

Towards an EMC White Paper – do we agree?

- Understanding the EMC effect and interpreting its consequences is a very important current challenge
- Best way to meet the challenges –new experiments
- Must understand the related nuclear structure issues
- The upcoming experiments require improved theory

EMC Models - general statements

- EMC effect clearly indicates that the nuclear medium modifies the structure of a bound nucleon
 - interplay between nuclear and partonic degrees of freedom.

- when modeling the EMC effect:

“Thou Shalt Honor Mark’s Commandments”

- ‘standard’ contributions (Fermi-motion, binding, etc.)
- Modified nucleons, but which ones?
 - ‘mean-field’ (80% of nucleons, small modification)
 - ‘SRC’ (20% of nucleons, 5x bigger modification)

Toward improved EMC Models

- Convolution formalism works on the light cone
 - Want light-front nucleon momentum distributions,
 - SRC effect
 - Ab initio distributions
 - SRC contributions to Fermi motion effects
- Reaction mechanisms, especially for semi-inclusive measurements

EMC experiments

experiment	approved	future
Inclusive	Many A, many Q^2	
Spin EMC	^7Li	
$d(e, e' N_S)$	p and n recoils	
flavor EMC	$^{40/48}\text{Ca}$	PV, π^\pm tagged
Tagged from A		N or A-1 recoil (ALERT)

Calculations needed! Particularly difficult for non-inclusive measurements.

EMC effect topics

Physics Topic	Well measured	Partially measured	Plans for some data	Plans for good data	Need THY support
Quarks/valence	X			X (A<12)	
Antiquarks/sea		X		X (FNAL)	(X)
Flavor dependence			X (48/40)		X
Spin dependence				X (7Li)	X
DIS (PDFs) at x>1				X	X
F _L vs F _T (A-dep of R)		X		X	X
EMC vs P _m /virt.				X	X
“FFs” vs P _m /virt.				X	X

EMC-SRC connection:

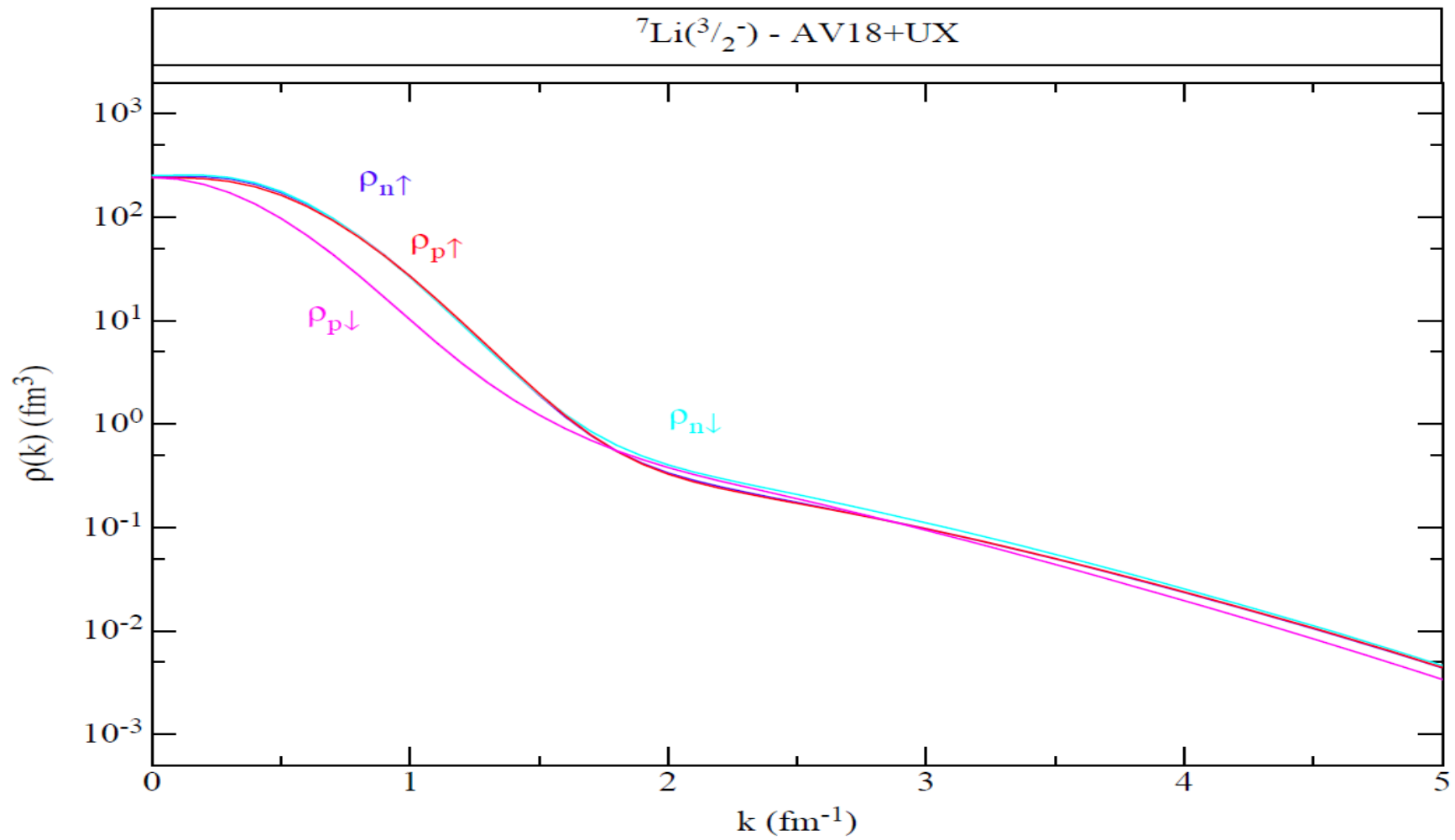
- A-dependence of EMC and SRC (light nuclei, varying N/Z ratios)
- Spin dependence: if SRCs are CAUSE of EMC effect, they should have little effect on g_1 as polarization of $k > k_F$ nucleons extremely small
- Tagged measurements (EMC vs virtuality)
 - More theory/experimental efforts to understand FSIs
 - ALERT (tagged DVCS) redundant ways to calculate kinematics → isolate events with significant FSI through kinematics [similar to radiative effect in $p(e,e'p)$]

