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Co-sputtering of metal oxides to reduce opto-mechanical losses

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Mechanical and optical thermal noise fundamentally limit the sensitivity of high-precision optomechanical experiments based on stabilized optical cavities, with gravitational-wave detectors being the main drivers of theoretical and experimental progress in this field. The most informative frequency band for gravitational signals lies in the mid-frequency range (a few to hundreds of Hz), where coating thermal noise originating from thermally driven fluctuations in multilayer dielectric coatings becomes a dominant source. Its magnitude is directly linked to internal friction and stress within the coating layers. Advancing this research requires the development of optimized coatings that reduce thermal noise while maintaining excellent optical performance. Potential directions include exploring alternative mixed metal-oxide materials such as $\text{TiO}_2\text{-SiO}_2$, $\text{TiO}_2\text{-GeO}_2$, Hf_2O_3 , and Zr_2O_3 . In this proposed project, we are using the magnetron sputtering apparatus to perform the co-sputtering of Metal oxides on the glass substrates by varying the deposition parameters.

Presenter: ALI, Zahid