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Overview of possible multimaterial designs for improving current coatings

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A factor of two in coating thermal noise reduction is required to achieve the design sensitivity of Advanced LIGO+. For ET-HF and the initial Cosmic Explorer design very similar coating thermal noise levels are assumed. Low optical absorption of the coatings of $< 1\text{ppm}$ is also required, but challenging to meet.

Multimaterial designs allow for a trade-off between thermal noise and absorption, allowing for one of the parameters to be reduced while slightly increasing the other. In case of a low refractive index contrast between coating materials, a multimaterial design can reduce the total number of layers required to achieve a certain reflectivity, potentially reducing defects during deposition, or issues from heat treatment or stress effects.

On this poster, we will explore the parameter space of possible improvements in coating performance via multimaterial designs - on the example of the Advanced LIGO+ design. A range of currently interesting materials e.g. germania-based coatings, silicon nitride and aSi will be considered.

Autore principale: STEINLECHNER, Jessica (Maastricht University)

Coautore: Dr. MARTIN, Iain (University of Glasgow)

Relatore: STEINLECHNER, Jessica (Maastricht University)

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