

# Measurements of $\Lambda(\bar{\Lambda})$ hyperons' local spin polarization in Au+Au collisions from the RHIC Beam Energy Scan-II

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## Abstract

The second harmonic cosine and sine modulations of the local spin polarization of  $\Lambda$  and  $\bar{\Lambda}$  hyperons, along the out-of-plane direction ( $\langle P_y \rangle$ ) and along the in-plane direction ( $\langle P_z \rangle$ ), respectively denoted as  $\langle P_{2y} \rangle$  and  $\langle P_{2z} \rangle$ , are newly proposed observables for probing the spin Hall effect (SHE) driven by the gradient of baryon chemical potential.  $\langle P_{2y} \rangle$  and  $\langle P_{2z} \rangle$  are measured in Au+Au collisions at  $\sqrt{s_{NN}} = 7.7, 9.2, 11.5, 14.6, 17.3, 19.6$  and  $27$  GeV from the RHIC Beam Energy Scan-II. A monotonic decrease of  $\langle P_{2y} \rangle$  for  $\Lambda$  with increasing collision energy, and smaller positive  $\langle P_{2z} \rangle$  with hints of sign change at  $\sqrt{s_{NN}} = 7.7$  GeV are observed. However,  $\langle P_{2y} \rangle$  and  $\langle P_{2z} \rangle$  for  $\bar{\Lambda}$  show no significant energy dependence within the large statistical uncertainties. The local polarization components are influenced by thermal vorticity, shear-induced effects, and baryon chemical potential. The local components and their difference will be presented. These measurements provide valuable insights into the spin dynamics of QCD matter in high baryon density environments.