Πυρηνική Φυσική

24/10/2025

ΘΜ

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Έναρξη: 13:15

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(p) – (n) $\vec{I} = \frac{\vec{1}}{2} + \frac{\vec{1}}{2} + \vec{\ell}$

$\ell = 0$	$^3S_1$	$S = 1$
$\ell = 1$	$^1P_1$	$S = 0$
$\ell = 1$	$^3P_1$	$S = 1$
$\ell = 2$	$^3D_1$	$S = 1$

$$\vec{\mu} = g\vec{I}$$

$$\mu_2 \equiv \langle 1\,1 \,|\, \mu \,|\, 1\,1 \rangle$$

μαγνητική διπολική ροπή

$|j\, m_j\rangle$ $\qquad$ $|I\, m_I\rangle$

$m_I = I$

$$\mu_D = \langle I\,I \,|\, \mu_2 \,|\, I\,I \rangle \quad \propto {}^3S_1 + b\, {}^3D_1$$

$$\begin{cases} \Psi_d = \alpha \Psi_S + b \Psi_D \\ \approx \qquad\quad \approx \end{cases}$$

$$\alpha^2 + b^2 = 1$$

$$\langle \Psi_d \,|\, \hat{\mu} \,|\, \Psi_d \rangle =$$

$$\alpha^2 \langle \Psi_S \,|\, \hat{\mu} \,|\, \Psi_S \rangle$$

$$b^2 \langle \Psi_D | \hat{\mu} | \Psi_D \rangle$$

$$\mu_S = 0.88$$

$$\mu_D = 0.31$$

$$\left(0.85573\,\mu_N\right)^{exp} = \underline{\alpha^2}^{th}\, 0.88 + \underline{b^2}^{th}\, 0.31$$

$$\left.\begin{aligned} \alpha^2 &= 0.96 \\ b^2 &= 0.04 \end{aligned}\right\} \rightarrow 4\,\%$$

$$\left(\langle r^2 \rangle_{n}\right) = \underline{\alpha^2} \langle \Psi_S | r^2 | \Psi_S \rangle + \underline{b^2} \langle \Psi_D | r^2 | \Psi_D \rangle$$

