

Deuteron-equivalent phase-equivalent transformation and its manifestation in many-body systems.

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Method

$$H\Psi(E, r) = E\Psi(E, r),$$

$$|a_n\rangle \in \mathcal{L}^2 \quad \langle a_i | a_j \rangle = \delta_{ij}$$

$$\Psi(E, r) = \sum_{n=0}^{\infty} c_n(E) |a_n\rangle,$$

$$\sum_{n'=0}^{\infty} (H_{nn'} - \delta_{nn'} E) c_{n'}(E) = 0$$

PET

(phase-equivalent transformation)

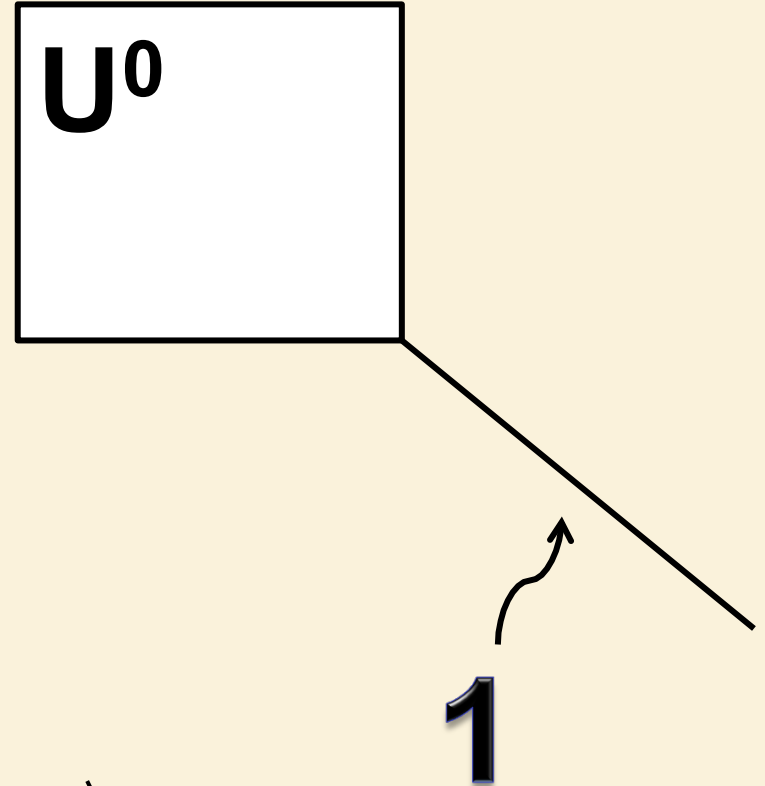
$$[\tilde{H}] = [U][H][U^\dagger]$$

$$[U] = [U^0] \oplus [I]$$

$$U^0 = \sum_{i,j \leq N} |a_i\rangle U_{i,j}^0 \langle a_j|$$

$$\Psi(E, r) = \sum_{n=0}^{\infty} c_n(E) |a_n\rangle,$$

$$\tilde{\Psi}(E, r) = \sum_{n=0}^N \tilde{c}_n(E) |a_n\rangle + \sum_{n=N+1}^{\infty} c_n(E) |a_n\rangle$$



DET-PET

(deuteron-equivalent phase-equivalent transformation)