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EMC vs P_m /virt.				X	X
“FFs” vs P_m /virt.				X	X

Theory needs

- Calculations including detailed nuclear structure
- Calculations including multiple observables in same framework
- Additional calculations for Flavor and Spin dependence, DIS at $x>1$
- Nuclear effects in GPDs, TMDs [beyond scope of this meeting]
- FSI and related reaction mechanism issues
- Can we agree on ‘baselines’ for various EMC effect, FF modification?
- Can we agree on corrections [x_p vs x_A/A]



SRC and Nuclear structure

- Remarkable advancement in ab-initio calculations of heavy nuclei!
- Good discussions with EFT people!
 - Scale and scheme dependence questions
 - Language questions
- Full understanding of SRCs requires measuring a self-consistent, high Q^2 , series of:
 - (e,e')
 - (e,e'p)
 - (e,e'pN)

Priorities???
- Cross section calculations needed! Reaction mechanisms.
- EFT scale set to understand reaction (impulse approx)

New Results of heavy nuclei!

- EVERY GOOD CONFERENCE SHOULD PRESENT NEW RESULTS!
- Remarkable progress in ab-initio calculations of heavy nuclei
- New data on the c.m. motion of SRC pairs and the proton/neutron energy sharing in asymmetric nuclei.
- Coming (really) soon: $(e,e'np)/(e,e'pp)$ ratio for high momentum and heavy nuclei + 'differential' $(e,e'Np)/(e,eN)$ ratios.
- All new data consistent with SRC theory predictions. Seem to support:
 - the ground state description of SRCs in nuclei.
 - the choice of kinematics & ratios and reduced reaction mechanisms.

SRC in asymmetric nuclei

- Good indication for strong isospin effects from new data.
- Tritium experiments forthcoming – more theory predictions needed!
- Need to extend to heavy nuclei in (e,e') , $(e,e'p)$ and $(e,e'pN)$ to understand the effects in a self-consistent manner.

New (old) probes

- New capabilities using proton (GSI/DUBNA) and gamma (GlueX) beams.
- How important is it to use different probes? Are reaction mechanisms that different?
- Can GlueX be used to look for exotics? e.g. $\gamma + n \rightarrow p \pi^-$ on a deuteron with proton vs. resonance recoil.
- What can we learn by detecting the A-2 recoil system in inverse kinematics?

Spares follow

Moving to the Light-Cone

In already on page 3

- General feeling is that the importance of ab-initio light-cone densities was not emphasized enough in the last years.
- Another general feeling is that given recent advances it should not be very hard to calculate.
- **WOULD BE GREAT TO HAVE LIGHT-CONE DENSITIES! IT IS THE NATURAL FRAMEWORK FOR EMC AND SRC STUDIES.**