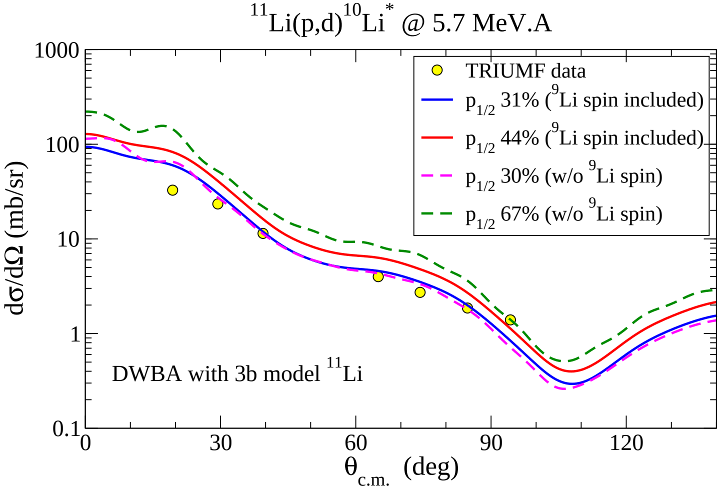
Trento. October 17 - 21, 2016
Physics beyond the limits of stability: exploring the continuum

- ^{11}Li$(p,d)^{10}$Li; DWBA $\longleftarrow$ (presented by R. Kanungo)
- ^{11}Li$(p,pn)^{10}$Li; TC

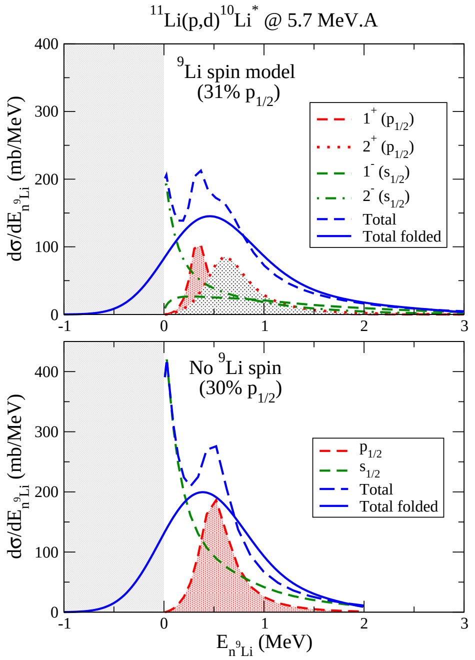
Jesús Casal[1,2], M. Gómez-Ramos[2] and A. M. Moro[2]

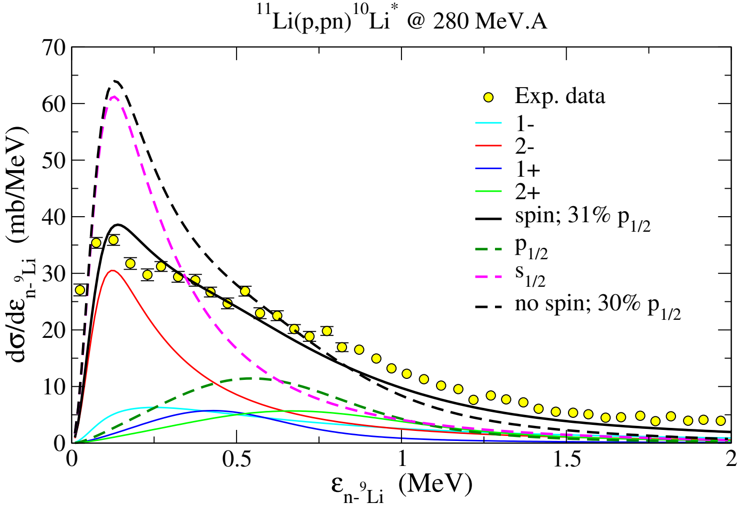
[1]ECT*, Trento, Italy

[2]Departamento de Física Atómica, Molecular y Nuclear
Universidad de Sevilla, Spain



