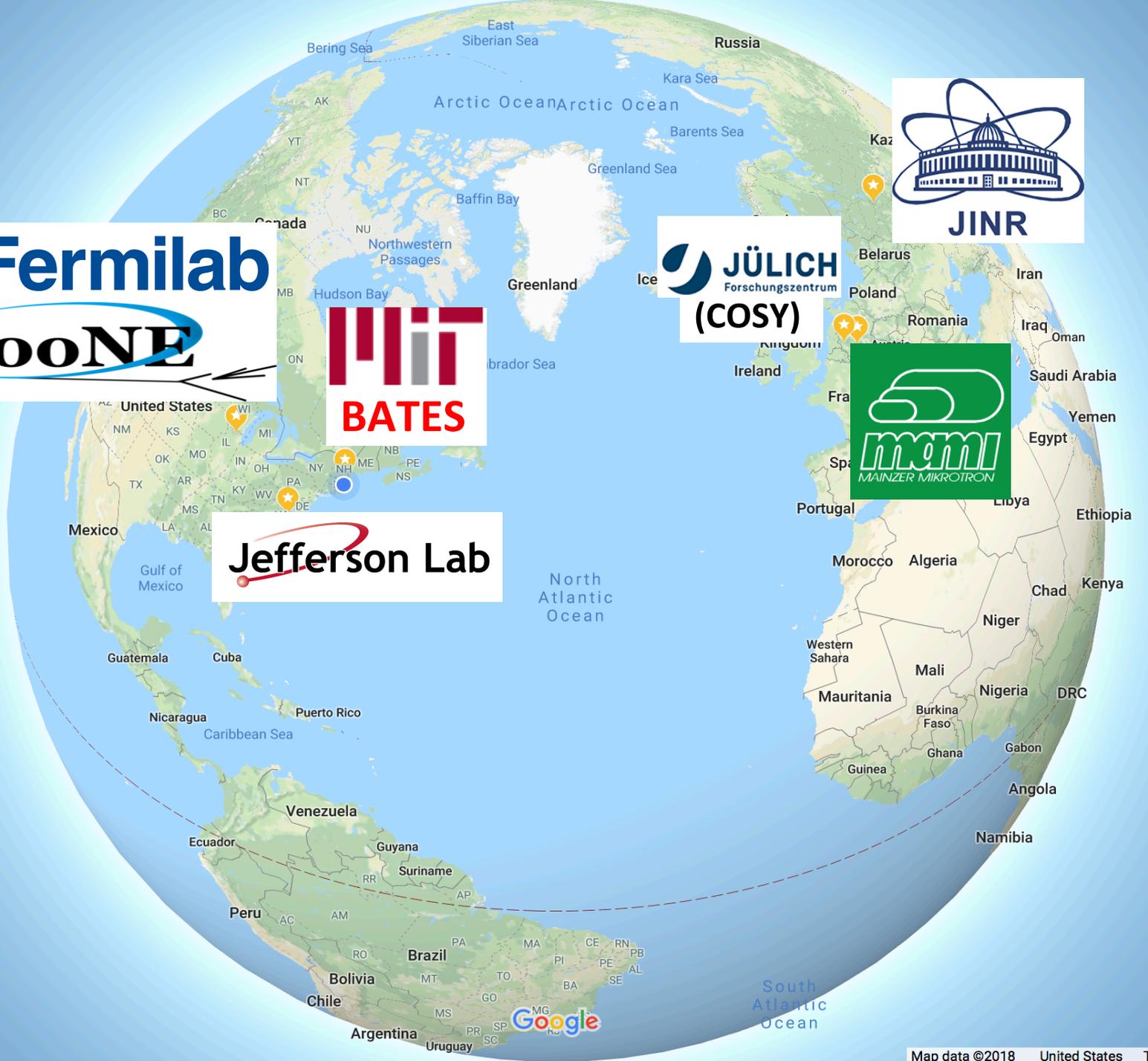


Session Summary:  
Spin physics in Nuclear  
Reactions and Nuclei

Richard Milner (MIT)

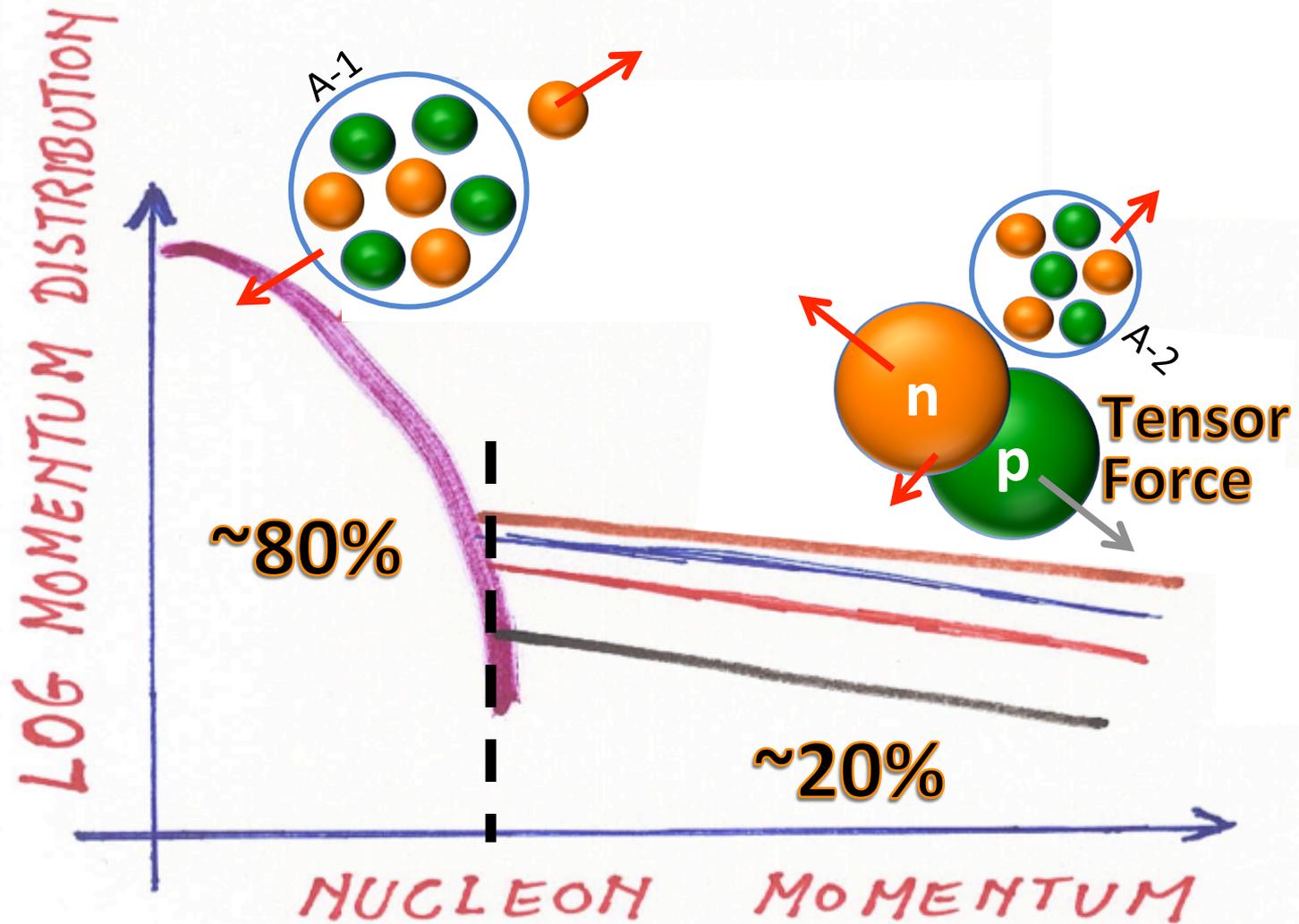




- Short-Range Correlations
- Deuteron Spin Structure
- Nucleon Spin Structure
- More...

