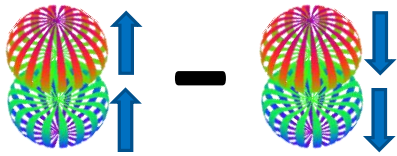# Tensor Spin Observables

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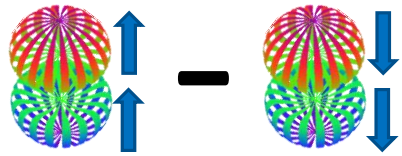
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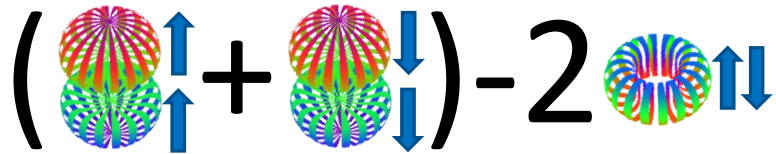
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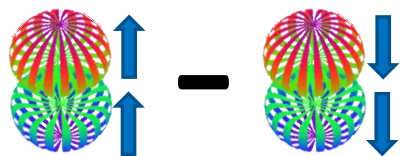
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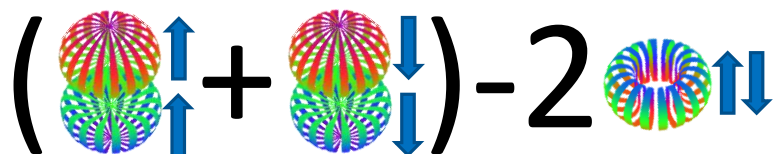Development of a high luminosity, high tensor polarized target has promise as novel probe of nuclear physics

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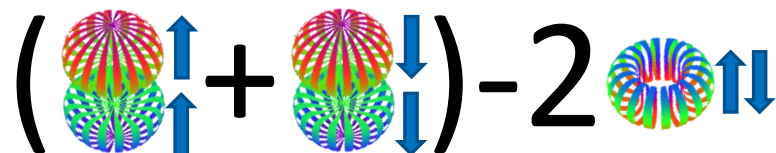
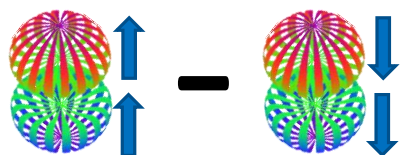Vector $P_z = p_+ - p_-$



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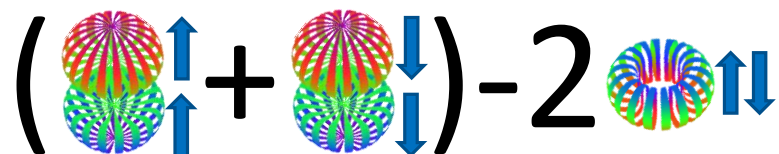Development of a high luminosity, high tensor polarized target has promise as novel probe of nuclear physics

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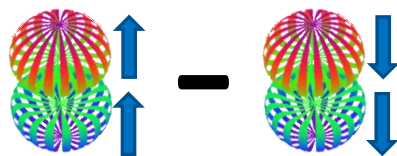
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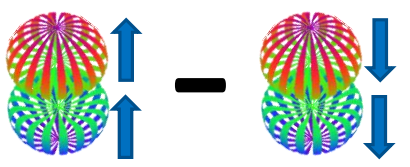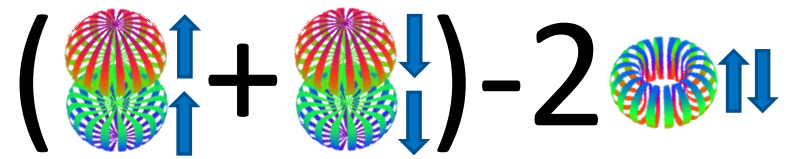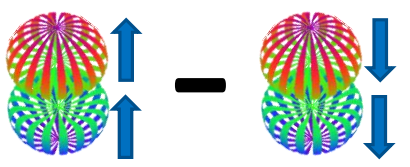
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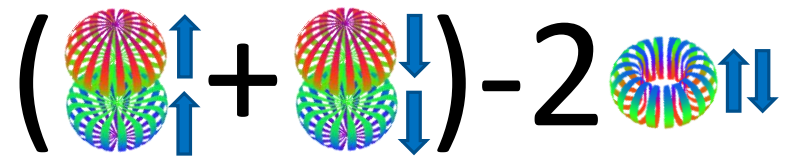# Tensor Spin Observables

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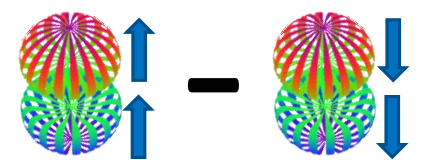$$^2\text{H} = \text{n} + \text{p} \implies b_1 = 0$$

