Coherent π^0 photoproduction on spin and isospin zero nuclei

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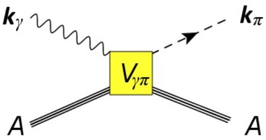
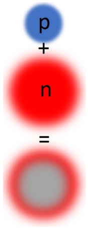


January 22, 2018

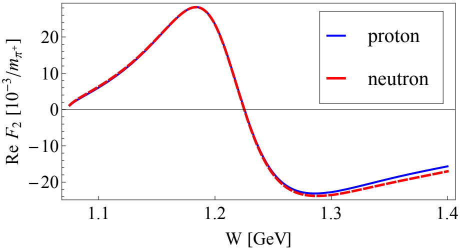
A tool so study neutron distribution



Distribution of protons is well known from e^- scattering

Neutron distributions only known with poorer accuracy
Divergent predictions of properties in heavy nuclei

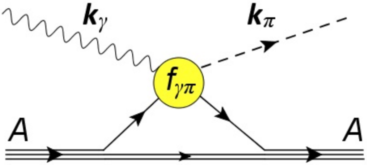
Neutron skin measurements provide an information on nuclear equation of states (extrapolation to neutron stars)



Energy dependence of F_2 CGLN amplitude from MAID2007
Spin independent part of the π^0 **photoproduction amplitude on p and n is the same**
We can measure nucleon distribution!! p + n

π^0 **photoproduction** + **proton dist. data** $\Longrightarrow$ **access to neutron skin**

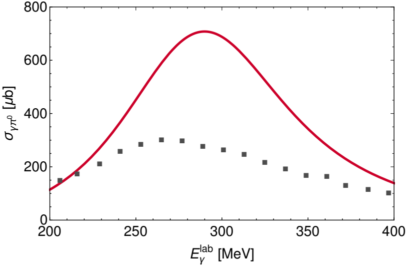
Final state interaction is important



$$V_{\gamma\pi}^{\lambda} = W_A \, \rho(q) F_2 \left[\hat{\mathbf{k}}_\gamma \times \hat{\mathbf{k}}_\pi\right] \cdot \mathbf{e}_\lambda$$

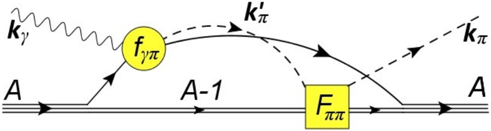
F_2 is a CGLN amplitude from MAID2007

$\rho(q)$ is the nuclear mass form factor



^{4}He$(\gamma, \pi^0)^4$He total cross section

Data: *Nucl. Phys. A660, 69 (1999)*



The Klein-Gordon equation:

$$(-\nabla^2 + m_\pi^2)\Phi(\mathbf{r}) + U(\omega, \mathbf{r})\Phi(\mathbf{r}) = \omega^2\Phi(\mathbf{r})$$

$U(\omega, \mathbf{r})$ is complex and energy dependent

$\mathrm{Im}[U] < 0 \quad \Longrightarrow$ pion flux is decreasing