

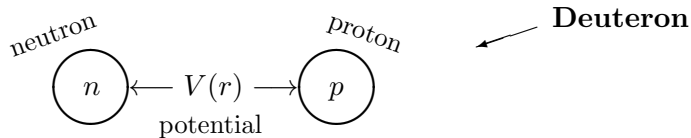
A nuclear model with explicit mesons

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Traditional nucleon-nucleon potential model



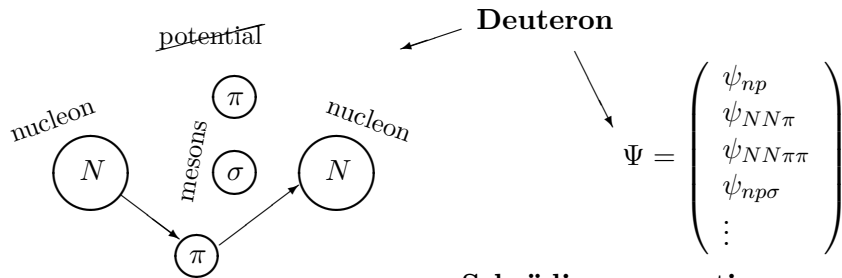
Schrödinger equation

$$\left(K_{np} + V(r) \right) \psi_{np} = E \psi_{np}$$

kinetic energy \nearrow \nearrow \nwarrow wavefunction

nucleon-nucleon potential, e.g. AV18 (central, tensor, 3body, ...)

Model with explicit mesons



Schrödinger equation

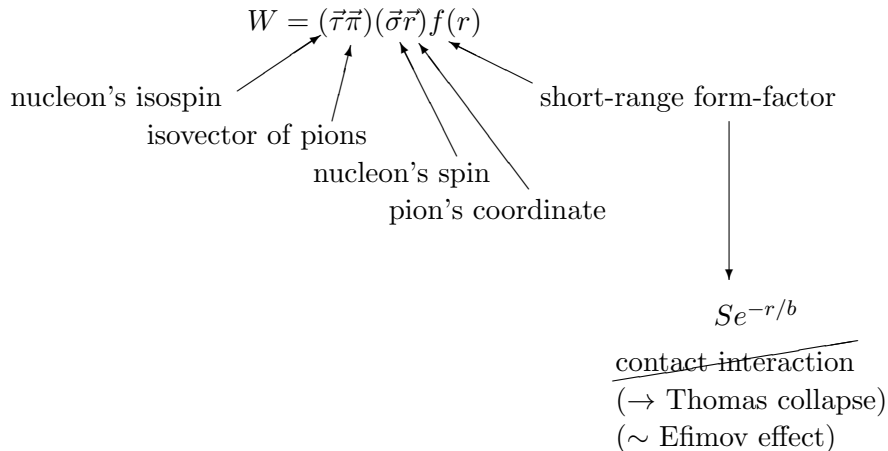
$$\begin{pmatrix} K_{np} & W_{N\pi}^\dagger & \cdots \\ W_{N\pi} & K_{NN\pi} + m_\pi & \cdots \\ \vdots & \vdots & \ddots \end{pmatrix} \begin{pmatrix} \psi_{np} \\ \psi_{NN\pi} \\ \vdots \end{pmatrix} = E \begin{pmatrix} \psi_{np} \\ \psi_{NN\pi} \\ \vdots \end{pmatrix}$$

pion's mass \Rightarrow pion is under barrier ("virtual")

pion generation operator (nucleon-pion coupling)

Nucleon-pion coupling operator

... should be short-range positive-parity scalar isoscalar, e.g. :



Tests of the model

- ▶ Deuteron: ✓ (with one σ -meson, proof of concept)
- ▶ Pion photoproduction off protons: ✓ (in one-pion approximation)
- ▶ ...

π^0 photoproduction off protons ($\gamma + p \rightarrow \pi^0 + p$)

$p(\gamma, \pi^0)p$