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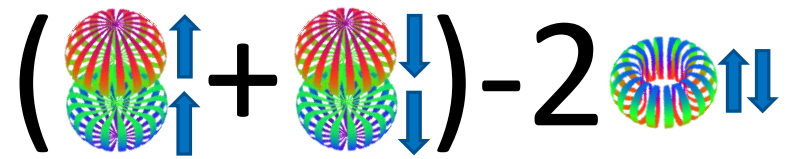
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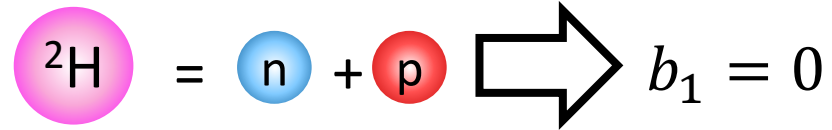
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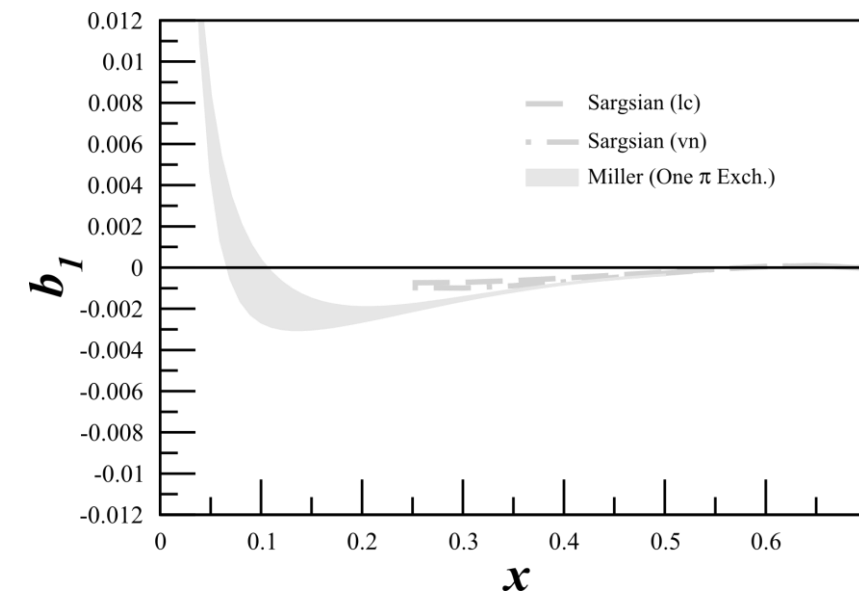
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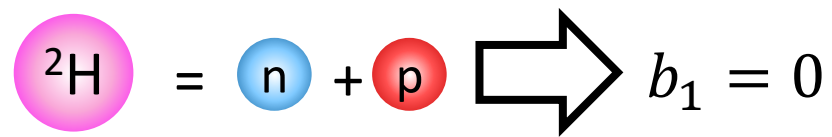[4] G Miller, Phys. Rev. **C89,** 045203 (2014)

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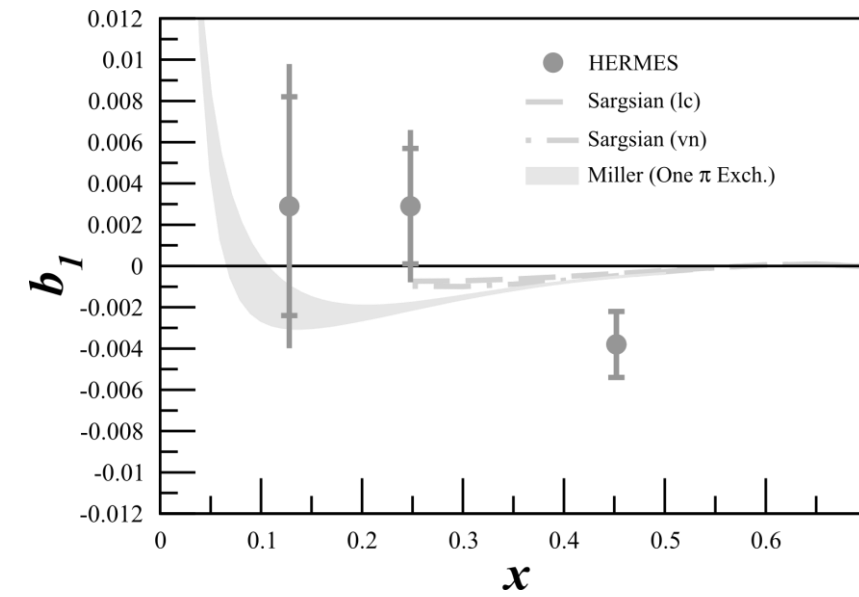
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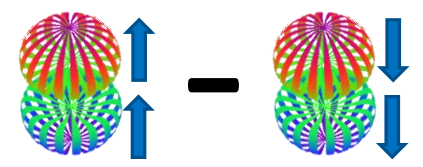$b_1$ allows us to quark distributions dependent on polarization of the nucleus