$$Q^{exp} \rightarrow 4\,\%$$

$$\ell = 0 \Rightarrow$$

σφαιρικά
συμμετρία

$$Q = 0.0282 \pm 0.0003 \text{ b}$$

$$28.2 \pm 0.3 \text{ mb}$$

$$\neq 0$$

$\Rightarrow$ Παραμορφωμένο δυναμικό

↪ διαφορετική απεικόνιση,

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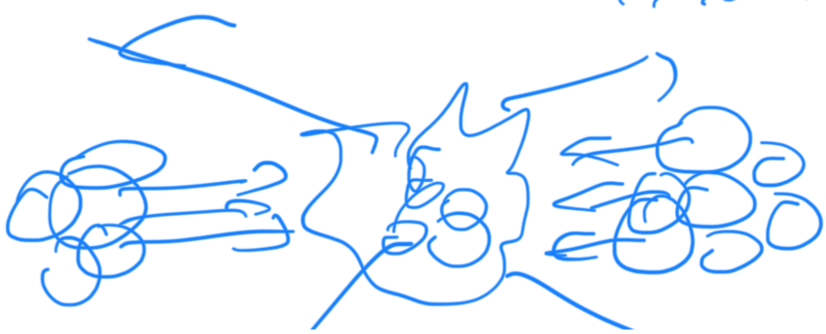
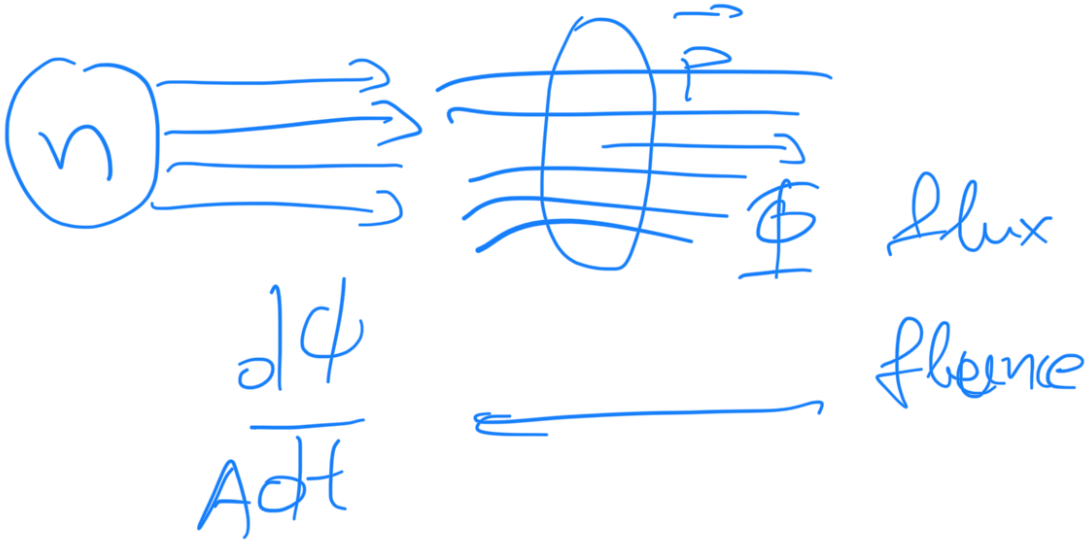
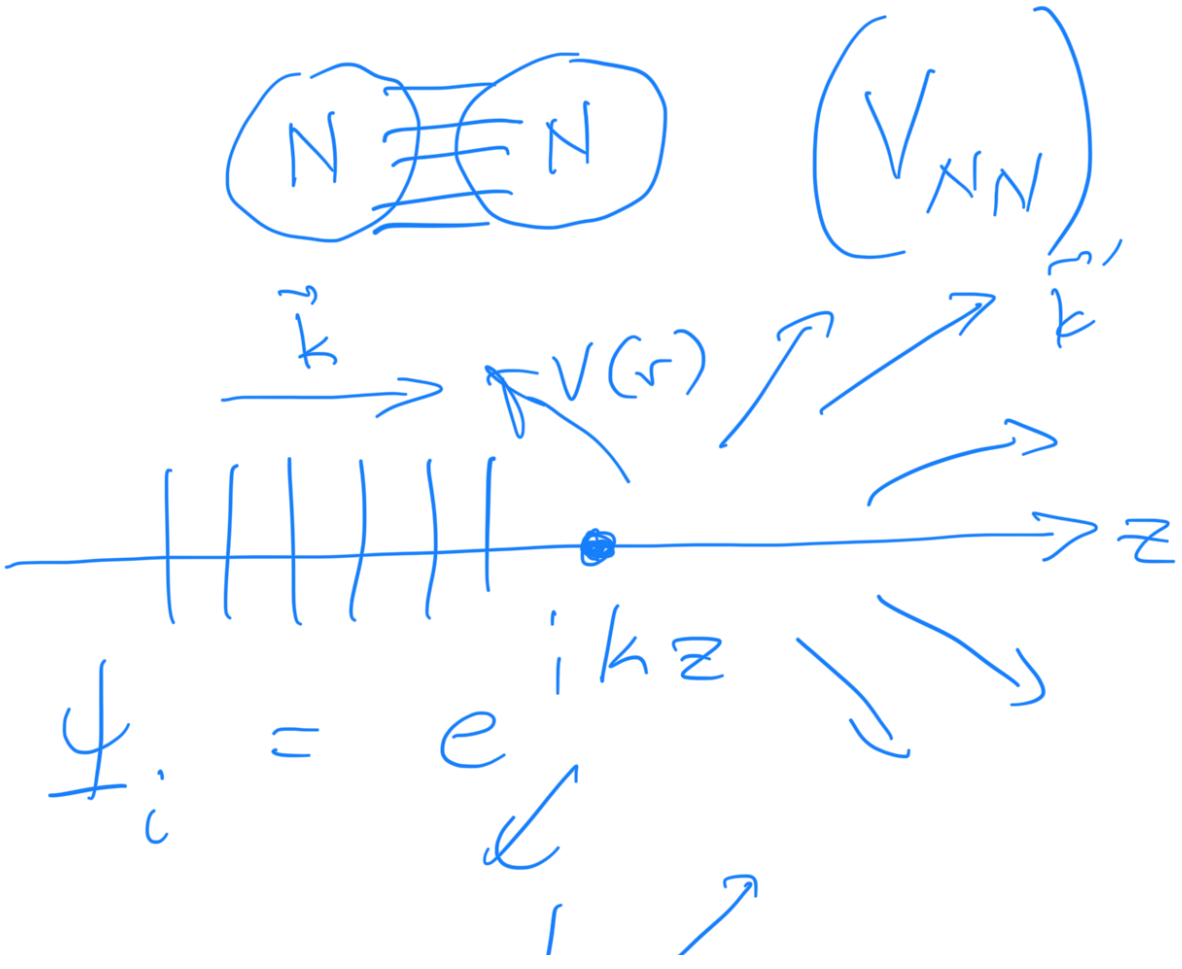
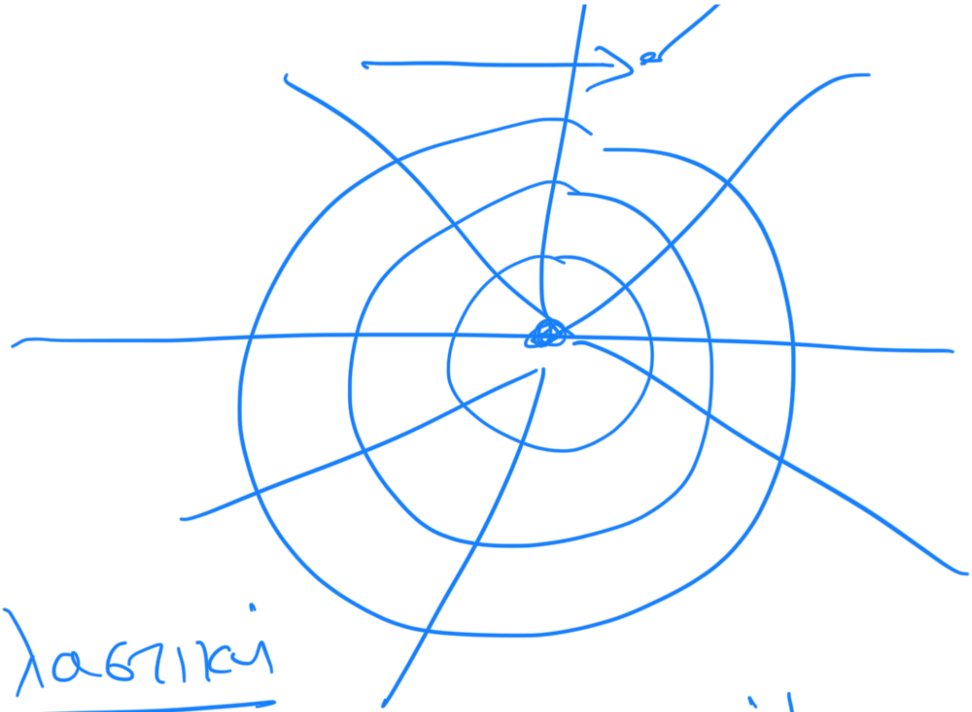
Σκέδαση νουκλεονίου νουκλεονίου (N-N)




