

Report of the RCNP Collaboration Research Network (RCNP-COREnet)		
COREnet058		PI: Daisuke Fujii
1	Title of research	Gravitational form factors and confining forces inside hadrons: bridging pressure, non-perturbative properties, and spectroscopy
2	List of Participants (Name and affiliation)	Daisuke Fujii (Advanced Science Research Center, Japan Atomic Energy Agency)
		Atsushi Hosaka (Research Center of Nuclear Physics, Osaka University)
		Akihiro Iwanaka (Yukawa Institute for Theoretical Physics, Kyoto University)
		Mamiya Kawaguchi (Anhui University of Technology)
		Masakiyo Kitazawa (Yukawa Institute for Theoretical Physics, Kyoto University)
		Riku Kojima (Research Center of Nuclear Physics, Osaka University)
		Kei Suzuki (Advanced Science Research Center, Japan Atomic Energy Agency)
		Mitsuru Tanaka (Nagoya University)
3	Period of research	2025.04.01~2026.03.31
4	Main location of collaboration implementation	Advanced Science Research Center, Japan Atomic Energy Agency
5	Publication list (Please include DOI if available)	Articles
		Mitsuru Tanaka, Daisuke Fujii, Scale-anomaly-induced binding pressure in hadrons, Phys. Lett. B 870, 139872 (2025)
		Mitsuru Tanaka, Daisuke Fujii, Mamiya Kawaguchi, Gravitational form factors of the nucleon in the Skyrme model based on scale-invariant chiral perturbation theory, Phys. Rev. D 112, 054048 (2025)
		Daisuke Fujii, Akihiro Iwanaka, Mitsuru Tanaka, Scalar-glueball-mediated scale-anomaly dominance of the confining pressure of the pion in holographic QCD, Phys. Rev. D 112, 094051 (2025)
	Talks	Mamiya Kawaguchi, Daisuke Fujii, Mitsuru Tanaka, Gravitational form factors of the nucleon via the Skyrme model based on scale-invariant chiral perturbation theory, International Conference on the Structure of Baryons (BARYONS 2025), Jeju, Korea, 11/11 (2025)
		Daisuke Fujii, Akihiro Iwanaka, Mitsuru Tanaka, Scale-anomaly-induced confining pressure in the pion and the nucleon on the light front form, International Conference on the Structure of Baryons (BARYONS 2025), Jeju, Korea, 11/13 (2025)
6	Description of the results and outputs	This year, our research mainly advanced the first pillar of the project, namely the relation between hadronic internal stresses and non-perturbative QCD phenomena. By using the model independent results of the gravitational form factors, we analyzed pressure distributions in the nucleon and pion in both instant and light-front form, and showed that the scale anomaly provides the dominant negative binding pressure in both the nucleon and pion, and in both the instant and light-front form. In addition, within the Skymion model based on scale-invariant chiral perturbation theory, we also clarified that the gluonic scale anomaly plays an essential role in the nucleon stability condition and the D-term. In holographic QCD, we obtained a picture in which the confining pressure inside the pion is mediated by a scalar glueball. On the other hand, the inverse construction of quark-model potentials and full collaboration with lattice QCD, which were originally proposed in the project plan, remain as future tasks.
7	Amount of budget implemented (for internal use only)	0