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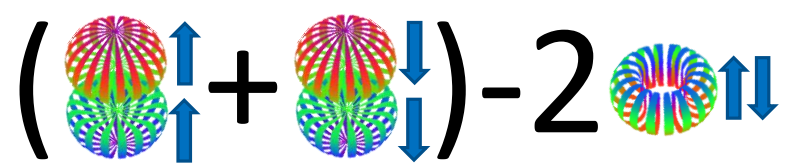
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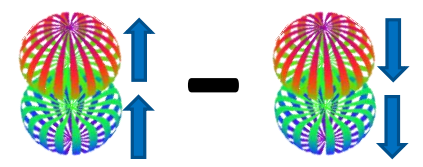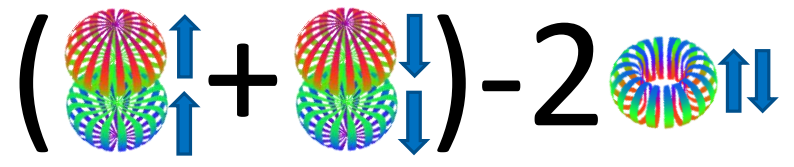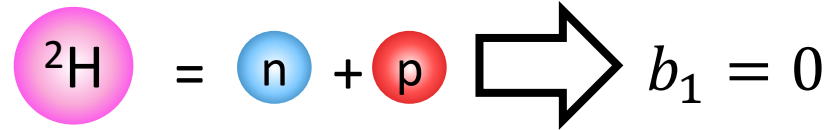Of all tensor observables, currently only elastic $t_{20}$ is well measured[1]

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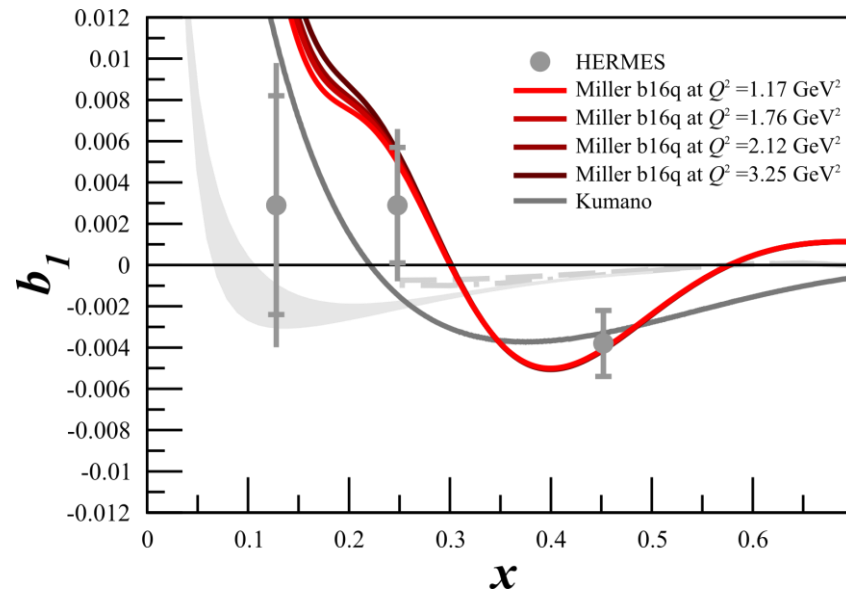$b_1$, $b_2$, $b_3$, $b_4$

