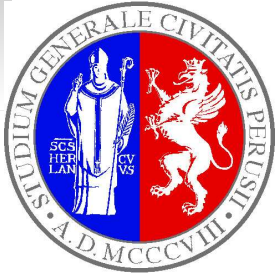


Realistic studies of DVCS off ^3He , ^4He



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Our contributions (mainly @ JLab Kin!)

The nucleus: *“a Lab for QCD fundamental studies”*

Realistic calculations: use of exact solutions of the Schrödinger equation, with realistic NN potentials (e.g., Av18) and 3-body forces → spectral functions

■ 1 - GPDs for ^3He :

We performed a complete impulse approximation realistic study
(S.S. PRC 2004, PRC 2009; M. Rinaldi and S.S., PRC 2012, PRC 2013)
No data; proposals? Prospects at JLAB-12 and EIC;

■ 2 - DVCS off ^4He :

data available from JLab at 6 GeV; new data expected at 12 GeV;
our calculations (not yet realistic)
(**Coherent:** S. Fucini, S.S., M. Viviani, Phys.Rev. C98 (2018) no.1, 015203)
(**Incoherent:** S. Fucini, S.S., M. Viviani, arXiv:1909.12261 [nucl-th]) .

My point: *I do not know if realistic calculations will describe the data. I think they are necessary to distinguish effects due to “conventional” or to “exotic” nuclear structure*

^3He calculations: summary

- **What we have:** (S.S. PRC 2004, 2009; M. Rinaldi and S.S., PRC 2012, 2013)
 - * I.A. calculation of the GPDs H_3 , E_3 , \tilde{H}_3 , within a AV18 + UrbanaIX realistic non-diagonal spin-dependent spectral function; Nucleon model: VGG
 - * Forward limit and nuclear FFs recovered; momentum SR slightly violated
 - * Interesting predictions: strong sensitivity to details of nuclear dynamics:
 - * extraction procedure of the neutron information, able to take into account all the nuclear effects encoded in an IA analysis;
- Coherent DVCS off ^3He would be:
 - * a test of IA; relevance of non-nucleonic degrees of freedom;
 - * a test of the A - and isospin dependence of nuclear effects;
 - * complementary to incoherent DVCS off the deuteron in extracting the neutron information (with polarized targets).
 - * Together with ^3H , nice possibilities (flavor separation of nuclear effects, test of IA); at the EIC, beams of polarized light nuclei will operate. $^3\vec{\text{He}}$ can be used.
- **What we are doing:** 1) GPDs \rightarrow CFFs \rightarrow X-sections
2) update of nucleonic models (GK, MMS (partons)...). FAST! (M. Rinaldi)
- **Theoretical challenge:** A relativistic LF treatment (in progress, Pace, Salmè)

⁴He calculations: summary

■ What we have:

■ Coherent case S. Fucini, S.S., M. Viviani PRC 98 (2018) 015203

- * I.A. calculation of the GPD H within a non-diagonal spectral function based on the **AV18 + UrbanaIX** interaction, realistic only in the ground part; Nucleonic model: GK
- * Forward limit and nuclear FFs recovered, momentum SR slightly violated
- * Numbers for CFFs, X-sections, BSA

■ Incoherent case S. Fucini, S.S., M. Viviani arXiv:1909.12261 [nucl-th]

