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Generalized distribution amplitudes and gravitational form factors for pion

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Generalized parton distributions (GPDs) have been investigated in the deeply virtual Compton scattering (DVCS) to solve the proton spin puzzle. On the other hand, the generalized distribution amplitudes (GDAs) can be studied in the two-photon process $\gamma^*\gamma \rightarrow h\bar{h}$ which is accessible at KEKB. Namely, the GDAs are the s-t crossed quantities of the GPDs. In 2016, the differential cross section of the process $\gamma^*\gamma \rightarrow \pi^0\pi^0$ was measured by the Belle collaboration in the e^+e^- collision [1], so that the pion GDAs can be obtained by analyzing the Belle data. Expressing the GDAs with a few parameters, we determined the GDAs by a χ^2 analysis [2]. The form factors of the quark energy-momentum tensor are obtained from the determined GDAs. Then, we calculated the mass radius as 0.56-0.69 fm and the mechanical radius as 1.45-1.56 fm for the pion by using the form factors. This is the first study on gravitational form factors and radii of hadrons from actual experimental measurements [2]. The Belle II will start taking data in 2018 by the upgraded SuperKEKB. Therefore, much accurate data are expected for the pion in the near future, and other hadron productions will be measured for the GDAs. The GDA studies are valuable for understanding not only the 3D structure but also gravitational properties of hadrons.

[1] M. Masuda et al. (Belle Collaboration), Phys. Rev. D **93**, 032003 (2016).

[2] S. Kumano, Qin-Tao Song and O. V. Teryaev, arXiv:1711.08088, Phys. Rev. D in press.

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