$$[\tilde{H}] = [U][H][U^\dagger]$$

$$[U] = [U^0] \oplus [I]$$

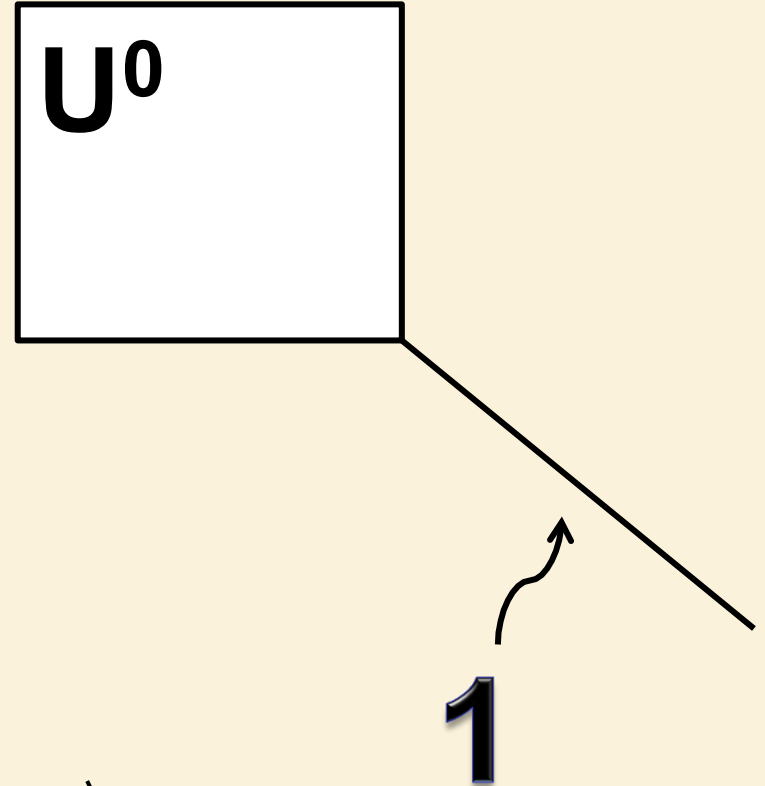
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$$U |d\rangle = |d\rangle$$

$|d\rangle$ — deuteron wave function



DET-PET

(deuteron-equivalent PET)