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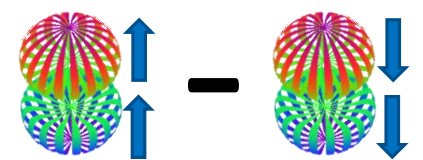Close-Kumano sum rule[3]
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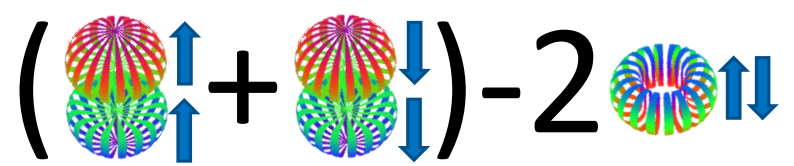[4] G Miller, Phys. Rev. **C89,** 045203 (2014
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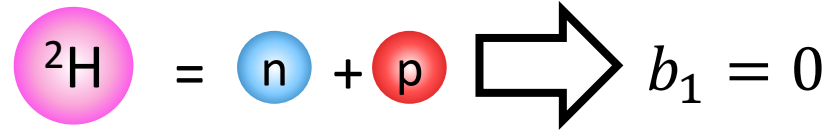
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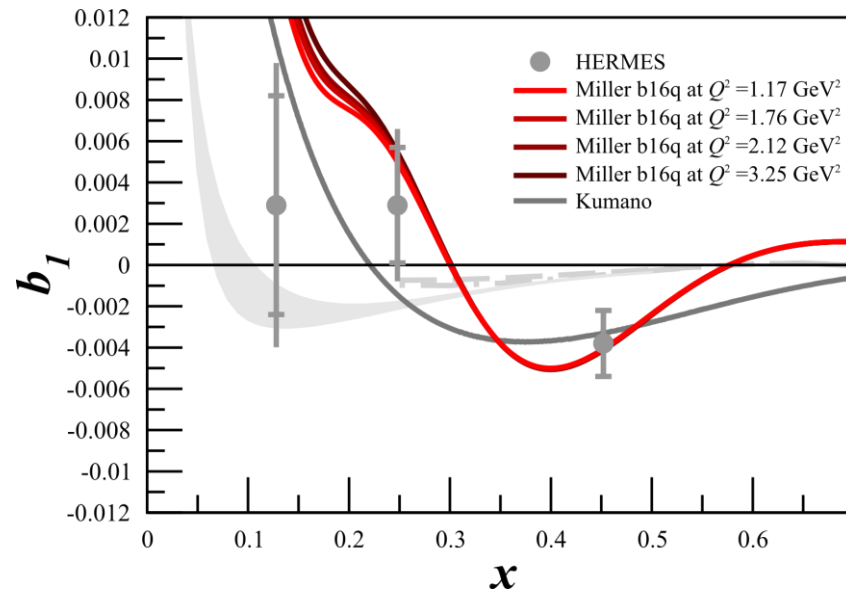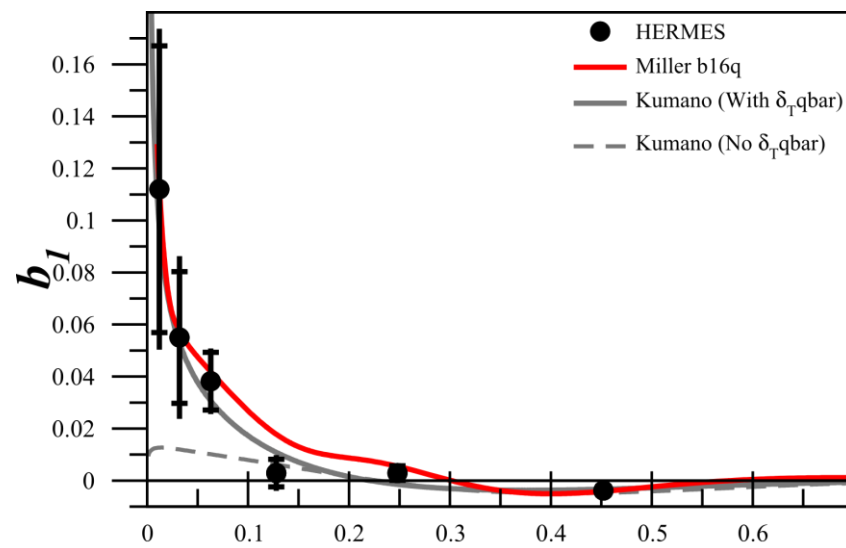
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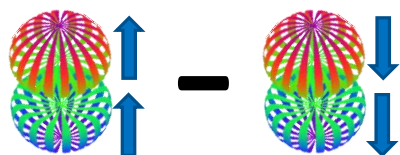Pionic effects[4,6]