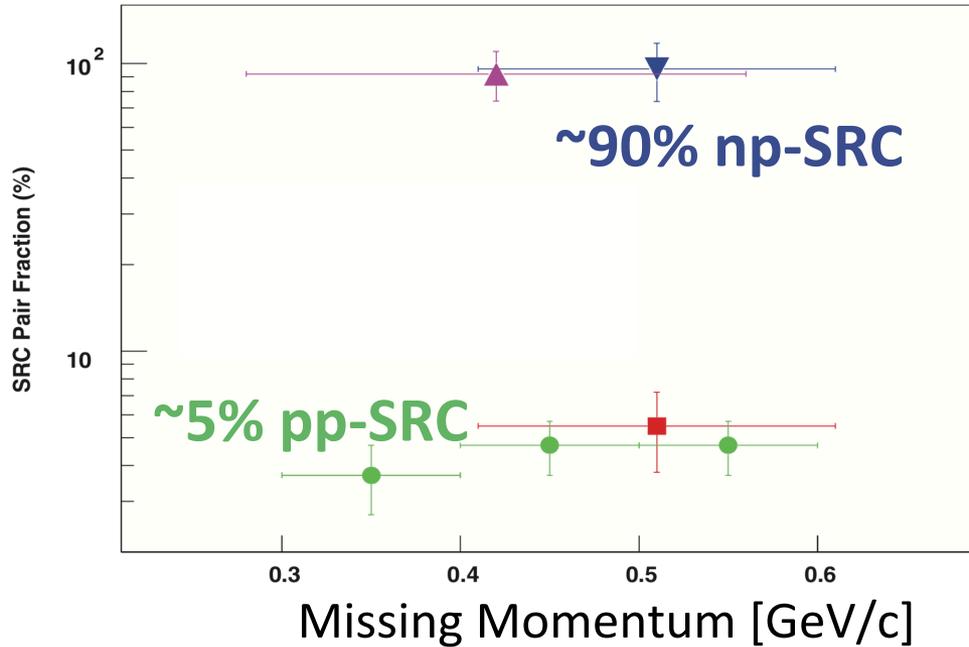
\*apologies to the talks not covered today

# Short-Ranged Correlations (SRCs)

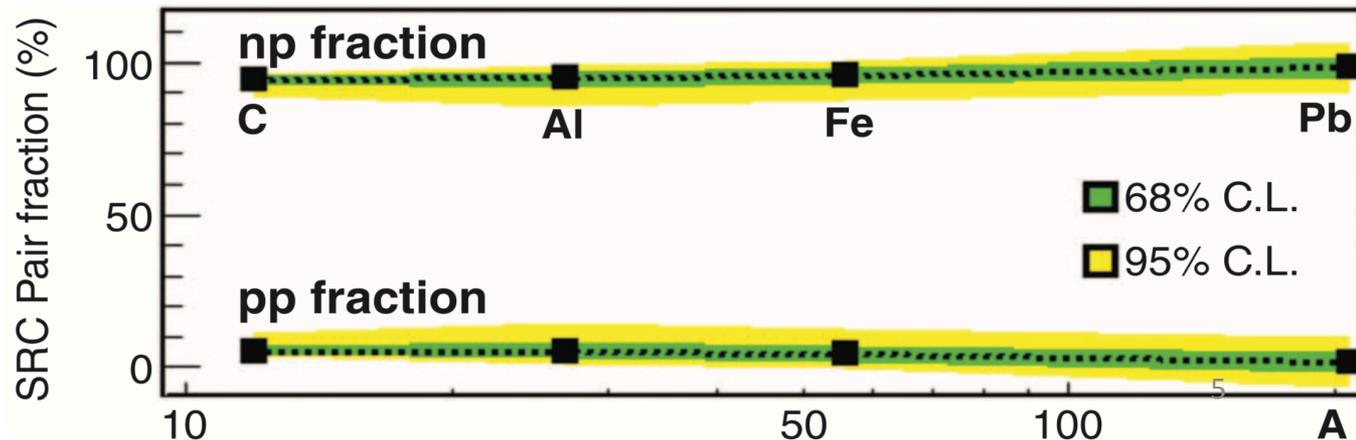


# Spin Selectivity of SRC Pairs

$^{12}\text{C}$



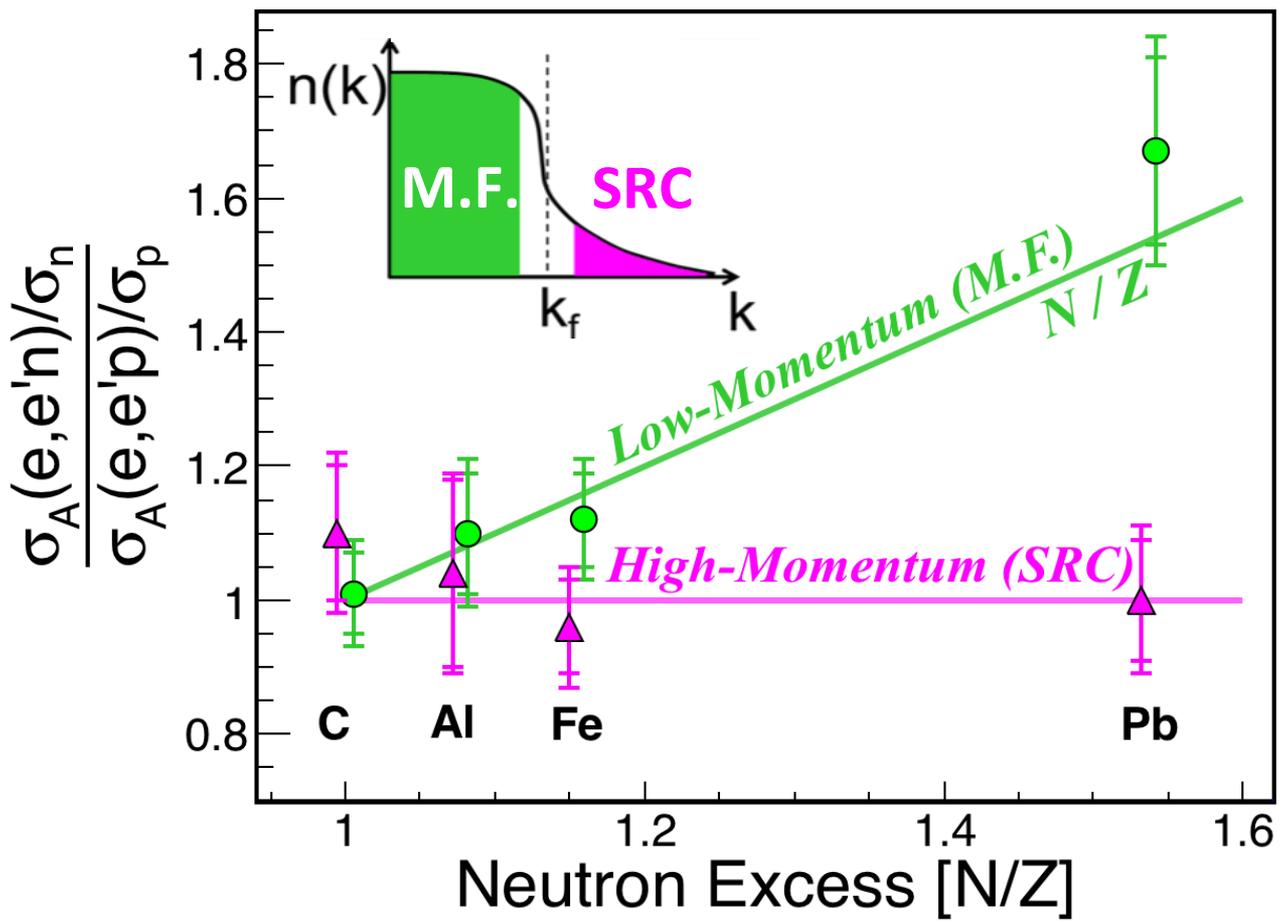
I. Korover:  
 Predominantly Spin=1 np pairs.  
 => Predominance of the Tensor part of the NN interaction at short distances.