n
$\vec{P}$
Φ
flux
$d\Phi$
$\overline{Adt}$
fluence


N
N
V_{NN}
$\vec{k}$
V(r)
$\vec{k}'$
z
$\psi_i = e^{ikz}$



ελαστική

$$\psi_f \sim f(\theta)\,\frac{e^{ikr}}{r} + e^{ikz}$$

πλάτος σκέδασης

$$p + {}^{92}_{42}Mo \rightarrow {}^{93}_{43}Ru + \gamma$$

$$\vec{j} = \frac{\hbar}{m}\,\mathrm{Im}\left(\psi^* \nabla \psi\right)$$

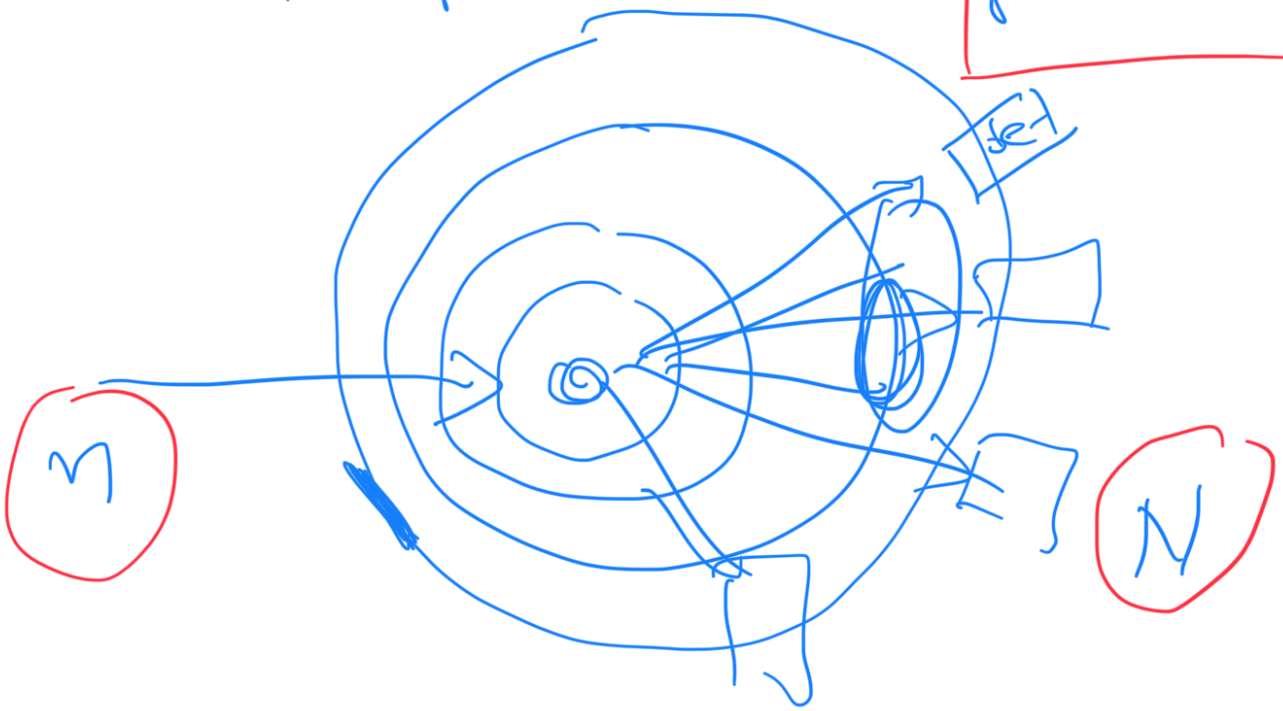
$$\vec{j} = \frac{\hbar}{m}\left(e^{-ikz} \ldots\right)$$