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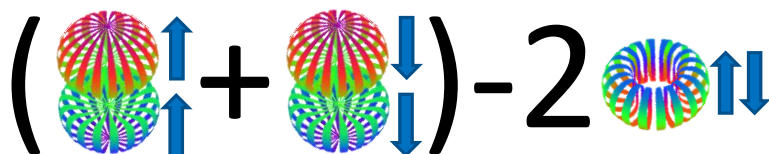[3] FE Close, S Kumano, Phys. Rev. **D42,** 2377 (1990)
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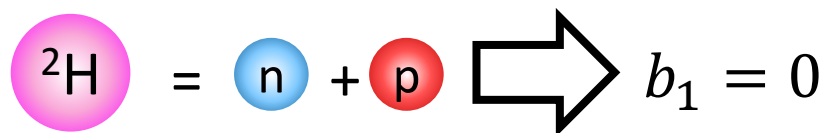
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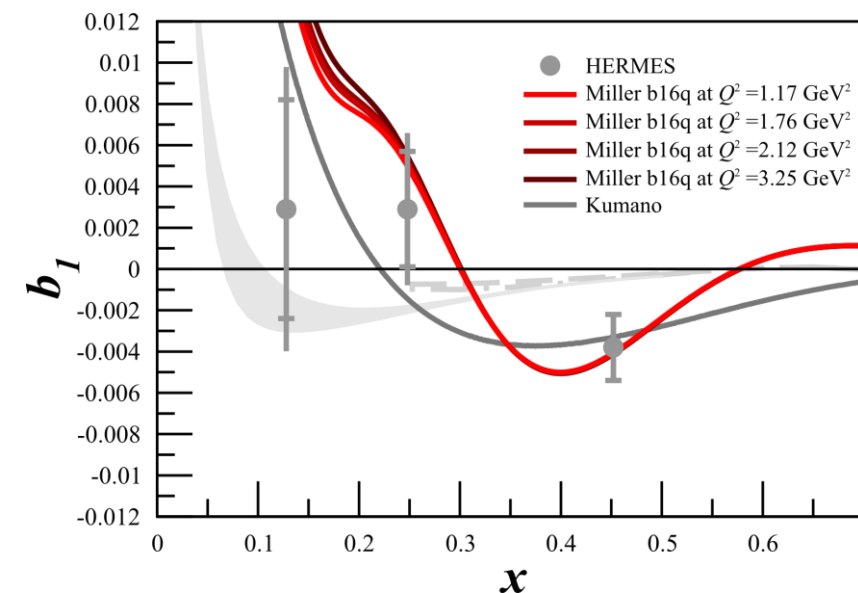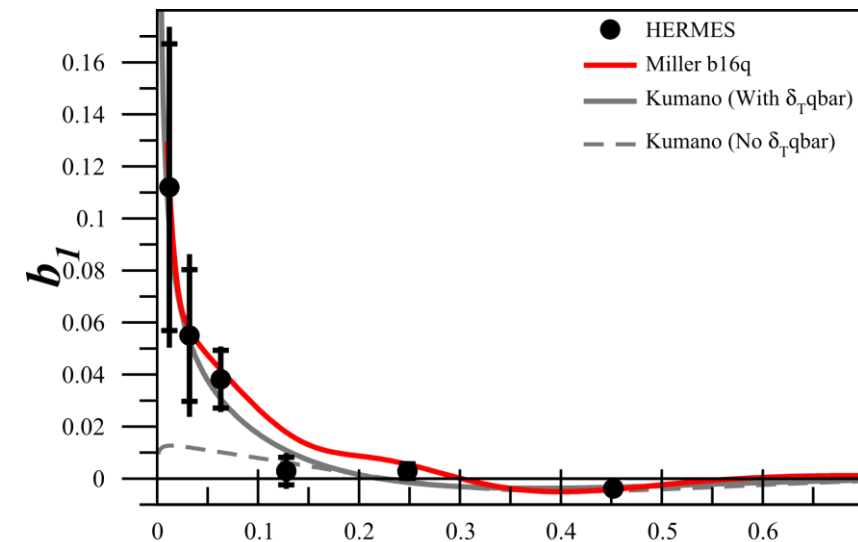
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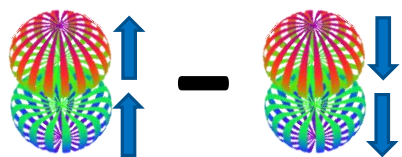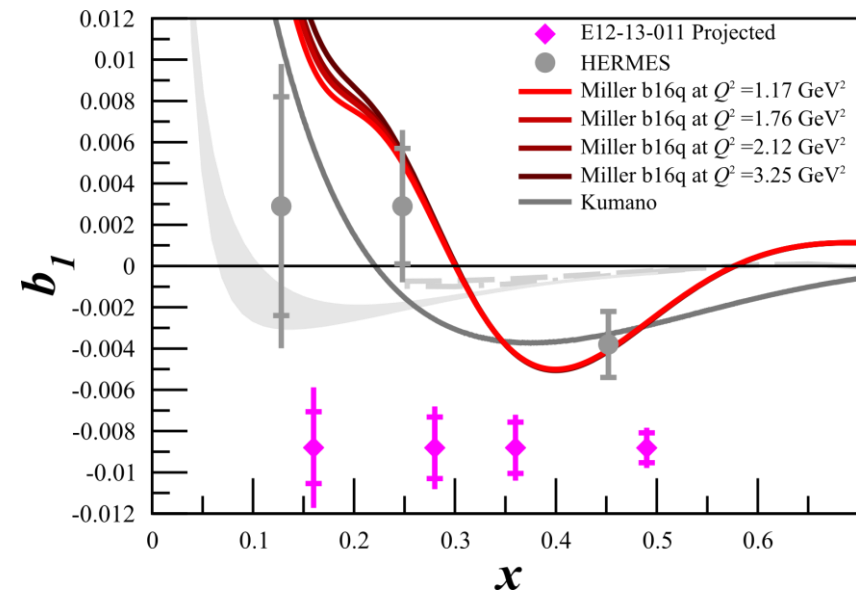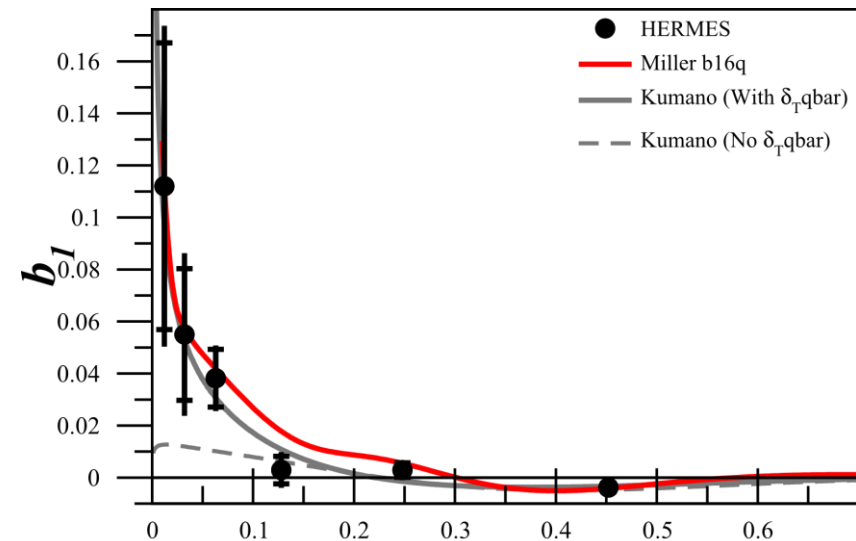# Tensor Spin Observables