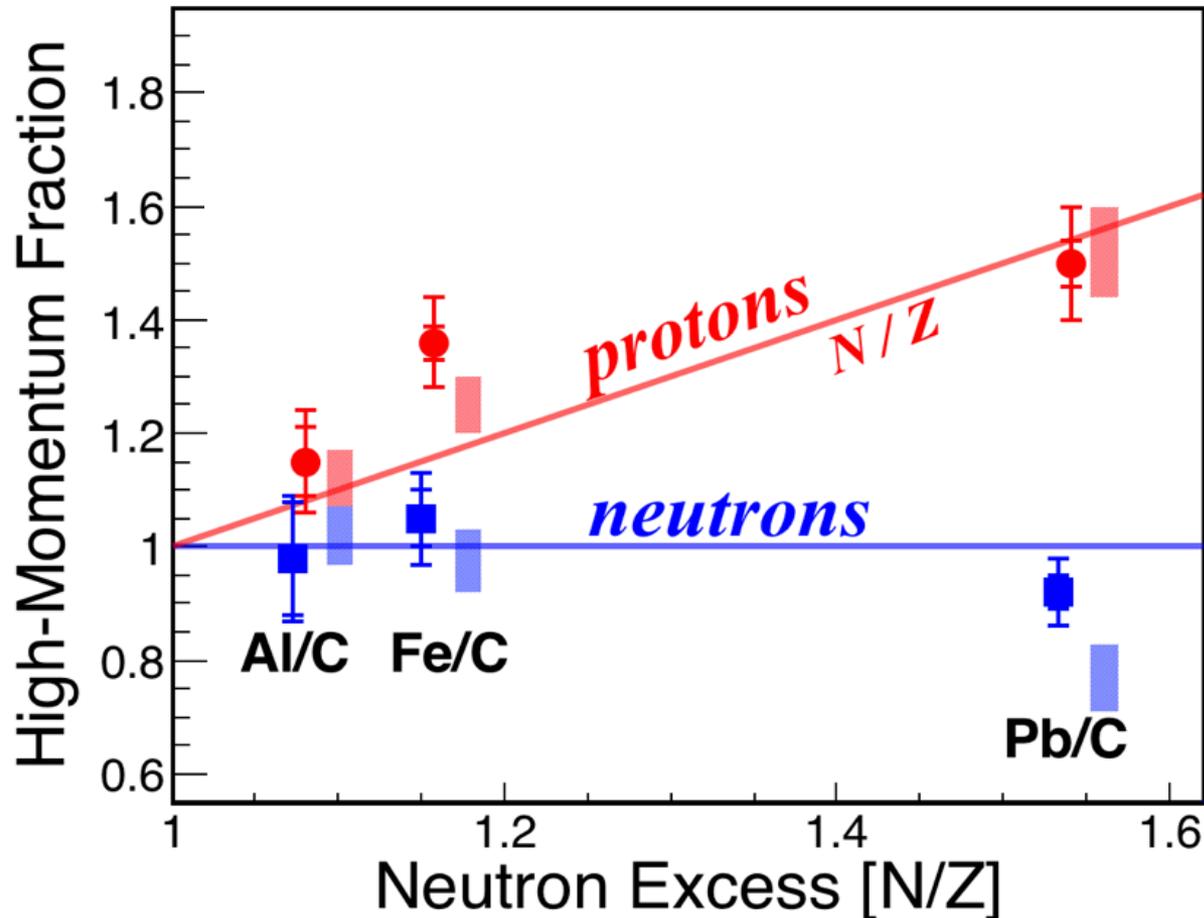
Subedy Science (2008);  
 Shneur PRL (2007);  
 Piassetzky PRL (2006);  
 Tang PRL (2003);  
 Hen Science (2014).

# Neutron-Rich nuclei:

Same # of high-momentum protons and neutrons



# Correlation Probability: Neutrons saturate Protons grow

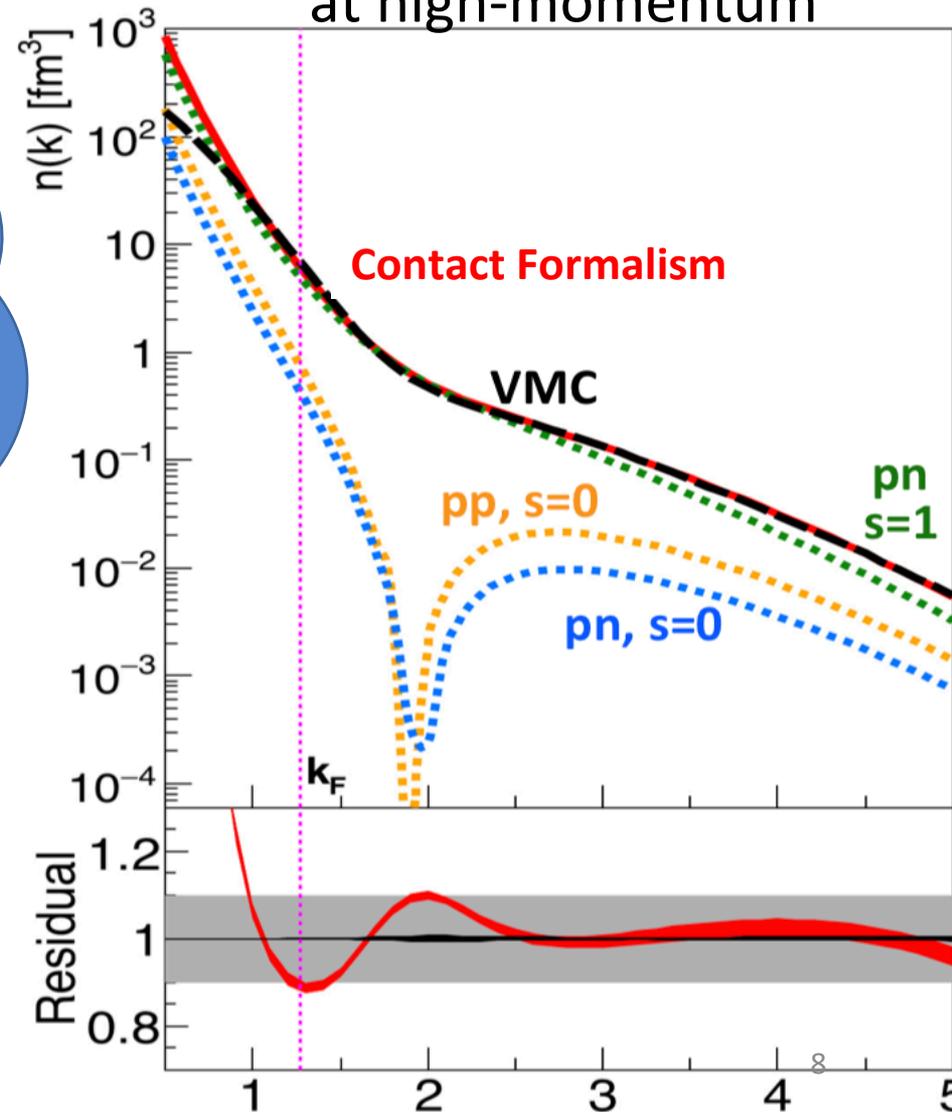


# Nuclear Contact Formalism

R. Cruz Torres:

- New formalism to describe SRC in nuclei.
- Bridge experimental data and ab-initio calculations.
- Implications for double beta decay matrix elements.

Contact agrees with VMC at high-momentum



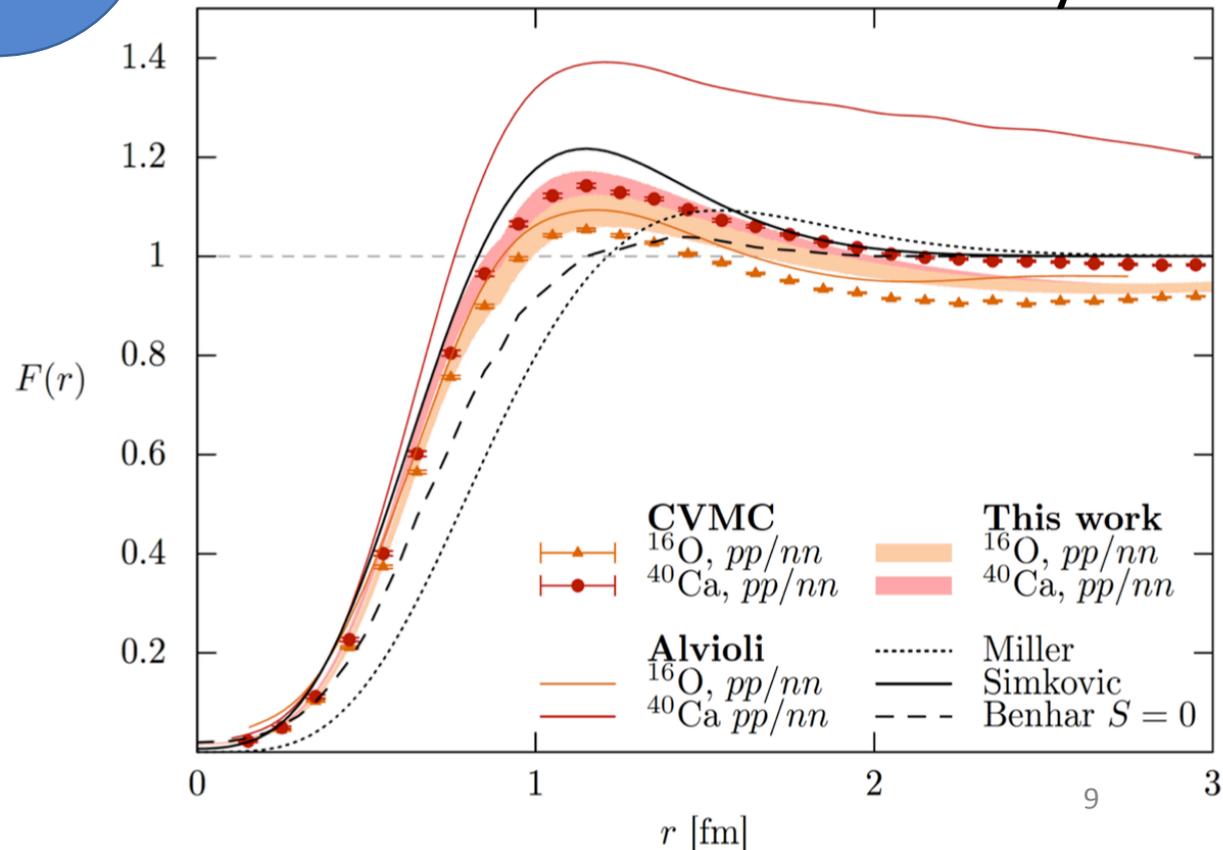
Weiss and Cruz Torres et al.,  
Phys. Lett. B **780**, 211 (2018).