$$U^0 = \sum_{i,j \leq N} |a_i\rangle U_{i,j}^0 \langle a_j|$$

$$|a_i\rangle = \sum_{l \leq N'} a_i^l \varphi_l$$

$$\langle a_i | a_j \rangle = \delta_{ij}$$

$$\langle a_i | d \rangle = 0, \quad i \leq N$$

$$|a_i\rangle = a_i^n \varphi_n + a_i^m \varphi_m + \dots$$

$$|d\rangle = d^n \varphi_n + d^m \varphi_m + \dots$$

DET-PET

Simplest case: U — 2×2 matrix

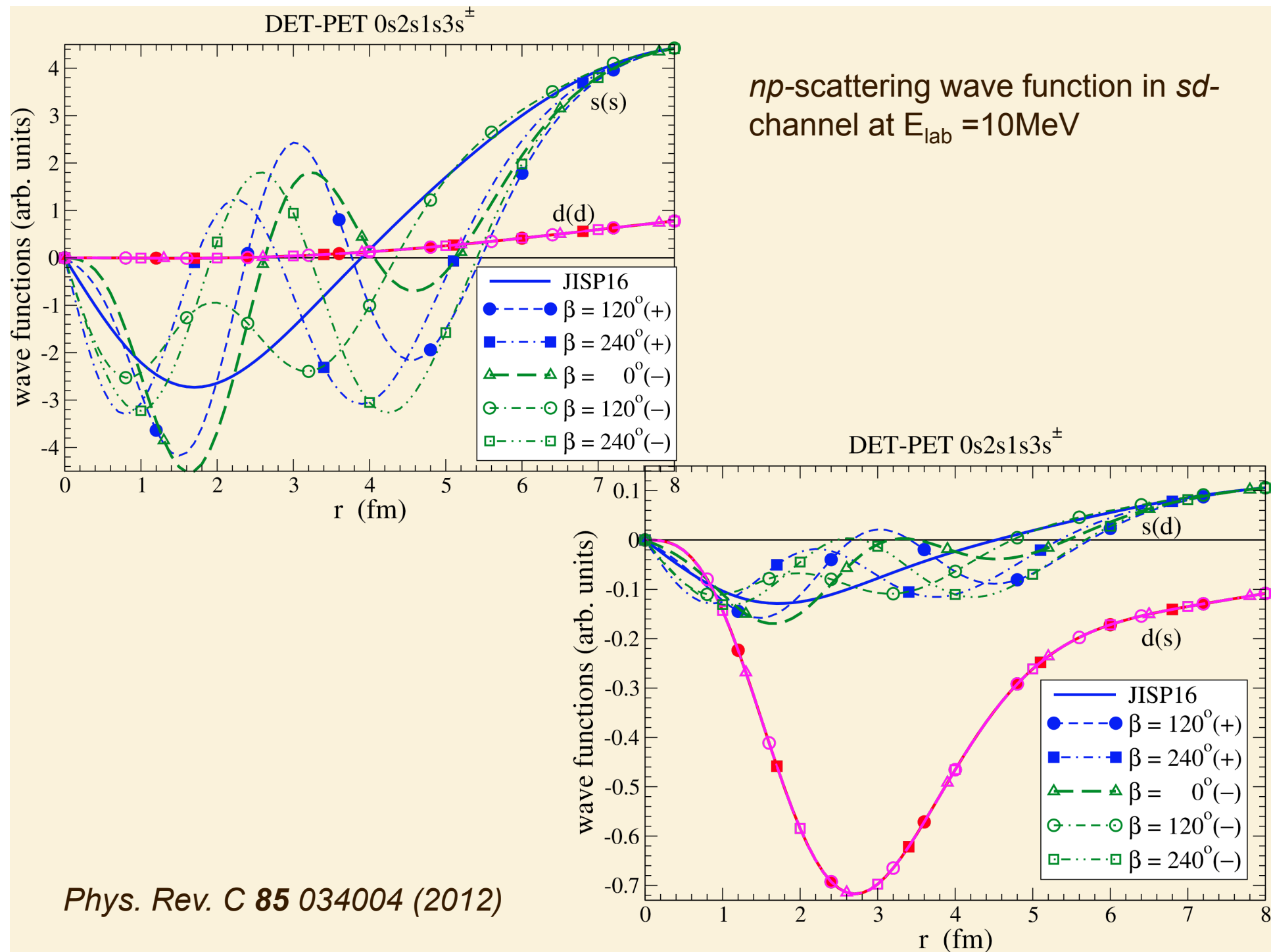
$$\begin{aligned} |a_1\rangle &= a_1^n \varphi_n + a_1^m \varphi_m \\ |a_2\rangle &= a_2^k \varphi_k + a_2^l \varphi_l \end{aligned} \quad a_1^n = \frac{d_m}{\sqrt{d_n^2 + d_m^2}} \quad a_1^m = -\frac{d_n}{\sqrt{d_n^2 + d_m^2}}$$