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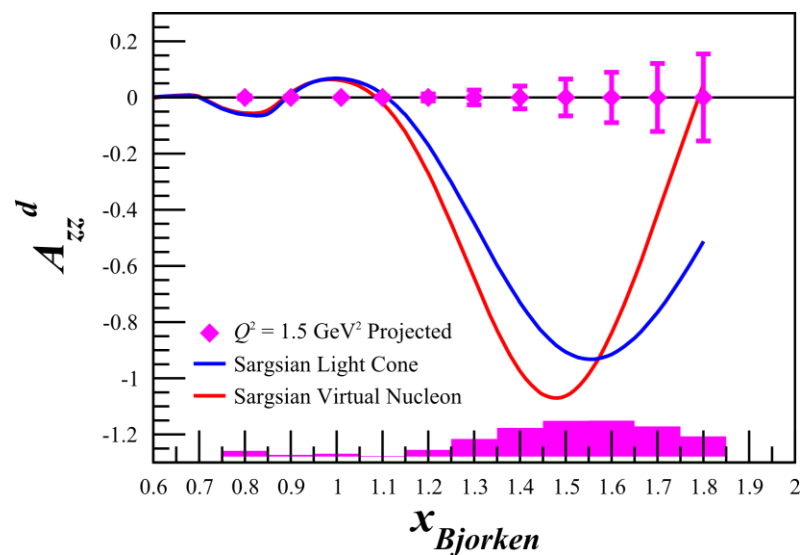
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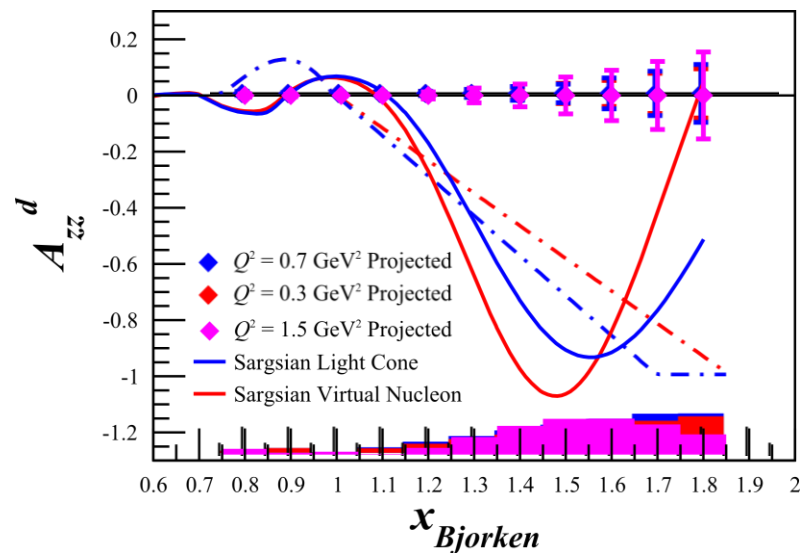
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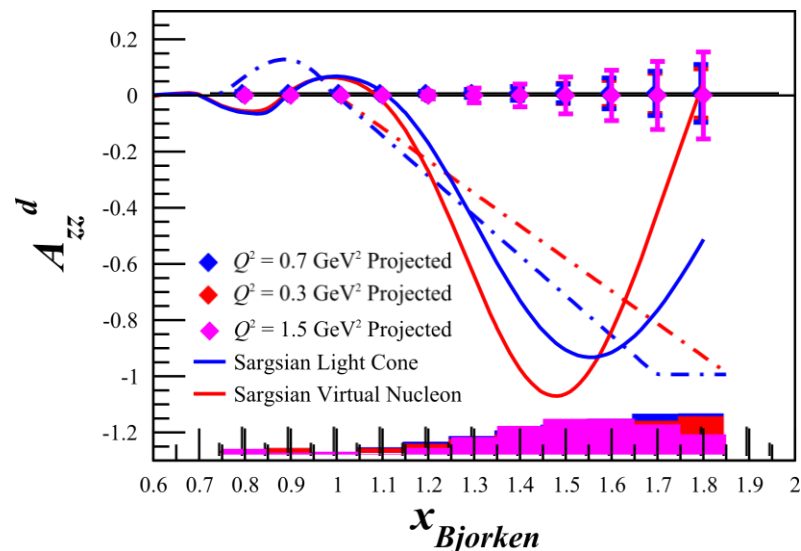
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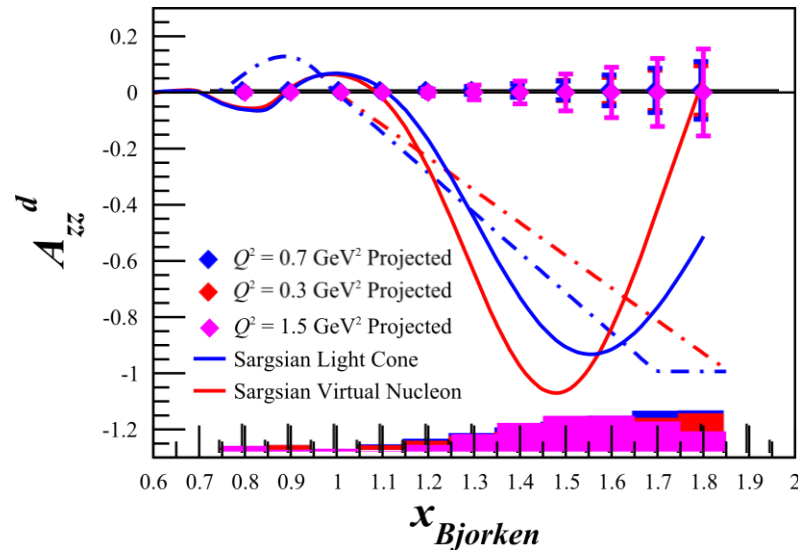
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$b_4$ in $x < 0.3$ region