Cruz Torres et al., Phys. Lett.  
B **785**, 304 (2018).

## R. Cruz Torres:

- New formalism to describe SRC in nuclei.
- Bridge experimental data and ab-initio calculations.
- Implications for double beta decay matrix elements.

## New correlation functions for double beta decay



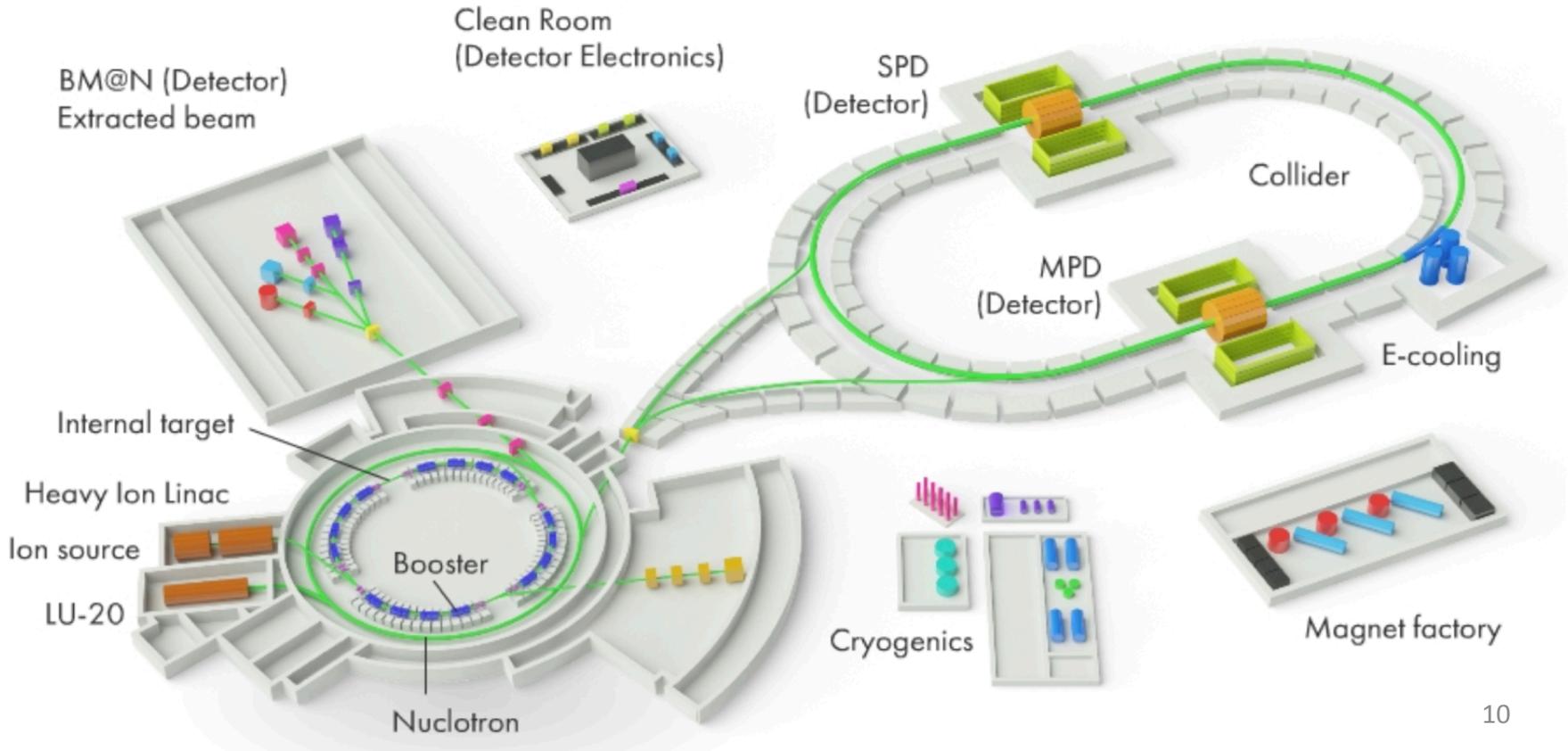
Weiss and Cruz Torres et al.,  
Phys. Lett. B **780**, 211 (2018).

Cruz Torres et al., Phys. Lett.  
B **785**, 304 (2018).

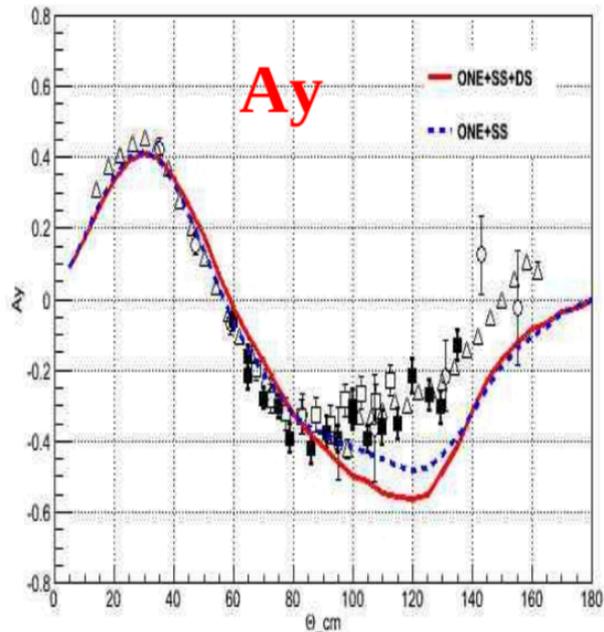
# Fixed target **DSS** experiment is devoted to study of the short range correlations using polarized deuteron and proton beams