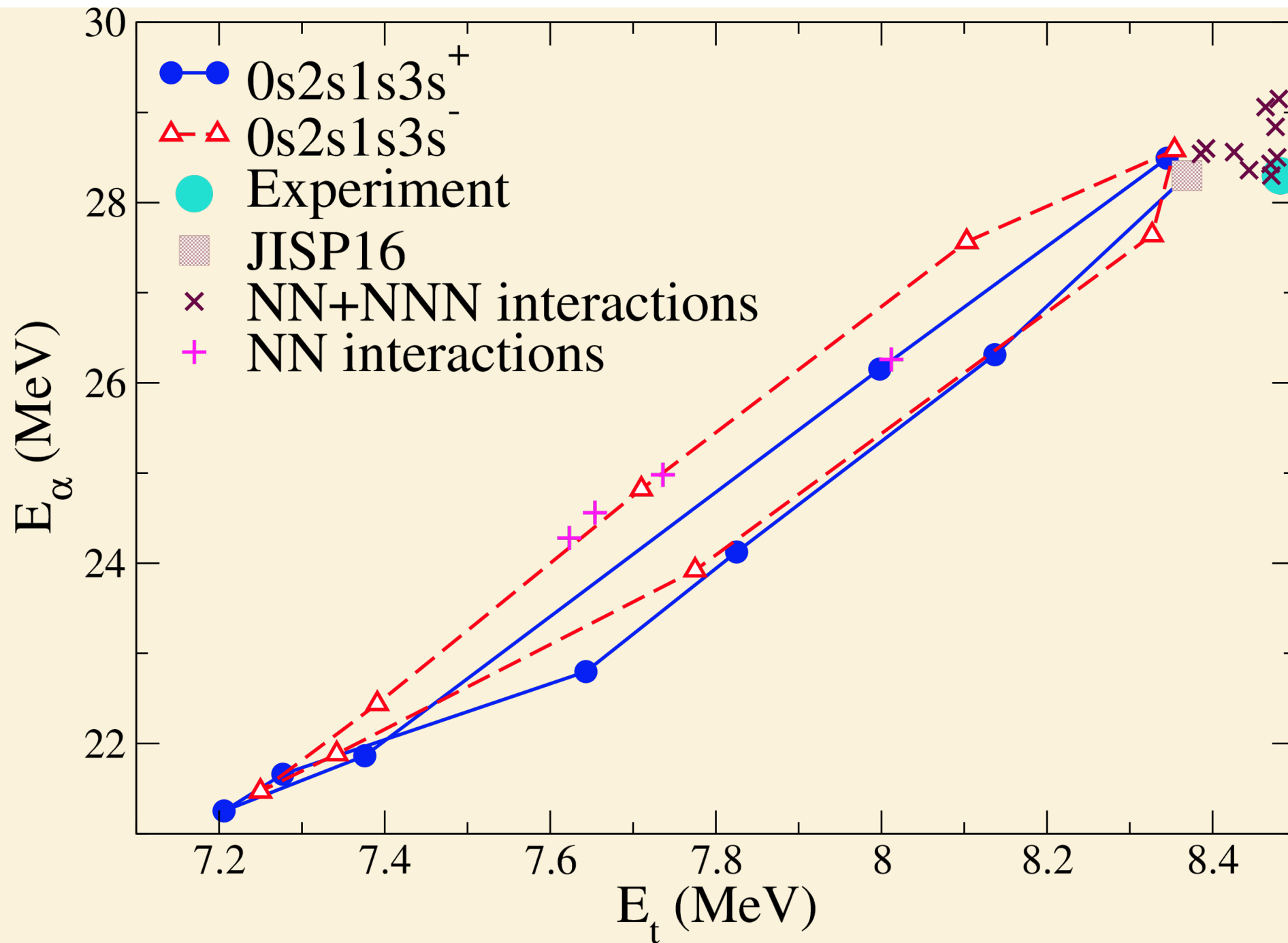
$$\det U_0 = +1 \quad \text{Rotation}$$

