

# High-energy hadron physics at J-PARC

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## ABSTRACT

I discuss our studies on recent global analyses of nuclear parton distribution functions (NPDFs) [1] and fragmentation functions [2,3]. Then, possible high-energy hadron physics projects, including the studies on the NPDFs and fragmentation functions, are discussed for the Japan Proton Accelerator Research Complex (J-PARC) [4].

First, the NPDFs are determined by global analyses of experimental data on structure-function and Drell-Yan cross-section ratios [1]. Valence-quark distributions are well determined, and antiquark distributions are also determined at  $x < 0.1$ . However, the antiquark distributions have large uncertainties at  $x > 0.2$ . It is difficult to fix gluon modifications in the whole- $x$  region. Second, fragmentation functions and their uncertainties are determined for pion, kaon, and proton by analyses of hadron-production data in  $e^+e^-$  annihilation [2]. It is important that the uncertainties are estimated in the fragmentation functions for the first time. We found that gluon and light-quark functions have large uncertainties at small  $Q^2$ . Then, it was proposed that the fragmentation functions can be used for determining internal structure of exotic hadrons such as  $f_0(980)$  by noting differences between favored and disfavored functions [3].

Next, possible projects are explained for high-energy hadron physics at J-PARC [4]. The facility provides an intensity frontier with 50 GeV proton beam for nuclear and particle physics. It could cover a wide range of hadron physics from strongly interacting many-body systems with an extended hadronic degree of freedom, strangeness, to new forms of hadrons and hadronic matters. Using the primary proton beam, we could investigate various topics on exotic hadron searches, chiral dynamics in nuclear medium, structure functions, hard exclusive processes, and spin structure of the nucleon. The aforementioned NPDFs, especially antiquark distributions, and fragmentation functions can be also investigated at J-PARC in the large  $x$  or  $z$  region. I explain roles of the J-PARC projects on these topics.

## References

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