$$j_i = \frac{\hbar}{m} \mathrm{Im}\left(e^{} \frac{\partial}{\partial z} e^{ikz}\right)$$

$$= \frac{\hbar k}{m} = \boxed{v}$$

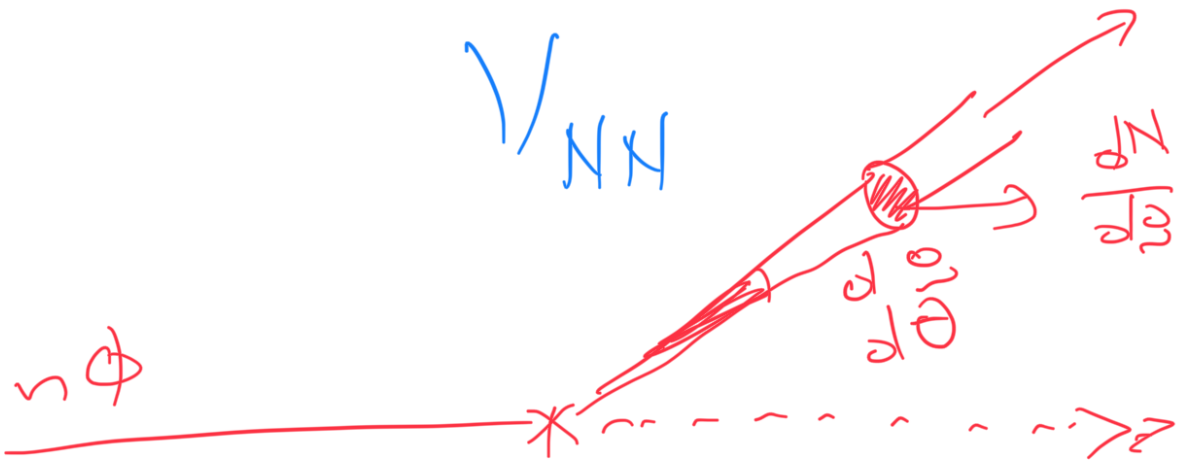
$$j_f = \frac{\hbar}{m} \mathrm{Im}\left\{ f^*(\theta) \frac{e^{-ikr}}{r} \cdot \frac{\partial}{\partial r}\left(f(\theta) \frac{e^{ikr}}{r} \right)\right\}$$

$$= \frac{\hbar k}{m} \frac{1}{r^2} |f(\theta)|^2 = \boxed{\frac{v}{r^2} |f(\theta)|^2}$$



$$d\sigma \qquad dN/d\Omega$$

$$\frac{dN}{d\Omega} = n\Phi$$



Ενεργός διατομή, σ

$$\sigma = \int \frac{d\sigma}{d\Omega}(\theta)\, d\Omega \quad *$$

σ: ολική

$\frac{d\sigma}{d\Omega}$: διαφορική

$\sigma = \sigma(E)$

V_{NN}

$$\frac{d\sigma}{d\Omega} = \frac{j_\phi r^2}{j} = \frac{v}{r^2} r^2 |f(\theta)|^2$$

$$\frac{d\sigma}{d\Omega} = |f(\theta)|^2$$

μέτρηση ↓ φυσική

$$\sigma = 2\pi \int_{-1}^{+1} |f(\theta)|^2 \, d(\cos\theta)$$

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$$\nabla^2\psi + \frac{2m}{\hbar^2}\left(\epsilon - V(r)\right)\psi = 0$$

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(μερικά κύματα
partial waves → l