*V.P. Ladygin*

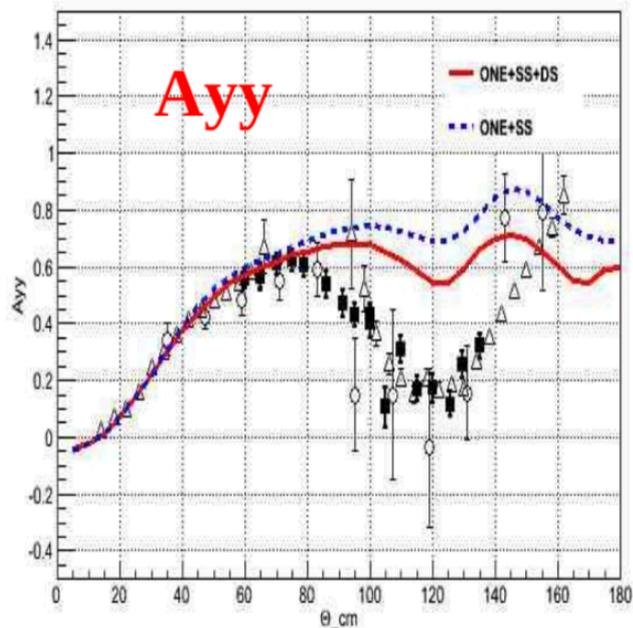
## NICA complex



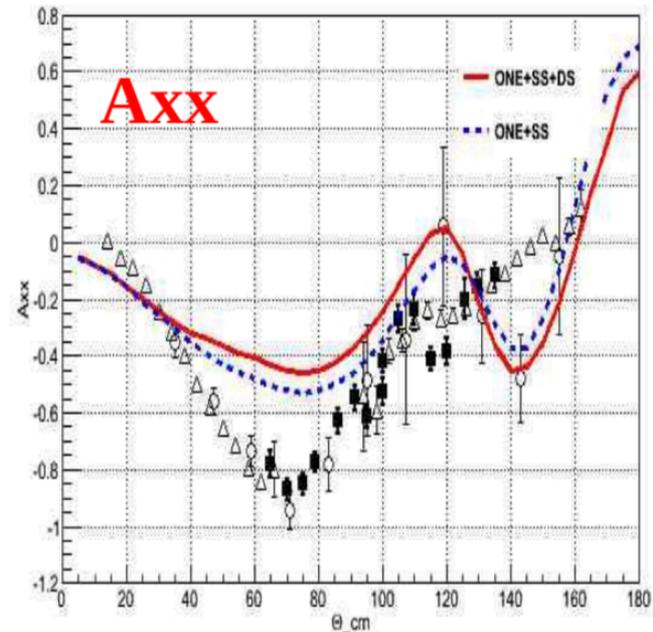
$T_d=400\text{MeV}$



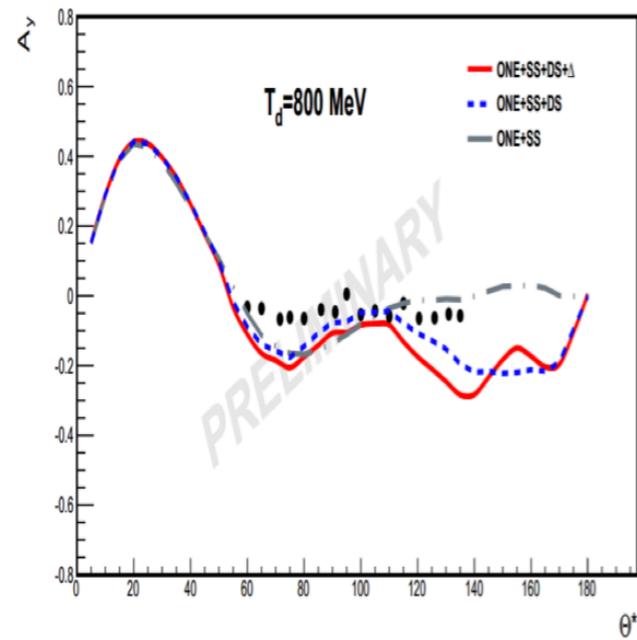
$T_d=400\text{MeV}$



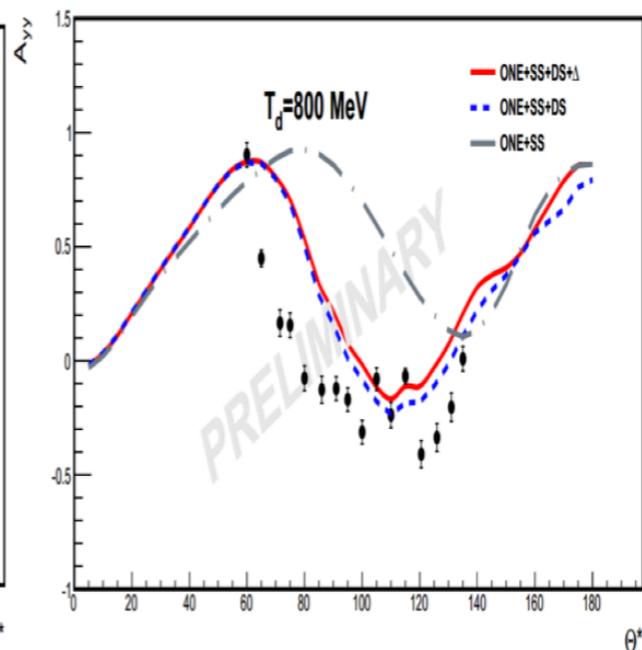
$T_d=400\text{MeV}$



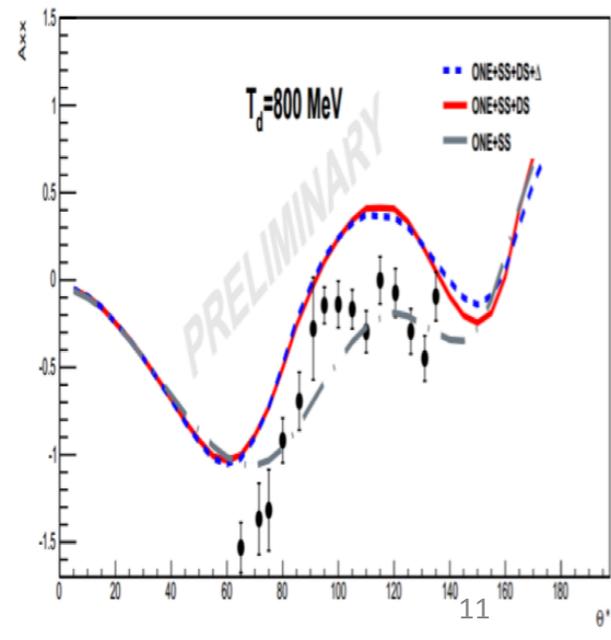
$T_d=800\text{ MeV}$



$T_d=800\text{ MeV}$



$T_d=800\text{ MeV}$



## Measurement of the Vector and Tensor Asymmetries at Large Missing Momentum in Quasielastic ( $\vec{e}, e'p$ ) Electron Scattering from Deuterium

A. DeGrush,<sup>1</sup> A. Maschinot,<sup>1</sup> T. Akdogan,<sup>1,‡</sup> R. Alarcon,<sup>2</sup> W. Bertozzi,<sup>1</sup> E. Booth,<sup>3</sup> T. Botto,<sup>1</sup> J. R. Calarco,<sup>4</sup> B. Clasie,<sup>1</sup> C. Crawford,<sup>5</sup> K. Dow,<sup>1</sup> M. Farkhondeh,<sup>1</sup> R. Fatemi,<sup>5</sup> O. Filoti,<sup>4</sup> W. Franklin,<sup>1</sup> H. Gao,<sup>6</sup> E. Geis,<sup>2</sup> S. Gilad,<sup>1</sup> D. K. Hasell,<sup>1,\*</sup> P. Karpus,<sup>4</sup> M. Kohl,<sup>7</sup> H. Kolster,<sup>1</sup> T. Lee,<sup>4</sup> J. Matthews,<sup>1</sup> K. McIlhany,<sup>8</sup> N. Meitanis,<sup>1</sup> R. Milner,<sup>1</sup> J. Rapaport,<sup>9</sup> R. Redwine,<sup>1</sup> J. Seely,<sup>1</sup> A. Shinozaki,<sup>1</sup> A. Sindile,<sup>4</sup> S. Širca,<sup>10</sup> E. Six,<sup>2</sup> T. Smith,<sup>11</sup> B. Tonguc,<sup>2</sup> C. Tschalär,<sup>1</sup> E. Tsentelovich,<sup>1</sup> W. Turchinets,<sup>1,†</sup> Y. Xiao,<sup>1</sup> W. Xu,<sup>6</sup> Z.-L. Zhou,<sup>1</sup> V. Ziskin,<sup>1</sup> and T. Zwart<sup>1</sup>

(BLAST Collaboration)

<sup>1</sup>*Laboratory for Nuclear Science and Bates Linear Accelerator Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA*

<sup>2</sup>*Arizona State University, Tempe, Arizona 85287, USA*

<sup>3</sup>*Boston University, Boston, Massachusetts 02215, USA*

<sup>4</sup>*University of New Hampshire, Durham, New Hampshire 03824, USA*

<sup>5</sup>*University of Kentucky, Lexington, Kentucky 40504, USA*

<sup>6</sup>*Triangle Universities Nuclear Laboratory and Duke University, Durham, North Carolina 27708, USA*

<sup>7</sup>*Hampton University, Hampton, Virginia 23668, USA and Thomas Jefferson National Accelerator Facility, Newport News, Virginia 23606, USA*

