Contribution ID: **26** Type: **Oral**

# Measurement of $\Lambda\bar{\Lambda}$ spin correlation in proton-proton collisions at STAR

According to current understanding, the QCD vacuum contains a condensate of quark-antiquark pairs: $u\bar{u}$, $d\bar{d}$, and $s\bar{s}$. Due to the vacuum' s quantum numbers, $J^{PC} = 0^{++}$, these pairs are expected to appear as maximally entangled spin-triplet states with aligned spins. A recent proposal suggests that the $s\bar{s}$ pairs in the quark condensate may be experimentally probed through measurements of spin-spin correlations in $\Lambda\bar{\Lambda}$ hyperon pairs. In this talk, we present the first experimental measurements of spin-spin correlations for $\Lambda\bar{\Lambda}$, $\Lambda\Lambda$, and $\bar{\Lambda}\bar{\Lambda}$ pairs in $p+p$ collisions at $\sqrt{s} = 200$ GeV, recorded by the STAR detector in 2012. Both short-range ($|\Delta y| < 0.5$ and $|\Delta\phi| < \pi/3$) and long-range ($0.5 < |\Delta y| < 2.0$, or $\pi/3 < |\Delta\phi| < \pi$) $\Lambda$ hyperon pairs are analyzed. For the first time, a significant spin-spin correlation is observed in short-range $\Lambda\bar{\Lambda}$ pairs, consistent with their origin in the hadronization of maximally spin-entangled $s\bar{s}$ pairs from the QCD vacuum. These results also offer valuable insight into the strange quark hadronization, the spin structure of the $\Lambda$ hyperon, and mechanisms of the spin transfer from polarized protons to $\Lambda$ hyperons.

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**Session Classification:** Parallel

**Track Classification:** Three-dimensional structure of the nucleon: transverse momentum dependent parton distributions