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Fundamental measurements of the proton's sub-structure using high-energy polarized proton-proton collisions BERND SURROW, Temple University, STAR COLLABORATION — Understanding the structure of matter in terms of its underlying constituents has a long tradition in science. A key question is how we can understand the properties of the proton, such as its mass, charge, and spin (intrinsic angular momentum) in terms of its underlying constituents: nearly massless quarks (building blocks) and massless gluons (force carriers). The strong force that confines quarks inside the proton leads to the creation of abundant gluons and quark-antiquark pairs (QCD sea). These "silent partners" make the dominant contribution to the mass of the proton. Various polarized deep-inelastic scattering measurements have shown that the spins of all quarks and antiquarks combined account for only 25% of the proton spin. New experimental techniques are required to deepen our understanding on the role of gluons and the QCD sea to the proton spin. High energy polarized proton-proton ($p + p$) collisions at RHIC at Brookhaven National Laboratory provide a new and unique way to probe the proton spin structure using very well established processes in high-energy physics, both experimentally and theoretically. Various results in polarized $p + p$ collisions will be presented.

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