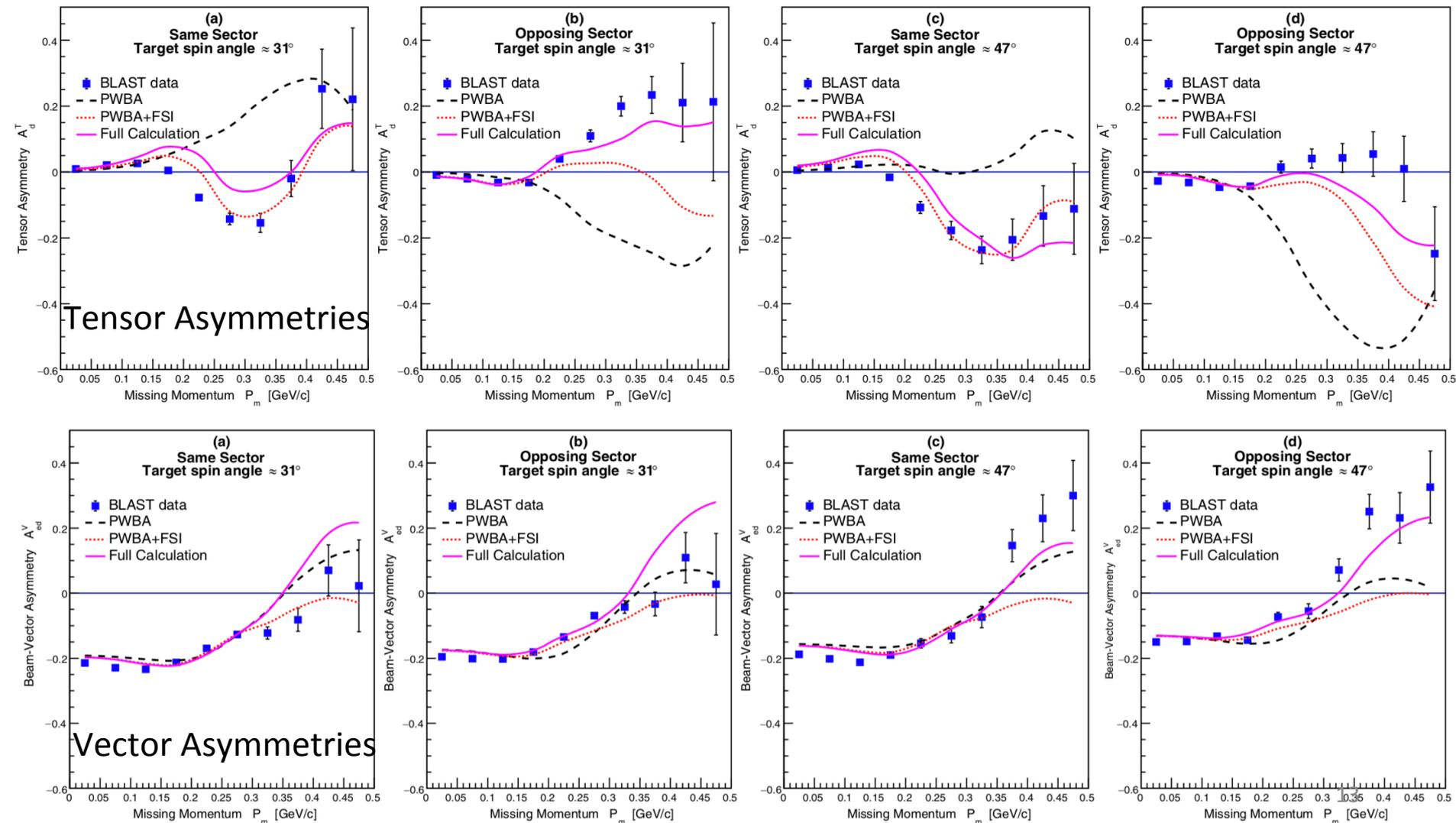
<sup>8</sup>*United States Naval Academy, Annapolis, Maryland 21402, USA*

<sup>9</sup>*Ohio University, Athens, Ohio 45701, USA*

<sup>10</sup>*Faculty of Mathematics and Physics, University of Ljubljana, and Jožef Stefan Institute, 1000 Ljubljana, Slovenia*

<sup>11</sup>*Dartmouth College, Hanover, New Hampshire 03755, USA*

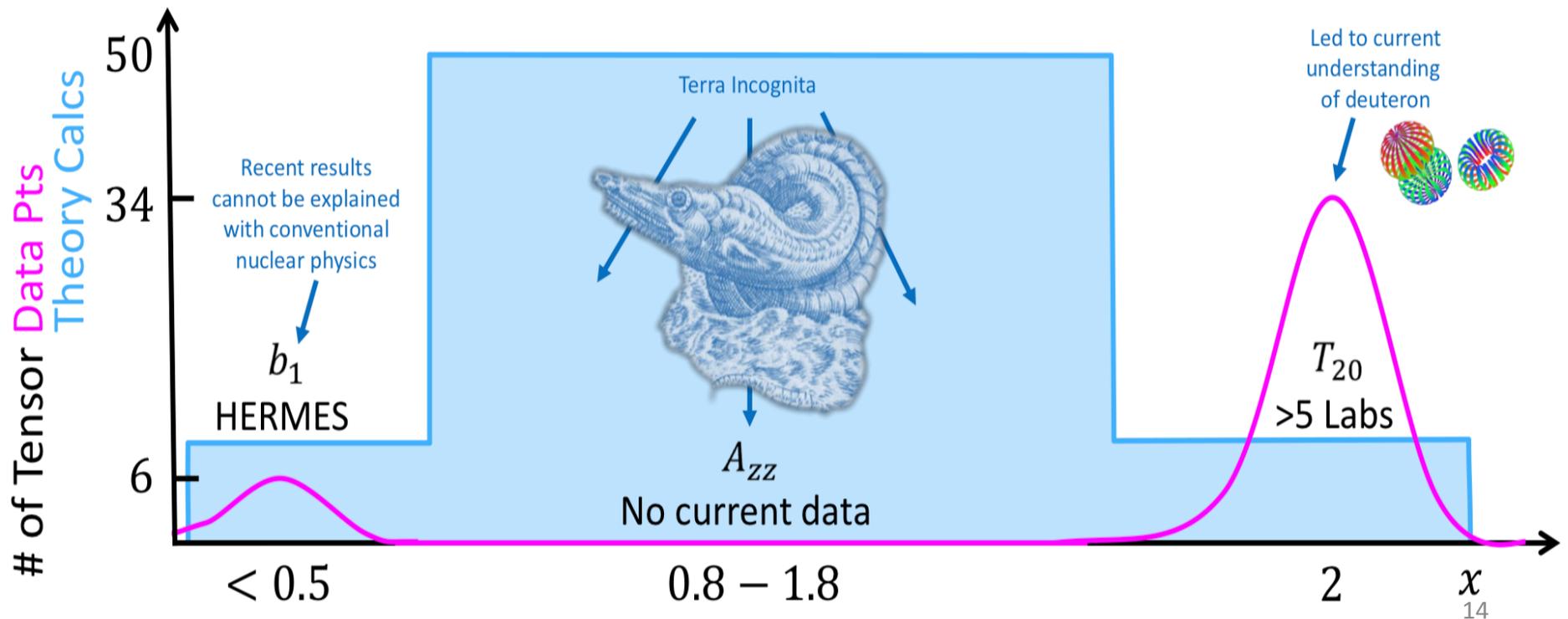
# R. Milner: New BATES data with sensitivity to the deuteron D-wave and tensor component of FSI



# JLab Tensor Polarized Deuteron Breakup

E. Long

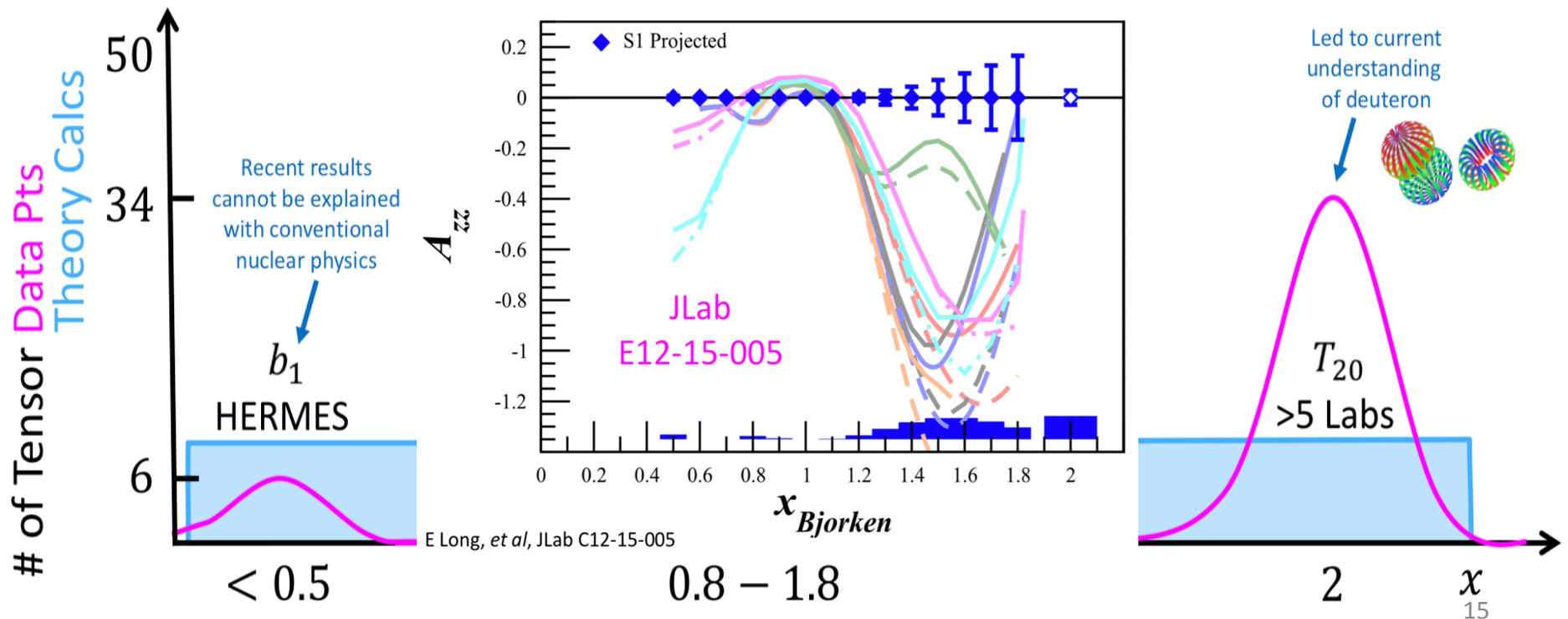
## Current Landscape of Tensor Observables



