Quantum Chromodynamics (QCD), the theory of strong interactions, is a cornerstone of the Standard Model of modern particle physics. It explains all strongly interacting matter in terms of point-like quarks interacting by the exchange of gauge bosons, known as gluons. This strongly interacting matter is responsible for 99% of the visible mass in the universe. Over the past several decades, a rich picture has come to light, with several overarching questions remaining that have been and continue to be addressed by the RHIC scientific program: what is the nature of the spin of the proton? how do quarks and gluons hadronize into final-state particles? how can we describe the multidimensional landscape of nucleons and nuclei? what is the nature of the initial state in nuclear collisions? what is the nature of diffractive exchange? Do we see effects of QCD vacuum related with tunnelling and topology (instantons, sphalerons) in diffractive particle production? Can we confirm glueball interpretation of the particles known as $f_0(1500)$ and $f_J(1710)$.

RHIC is one of two currently operating circular accelerators of protons and heavy-ions, and the only one in which it is possible colliding of polarized (longitudinally or transversely) proton beams. STAR detector, which began taking data in 2001, is at present the only one still operating at RHIC. It is expected that STAR will collect data till summer 2021 and they will be analysed for several subsequent years. One of the most significant achievement of the RHIC experiments (originally in addition to STAR there were three smaller detectors BRAHMS, PHOBOS and PHENIX installed at RHIC) is the first observation of a new state of matter, the so-called quark-gluon plasma (QGP) in heavy-ion collisions. Examination of the phase diagram of quantum chromodynamics (QCD), the initial state and the nature of the hadronization process in heavy-ion collisions are still the main objectives of the physics program of the STAR experiment. In parallel, programs of investigation of the nature of the proton spin, the so called physics of low-x in nuclei, the study of diffractive processes in which one of both colliding protons remain intact, are ongoing.

Measurements related to the above listed scientific aims will serve as an important step towards our complete understanding of the strong interactions and quantum chromodynamic description of nucleon and nuclei structure. It should be stressed that several from the proposed studies will add to the understanding of long range QCD interactions i.e. non-perturbative QCD regime, where calculations are difficult, phenomenological in nature and must be guided by measurements.