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Any non-zero value indicates exotic gluonic components[5]

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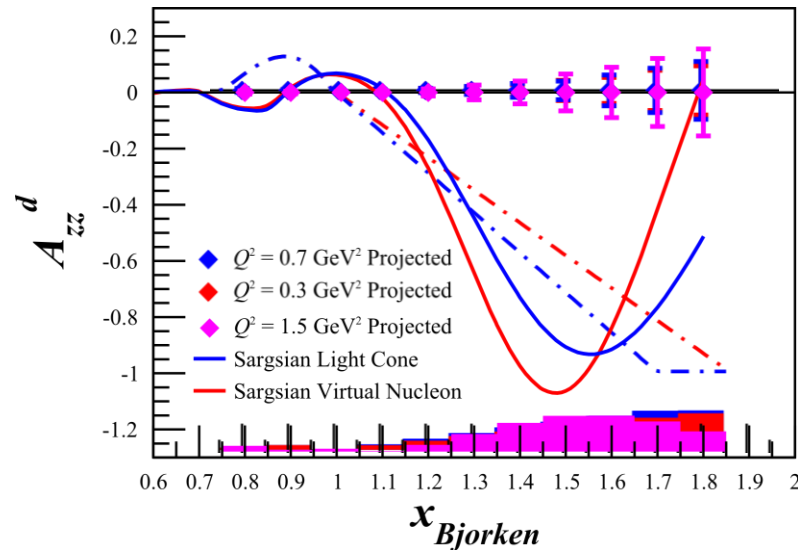Similar to $t_{20}$, but in QE
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[1] J Arrington *et al*, Prog. Part. Nucl. Phys. **67,** 898 (2012)
[2] M. Sargsian, private communication
[3] L Frankfurt, M Strikman, Phys. Rept. **160,** 235
[4] W Cosyn, M Sargsian, arXiv:1407.1653
[5] R Jaffe, A Manohar, Phys. Lett. **B223,** 218 (1989)