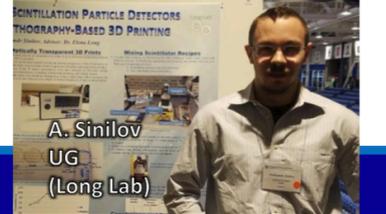
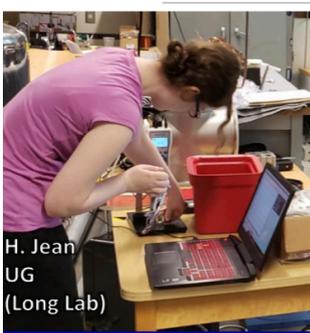
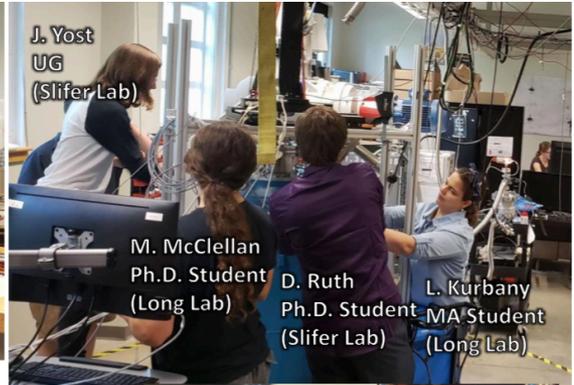
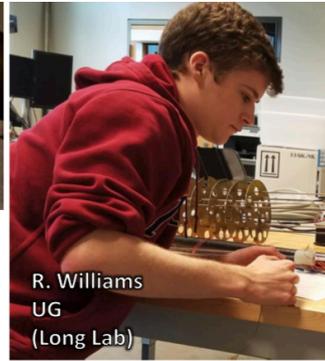
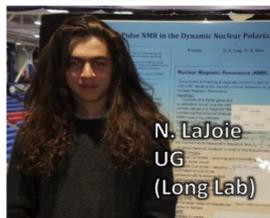
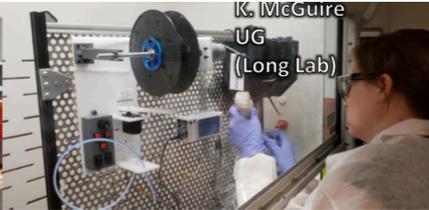
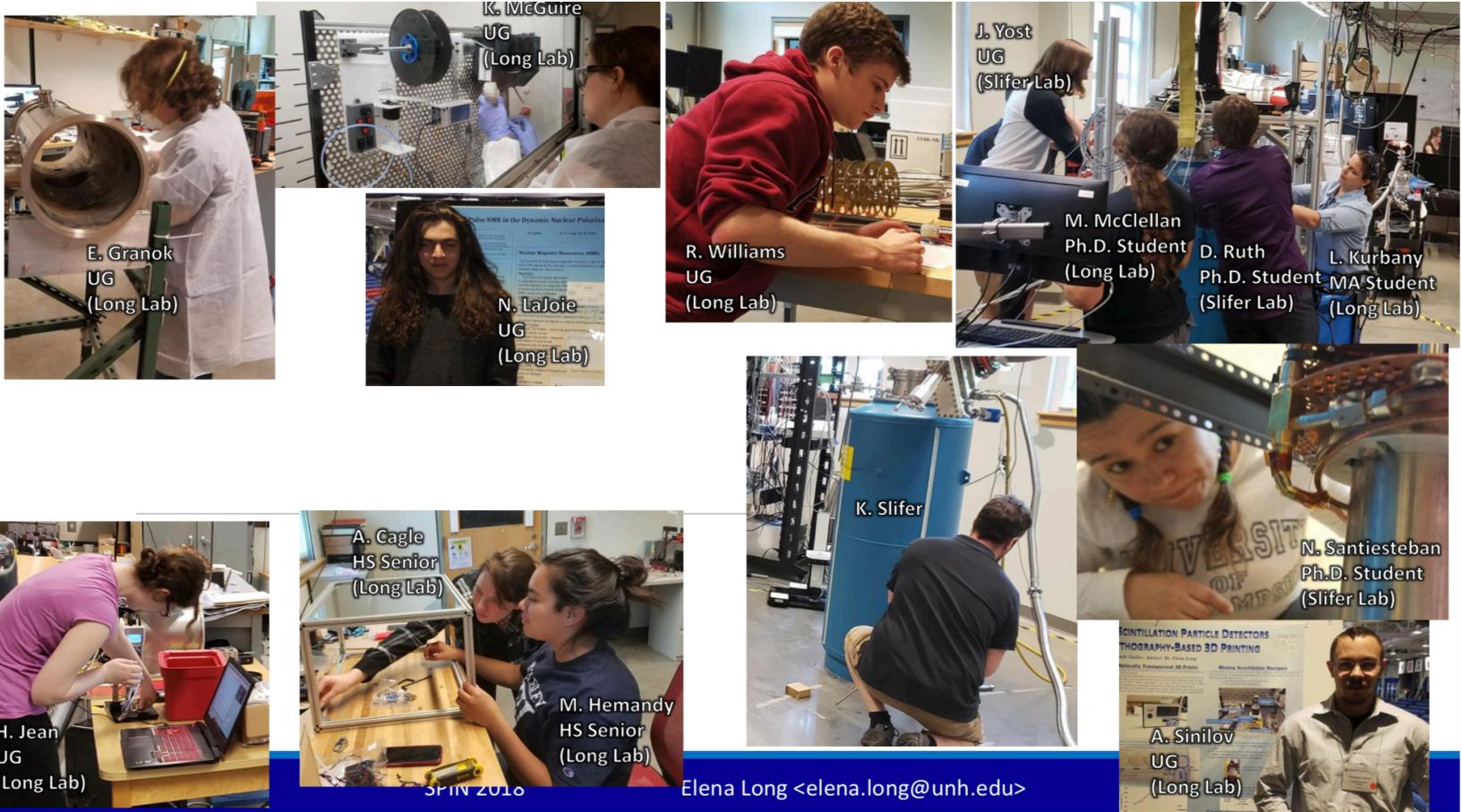
# JLab Tensor Polarized Deuteron Breakup

