Soutenance de thèse

Lundi 16 Décembre 2024
15h, Amphithéâtre C2N

Control of linear and nonlinear resonances in coupled nanoelectromechanical membranes

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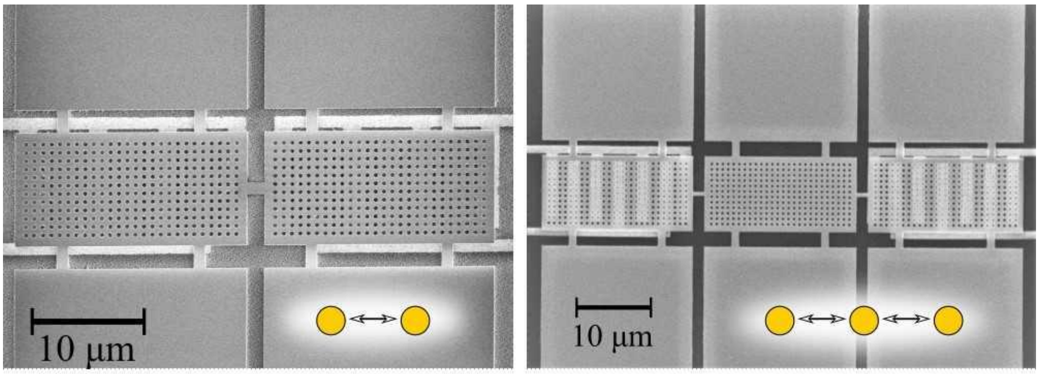
Abstract :
Micro-and nanoelectromechanical systems (MEMS/NEMS) play a central role in integrated photonics and fundamental physics research. This research focuses on the design, fabrication, and characterization of coupled nano-opto-electromechanical membranes, providing new insights into their linear and nonlinear dynamics.

Key highlights include the development of advanced photonic crystal mirrors for improved optical readouts, enabling precise control and characterization of mechanical eigenmodes in coupled resonators. In the linear regime, interferometric techniques reveal novel phenomena such as CPA-like effects, amplitude annihilation, and phase enhancement. Nonlinear dynamics reveal bistability and multistability, modeled with coupled Duffing oscillators and controlled by innovative feedback strategies.

Expanding to three coupled resonators, the study explores Fano resonances, eigenmode control, and phase locking in both linear and nonlinear regimes, demonstrating the intricate interplay between these effects. These findings open avenues for future research on collective behavior and applications in sensing, low-power modulation, and advanced nonlinear systems.

This work bridges fundamental physics and practical applications, presenting a comprehensive study of coupled resonators that paves the way for innovations in electromechanical technologies.



Coupled nano-opto-electro-mechanical resonators