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Enabling quantum optomechanics for phononic crystals and superfluid helium films

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Stellingen

Behorende bij het proefschrift

Enabling Quantum Optomechanics for Phononic Crystals and Superfluid Helium Films

1. SNSPDs can in principle be operated with 94% detection efficiency while having dark count rate less than 1 per hour. *Chapter 2*
2. It is possible to pick out 1 photon at a wavelength of 1064.000000 nm in a sea of 10^{16} photons at wavelength of 1064.000004 nm. *Chapter 3*
3. Optical cooling of a mechanical resonator near the ground state is easy compared to proving it. *Chapter 4*
4. Superfluid optomechanics brings together concepts from quantum optics, fluid dynamics, and nonlinear physics within a single experimental system. *Chapter 6*
5. The future development of SNSPD technology will increasingly depend on extending near-ideal single-device performance to scalable arrays and integrated quantum photonic systems. *Charaev et al., Nature Communications (2024).*
6. Regardless of whether gravity induces wavefunction collapse, experimental tests of macroscopic quantum superpositions are essential for constraining such theories. *Penrose, General Relativity and Gravitation (1996).*
7. The largest macroscopic quantum superposition produced to date must be kept isolated for over 84000 years to rule out gravitational induced collapse of wave function. *Pedalino et al., Nature (2026).*
8. Integrated quantum fluids can become the next generation of quantum simulators. *Reeves et al., Science (2025).*
9. Love and peace are easily spoken of, yet life's greatest luxuries.
10. Every scientific question deserves another "why?".

Xinrui Wei
Leiden, 8 September 2026