E. Long

## Current Landscape of Tensor Observables

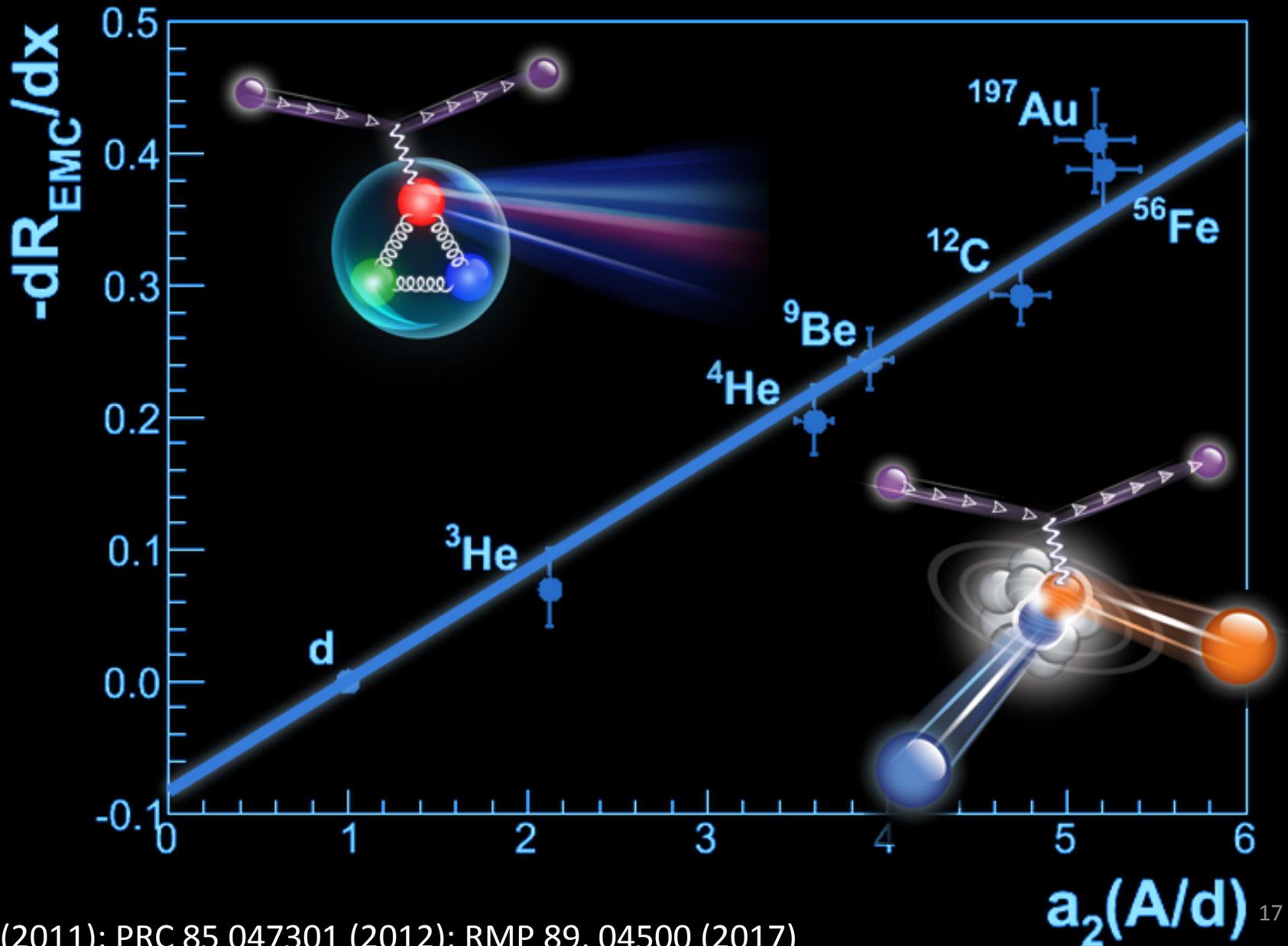


# JLab Tensor Polarized Deuteron Breakup



SPIN 2016 Elena Long <elena.long@unh.edu>

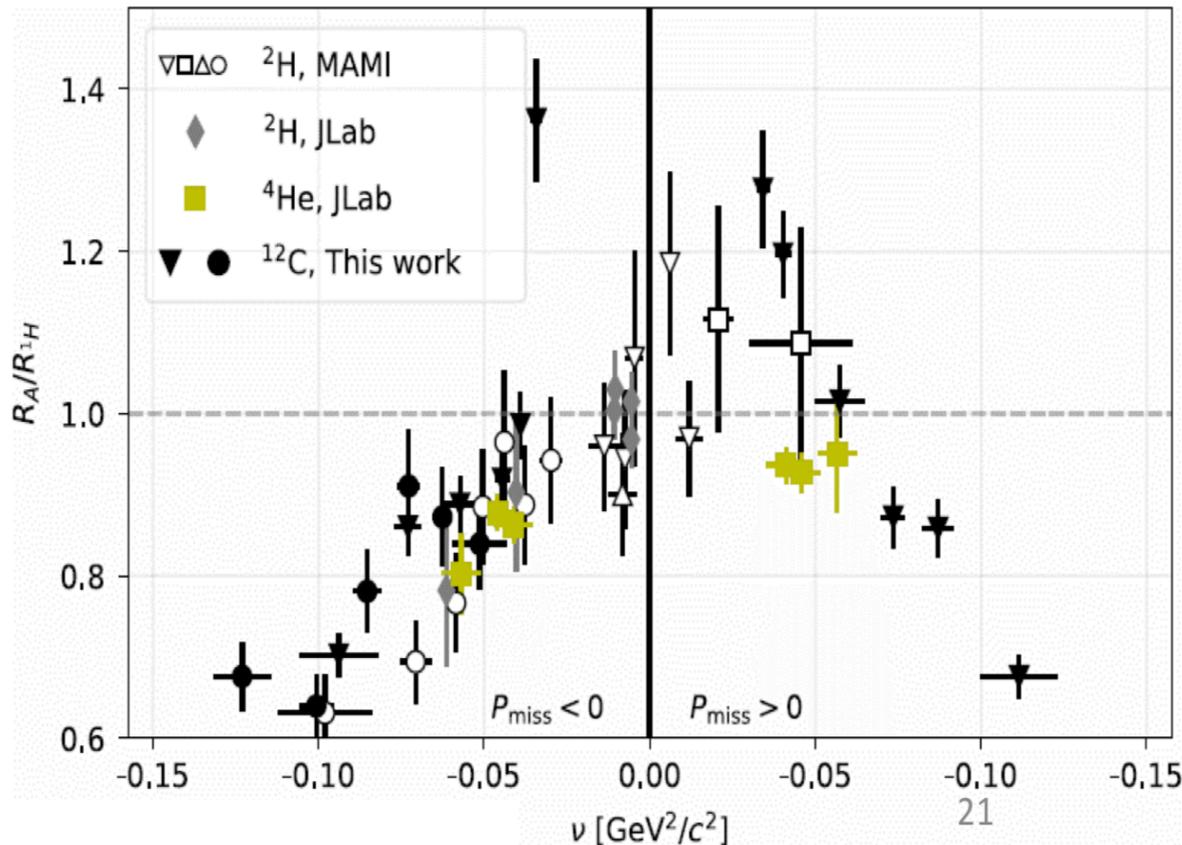
# EMC – SRC Correlation



# MAMI: Bound Nucleon Structure from Polarization Transfer

I. Mardor:

- Deviation of polarization transfer ratio from unity as a function of virtuality
- Universal A dependence



# JLab: Free Neutron Structure from Deuteron Tagged DIS

## Expected Results

### Dark Symbols:

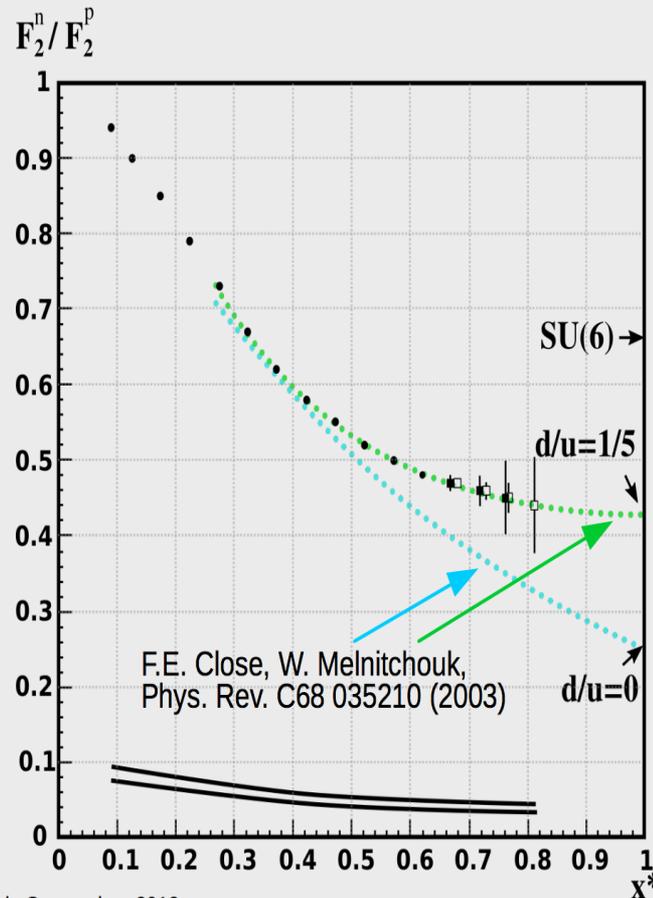
$W^* > 2 \text{ GeV}$

( $x^*$  up to 0.8, bin centered  $x^* = 0.76$ )

### Open Symbols:

"Relaxed cut"  $W^* > 1.8 \text{ GeV}$

( $x^*$  up to 0.83)



C. Ayerbe Gayoso:

- Using DIS  $d(e, e' p_{\text{recoil}}) X$  to study the structure of the 'almost free' neutron.

# Strange Axial FF from Neutrino Scattering

K. Woodruff:

- Ratio of Charge-Current to Neutral-Current neutrino scattering sensitive to strange axial FF
- MicroBooNE detector ideal for such measurements down to low  $Q^2$