**Future of Tensor Measurements**
Approved measurement of $b_1$
2 upcoming proposals
4 structure functions to explore
Many more ideas from Tensor Workshop
Ample opportunities for exploration

# Tensor Spin Observables

**JLab LOI12-14-002: Tensor Asymmetry**

$A_{zz}$ in the $x > 1$ Region
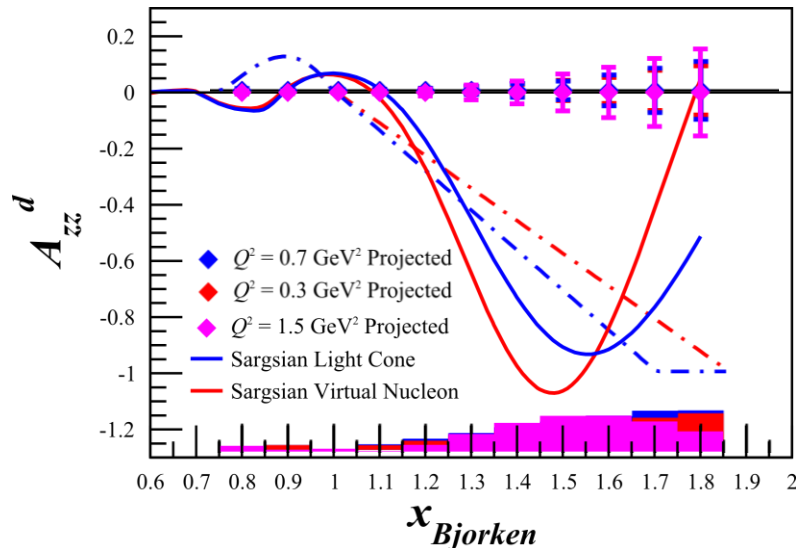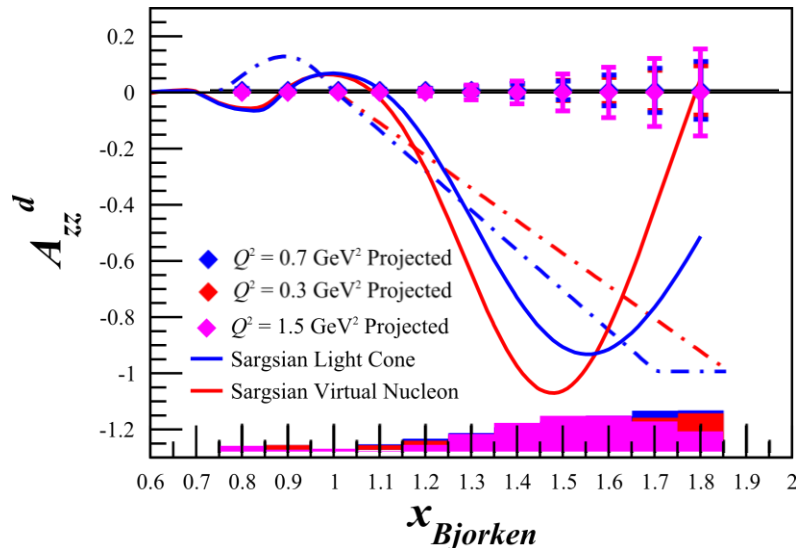
Similar to $t_{20}$, but in QE

SRCs & pn dominance[1]

Differentiate light cone and VN models[2]

Better understanding of s/d[3]

Final state interaction models[4]

Encouraged for full submission by PAC42

$$A_{zz} \propto \frac{\frac{1}{2}d^2 - sd}{s^2 + d^2}$$



- $Q^2 = 0.7$ GeV$^2$ Projected
- $Q^2 = 0.3$ GeV$^2$ Projected
- $Q^2 = 1.5$ GeV$^2$ Projected
- Sargsian Light Cone
- Sargsian Virtual Nucleon

**"The measurement proposed here arises from a well-developed context, presents a clear objective, and enjoys strong theory support. It would further explore the nature of short-range *pn* correlations in nuclei, the discovery of which has been one of the most important results of the JLab 6 GeV nuclear program."**
-JLab PAC42 Theory Advisory Committee

**JLab LOI12-14-001: Search for Exotic Gluonic States in the Nucleus**

$b_4$ in $x < 0.3$ region

Insensitive to bound nucleons or pions[5]

Any non-zero value indicates exotic gluonic components[5]

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**Ideas to probe novel nuclear effects through tensor structure are growing rapidly. It is paramount that a high luminosity, high tensor polarization target be developed to make these experiments possible**