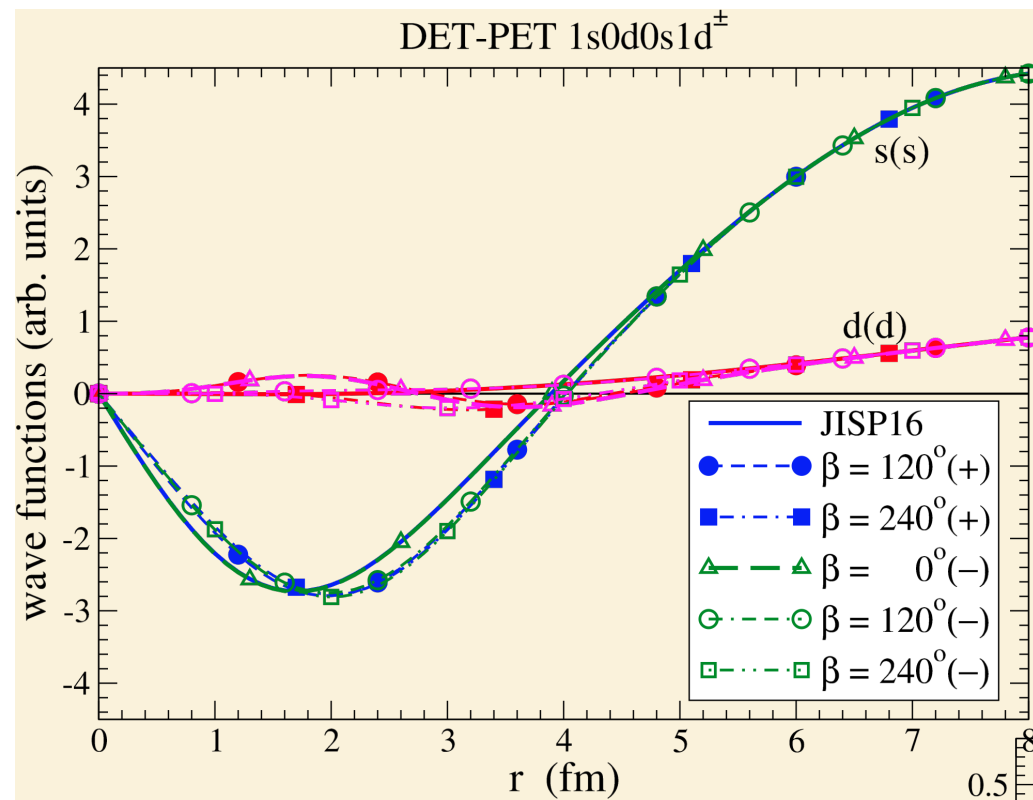
$$\det U_0 = -1 \quad \text{Rotation+reflection}$$

