 + GASP 14

Plan of my study abroad

- Current status
  - 6weeks
- Future plan
  - FUSION20 (2021, 1week)
  - UK lockdown seminars (now)