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The crystallization process in amorphous Ta2O5 thin films.

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Amorphous Ta2O5 thin films are at the heart of the mirrors of gravitational wave interferometers. Their mechanical and optical properties determine the noise floor of the whole instrument in its most sensitive frequency range and thus the portion of the observable Universe.
Those optical coatings are deposited in their amorphous form by PVD processes. It is then customary to expose the coatings to specific thermal treatments in order to improve their mechanical and optical properties. In doing so, the structure of the amorphous oxide rearranges itself to reach more stable configurations, leading eventually to the formation of nano-crystalline regions. This phenomenon is generally considered detrimental with respect to the final properties of the coating. Yet, there is a significant lack of knowledge on the detailed physics taking place in this early structural change.
In this poster we report our findings on the structural and optical investigation of this material when it is subjected to thermal treatments inducing the formation of crystalline nano-regions. Their evolution is probed by structural techniques and ab-intio methods. The results are analyzed on the basis of specific structural models. The impact of the nano-crystal on the light scattering properties is also reported as a function of the crystallized fraction in the films.

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