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Meeting the Advanced LIGO+ coating requirements by using multimaterial designs

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To realize the design sensitivity of Advanced LIGO+, about a factor of two in coating thermal noise reduction is required. For ET-HF and the initial Cosmic Explorer design very similar coating thermal noise levels are assumed. Another requirement on the highly-reflective mirror coatings is low optical absorption of $<1\text{ppm}$ which is 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.

This talk will give an overview of possible improvements of coating performance by using 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.

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