

## Exploring macroscopic quantum mechanics in optomechanical devices

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### Abstrak

Recent state-of-the-art technologies in fabricating low-loss optical and mechanical components have significantly motivated the study of quantum-limited measurements with optomechanical devices. Such research is the main subject of this thesis. In the first part, the author considers various approaches for surpassing the standard quantum limit for force measurements. In the second part, the author proposes different experimental protocols for using optomechanical interactions to explore quantum behaviors of macroscopic mechanical objects. Even though this thesis mostly focuses on large-scale laser interferometer gravitational-wave detectors and related experiments, the general approaches apply equally well for studying small-scale optomechanical devices.