The importance of Coatings in Interferometric Gravitational Wave Observatories

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LIGO and Virgo are Gravitational wave observatories. Their optical interferometers are designed to detect Gravitational Wave inspiral signals from Neutron Star and Black Hole pairs, as well as from other compact objects and violent processes. Events of this kind happening at tens of mega-parsec from Earth produce a space-time strain of $\sim 10^{-21}$ m/m.
At present, the sensitivity to signals from Gravitational Wave inspirals (length sensitivity $\sim 10^{-19}$ m/√Hz over 3-4 km arms) extends to events as far as ~15 mega-parsec. At this "reach", given the estimated Neutron Star densities in galaxies, we expect a few percents of an event per year (no signal yet observed).
Both Virgo and LIGO are undergoing upgrades, which will bring a sensitivity increase of a factor of ten, thus reaching over 1000 time more Universal volume. At that sensitivity signal detection will be a ~weekly frequency and mapping of the compact-body Universe will have started.
In the advanced detectors, the sensitivity ($\sim 10^{-20}$ m/√Hz) will be limited by thermal noise in the mirrors (dominated by the coating's thermal noise) and will require about a MW of standing optical power on the mirrors to match the mirror thermal noise with comparable optical length sensitivity. A mirror figure error of the order of a few Angstroms is also required.
This poses very stringent requirements on the mirror coating mechanical losses (to minimize thermal noise), optical absorption (to minimize heating, which would warp the mirrors out of their required figure error), and uniformity (which would directly spoil the figure error).
X-ray mirror coatings are the other branch of physics with comparable coating requirements. I am coming to this conference in search of ideas, suggestions, and possible synergies to best tackle this difficult problem and further extend the reach of the Gravitational Wave observatories.