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SMEFT probes of new physics in top spin measurements

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Collider experiments allow us to probe the spin state of fundamental particles in addition to their kinematics. Top quarks are unique candidates for spin polarization and spin correlation measurements and can be used for precision tests of the Standard Model.

Quantum information observables, like measures of entanglement, provide an additional handle to probe spin correlations. Entanglement can be heavily influenced by new physics, with $\mathcal{O}(20\%)$ deviations from the SM in scenarios not yet excluded by other measurements.
A quantum system with large enough entanglement can violate Bell inequalities. Top quark pairs can be used for this scope allowing a test of quantum mechanics at the TeV scale. Additionally, in the phase space region used for the detection of a violation of Bell inequalities, higher-dimensional effective operators are expected to become more relevant, enhancing the sensitivity of this measurement to BSM physics.

In this poster I will first present prospects of observing these quantum effects at the LHC within the Standard Model. Then I will show searches of new physics in the context of the Standard Model Effective Field Theory focussing on both measures of entanglement and spin correlations. I will present NLO-accurate numerical simulations obtained for the first time, and demonstrate how their inclusion in global SMEFT fits in the top sector can improve existing bounds on higher-dimension operators.

In-person participation

Yes

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