Notations: $\varphi_n = 0s$, $\varphi_m = 2s$, $\varphi_k = 1s$, $\varphi_l = 3s$

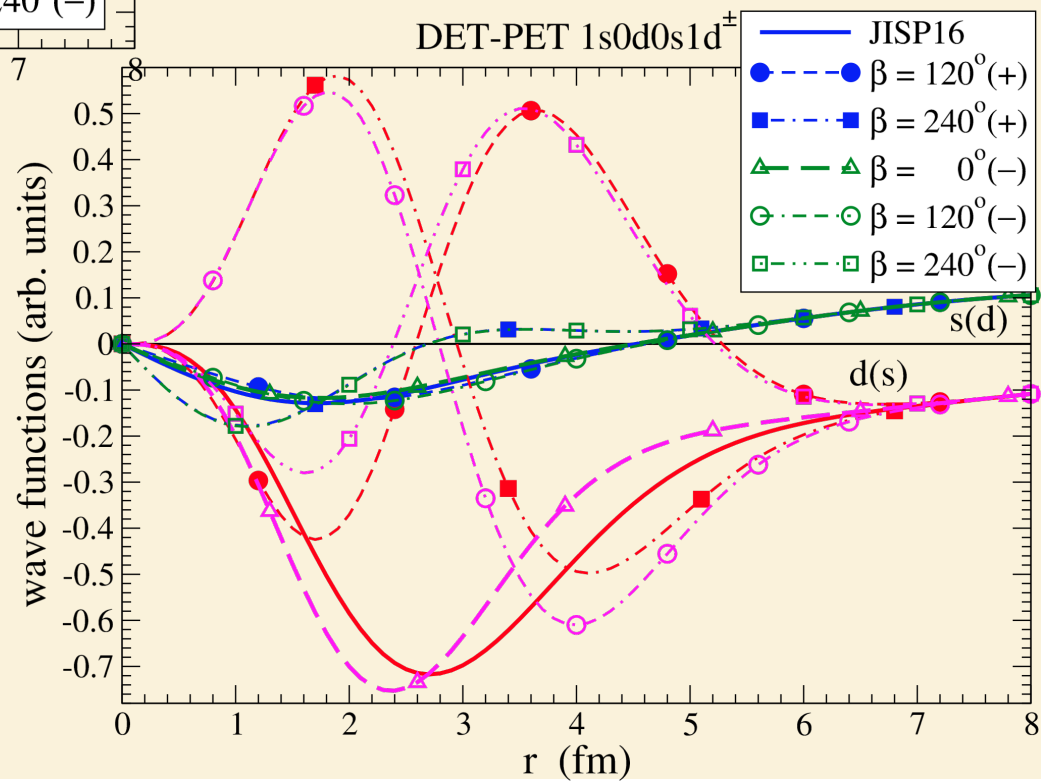
