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Fabrication and Optical Stability of Ultralight Micromirrors for ET Laser Power Stabilization

Radiation pressure noise at low frequencies remains a key challenge for the Einstein Telescope (ET). One approach is active stabilization using ultralight micromirrors suspended by extremely soft springs, providing large displacement response to fluctuating photon pressure. These devices are fabricated on silicon-on-insulator wafers and released by vapor HF etching, yielding mechanically stable membranes patterned with resonant waveguide gratings for high reflectivity at 1550 nm. Reflection measurements on first-generation samples confirm good optical performance. Rigorous coupled-wave analysis (RCWA) simulations of the angular dependence of reflectivity establish the basis for evaluating angular stability in the ET application. A second fabrication run with new suspension layouts, an optimized stiffness and additional test masses to compensate static photon pressure is in preparation. This project defines a potential technology path for radiation-pressure noise mitigation in ET.

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