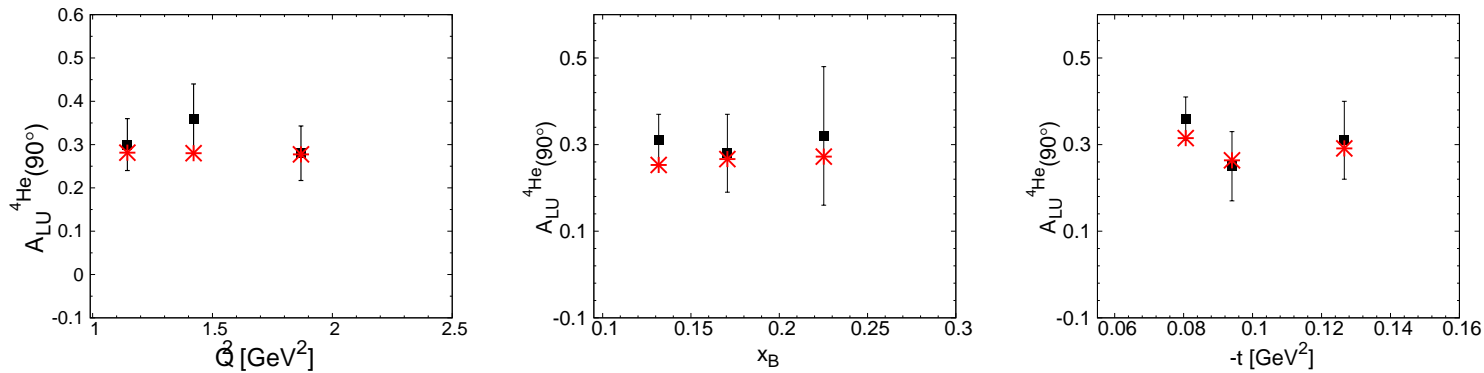
- * I.A. calculation of cross sections within a diagonal spectral function based on the **AV18 + UrbanaIX** interaction, realistic only in the ground part; cross section developed for a bound proton; Nucleon model: GK, MMS; numbers for X-sections, BSA

■ What we are doing: Beyond IA (FSI?); test of other nucleonic models

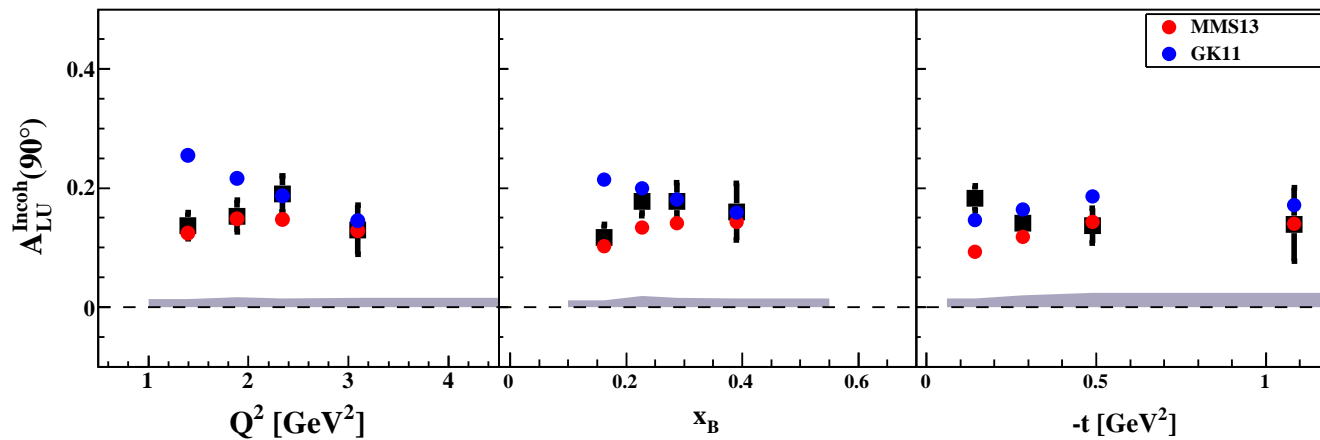
■ Theoretical challenge: A full realistic spectral function, never calculated before, not even diagonal (in slow progress, M. Viviani)

Comparison with EG6 data: $A_{LU}(\phi) = \frac{d\sigma^+ - d\sigma^-}{d\sigma^+ + d\sigma^-}$

■ Coherent case S. Fucini, S.S., M. Viviani PRC 98 (2018) 015203



■ Incoherent case S. Fucini, S.S., M. Viviani arXiv:1909.12261 [nucl-th]



While waiting for a realistic improvement, good predictivity. Good enough to be used as an input for an event generator (?)