

Toward Testing Quantum Nature of Gravity

K YAMAMOTO¹

¹*Department of Physics, Kyushu University, Motoooka 744, Nishi-ku, Fukuoka, Japan.*

Contact Phone: +81-92-802-4047

Contact Email: yamamoto@phys.kyushu-u.ac.jp

The unification of gravity and quantum gravity has been one of the challenging topics in the fundamental physics. Experimentally, no one has verified the quantum nature of gravity, whether the gravity follows the superposition principle in quantum mechanics. Developments in quantum technologies might enable us to verify the assumption of the quantum gravity in the future. Optomechanics is a promising way to generate the quantum state of a macroscopic object, which could be used to test the quantum nature of gravity. We investigate the feasibility of generating quantum conditional entanglement between macroscopic mechanical mirrors in optomechanical systems while under continuous measurement and feedback control, motivated by the recent experiment with a 7-mg mirror. We also discuss a future prospect of verifying the quantum nature of gravity.