Contribution ID: **67** Type: **Poster**

Reducing Thermal Noise in Gravitational-Wave Detectors: Crystalline Top Layer for Amorphous Coatings

Tuesday, 24 October 2023 14:05 (20 minutes)

A gravitational wave detector can measure small periodic distortions in spacetime known as gravitational waves. Improvement in the sensitivity of these detectors can help gain new insight into physics. These instruments require mirror coatings made of low and high refractive index layers with very low coating thermal noise. Future detectors, such as the Einstein Telescope, will operate at cryogenic temperatures for which new coatings have to be developed. Promising materials are amorphous silicon as high-index material and silicon nitride as low-index material, which have low mechanical loss but too high optical absorption. Ways to reduce this absorption while keeping the mechanical loss low would be 1) optimizing the parameters for the chosen deposition processes 2) heat treatment of the coatings 3) studying doping processes and passivation of dangling bonds by using hydrogenation and fluorination 4) Investigating effects of the substrate on the coating performance. Using industrially available silicon on insulators (SOI) wafers with a device layer of the right thickness to be used as crystalline top layer of the coating. In this project, suitable bonding technologies to bond the SOI wafer, coated with improved materials, to the mirrors will be investigated as well as the etching procedure to have a final crystalline silicon top layer. Such a layer would reduce the light field inside the coating and consequently the coating absorption while showing negligible thermal noise.

Presenter: DIKSHA, Diksha (Maastricht university, GWFP (NIKHEF))

Session Classification: Posters

Track Classification: Instrumentation and R&D