DET-PET 0s2s1s3s $^\pm$

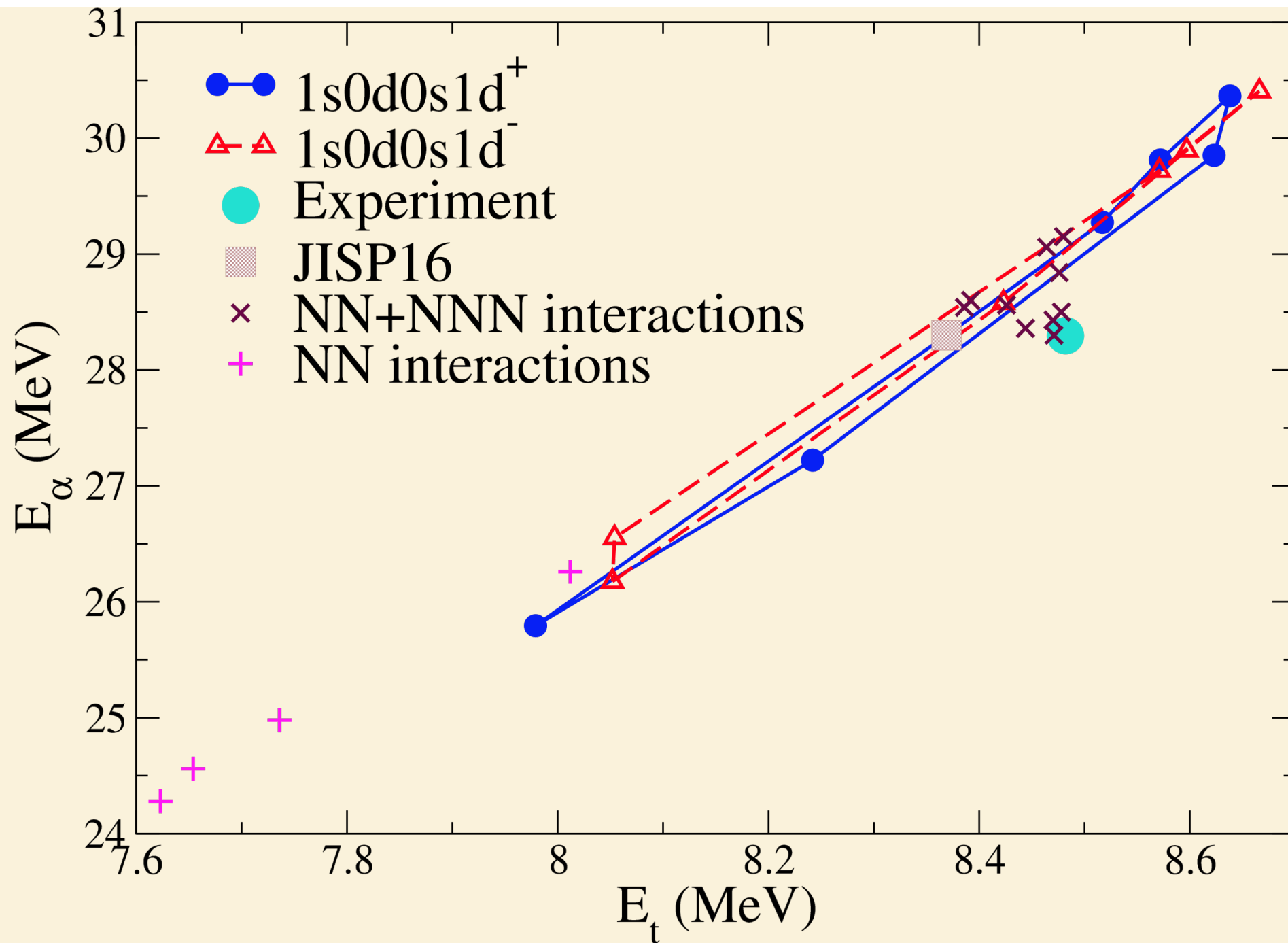


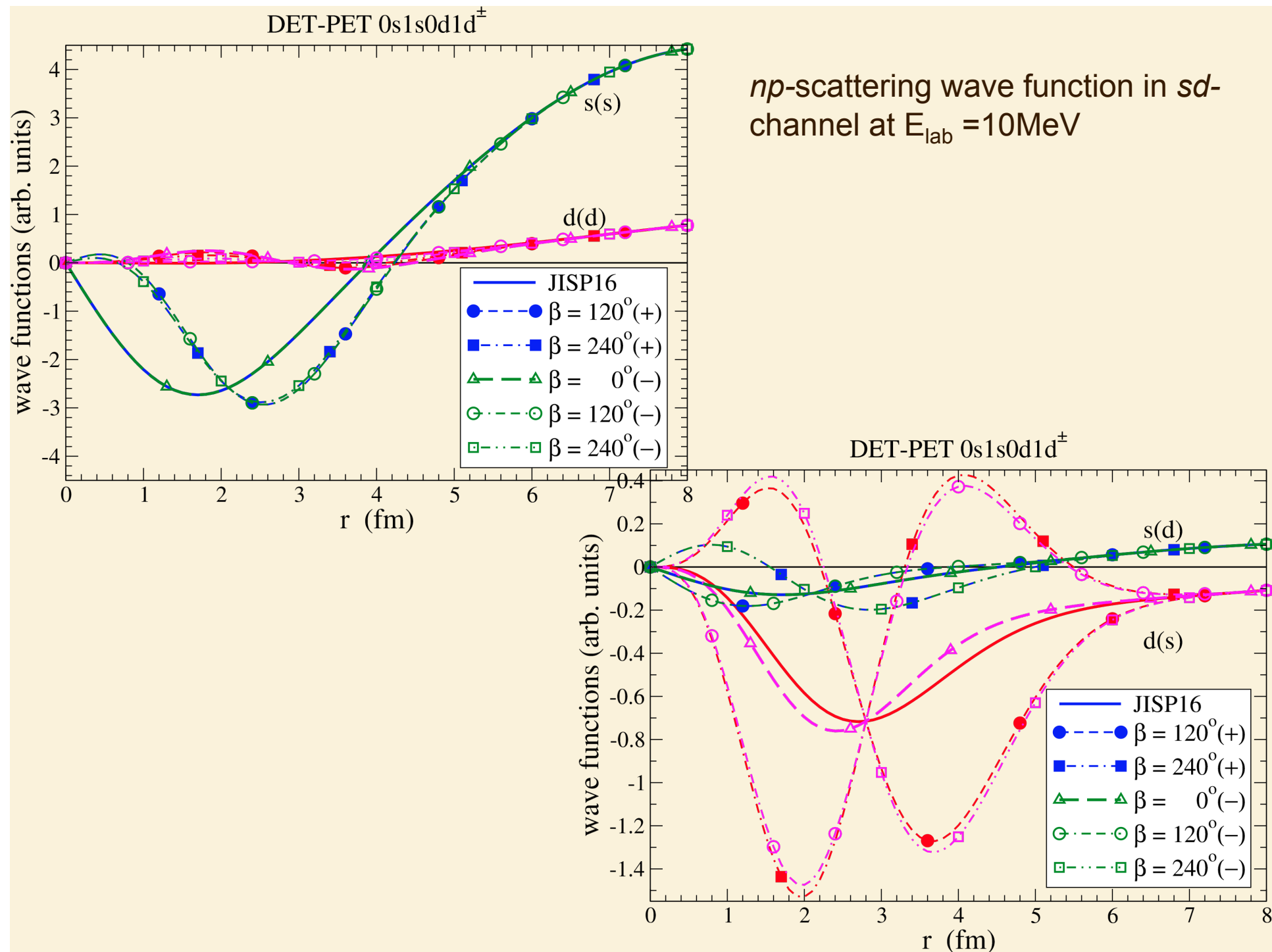