Data from Sanetullaev *et al.* [PLB 755 (2016) 481]


11Li(p,d)10Li* @ 5.7 MeV.A
9Li spin model
(31% p1/2)
1+ (p1/2)
2+ (p1/2)
1- (s1/2)
2- (s1/2)
Total
Total folded
No 9Li spin
(30% p1/2)
p1/2
s1/2
Total
Total folded
dσ/dEn9Li (mb/MeV)
En9Li (MeV)

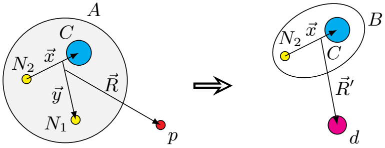


Data from Aksyutina *et al.* [PLB 666 (2008) 430]

(p, d) reaction

DWBA prior form

- Participant/spectator approach
- Three-body form factors



➢ Prior representaton of the T-matrix

$$\mathcal{T}_{if} = \left\langle \varphi_{\vec{q}}^{(-)}(\vec{x}) \Psi_f^{(-)}(\vec{R}') \middle| V_{pN_1} + U_{pB} - U_{pA} \middle| \Phi_A(\vec{x}, \vec{y}) \chi_{pA}^{(+)} \right\rangle,$$

where

$\varphi_{\vec{q}} \equiv$ continuum wave function of the binary fragment B

$\Psi_f \equiv$ final d-B wave function

$\Phi_A \equiv$ g.s. wave function of the initial 3-body composite A

$\chi_{pA} \equiv$ distorted p-A wave

- Assume that V_{prior} does not change the state of B
- Define overlaps:

$$\psi_{LJJ_TM_T}(\vec{y}) \equiv \int \frac{f_{LJ}^{J_T}(qx)}{x} \mathcal{Y}^*_{Ls_2J}(\widehat{x})\ \Phi_A^{j\mu}(\vec{x},\vec{y})d\vec{x}$$

So the T-matrix is

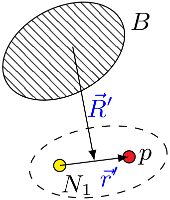
$$\mathcal{T}_{if} = \frac{4\pi}{q} \sum_{LJJ_TM_T} (-i)^L Y_{LM}(\widehat{q}) \langle LMs_2\sigma_2|JM_J\rangle\langle JM_JI\iota|J_TM_T\rangle \boldsymbol{\mathcal{T}_{if}^{LJJ_TM_T}}$$

with

$$\boldsymbol{\mathcal{T}_{if}^{LJJ_TM_T}} \equiv \langle \Psi_f^{(-)}(\vec{R}')|V_{pN_1} + U_{pB} - U_{pA}|\psi_{LJJ_TM_T}(\vec{y})\chi_{pA}^{(+)}\rangle$$

(p, pN) reaction

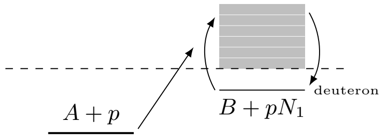
CDCC expansion of final state:



$$\Psi_f(\vec{r}', \vec{R}') \simeq \sum_{n\mathcal{J}\Pi} \phi_n^{\mathcal{J}\Pi}(k_n, \vec{r}')\chi_n^{\mathcal{J}\Pi}(\vec{K}_{pN_1\text{-}B}, \vec{R}')$$

Basis of N discretized bins

$$\phi_n^{\mathcal{J}\Pi}(k_n, \vec{r}') = \sqrt{\frac{2}{\pi N}} \int_{k_n-1}^{k_n} \phi_{pN_1}^{\mathcal{J}\Pi}(k, \vec{r}')dk.$$



BUT:

1. Other reactions? (e.g. knockout)
2. Higher order effects
   - Coupling between ^{10}Li states
   - Excitation of ^{11}Li before fragmentation
   - Structure and dynamic core (^{9}Li) excitations
3. Other nuclei (e.g. ^{6}He, ^{14}Be)