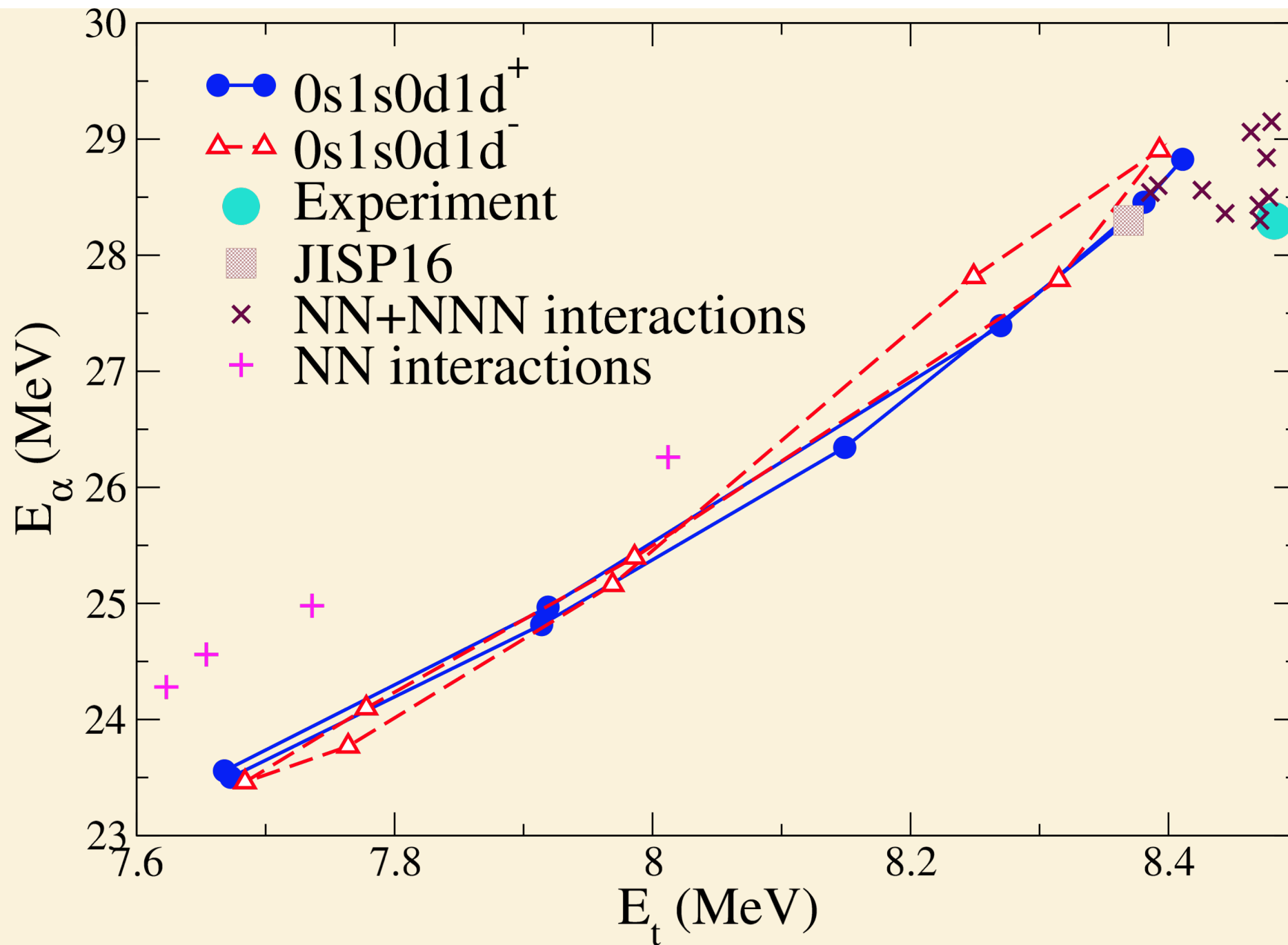


np -scattering wave function in sd -channel at $E_{\text{lab}} = 10\text{MeV}$









Thank you!