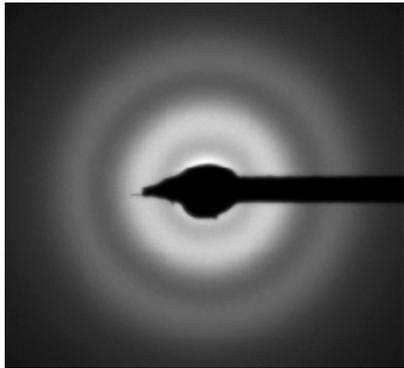


The atomic structure and properties of heat-treated Ta₂O₅ coatings

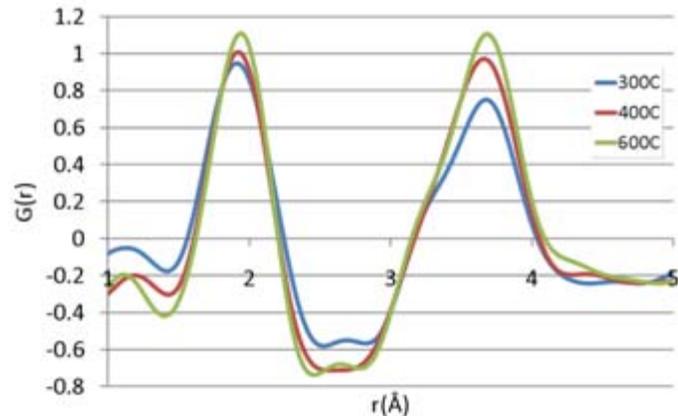
R Bassiri¹, K B Borisenko², D J H Cockayne², J Hough¹, I Martin¹, I MacLaren¹, S Rowan¹

¹ SUPA, University of Glasgow, ² Department of Materials, University of Oxford

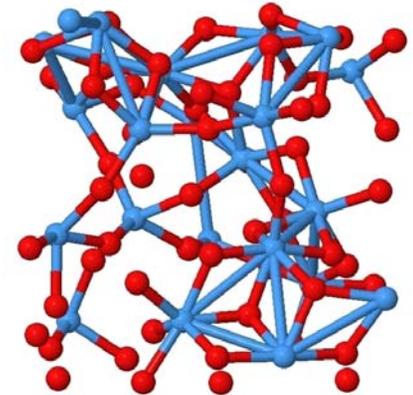
- Thermal noise arising from the mechanical loss of the mirror coatings is an important noise source in gravitational wave detectors, limiting detector sensitivity
- What is causing the mechanical loss on an atomic level of these coatings?



Amorphous diffraction pattern of Ta₂O₅



Reduced density functions (RDFs) of heat-treated Ta₂O₅

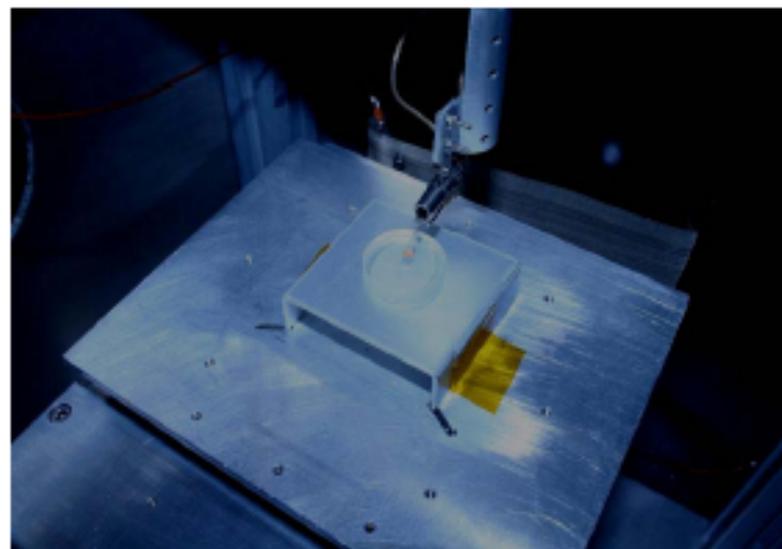


Ta₂O₅ atomic model

- Here we investigate the atomic structure of mirror coatings heat-treated to 300, 400, 600 and 800°C
- Results show a possible link between crystallisation of the coating and high levels of mechanical loss
- Measurement techniques developed to probe the atomic structure of amorphous coatings provide a promising way of investigating the changes in atomic structure and relating it to the mechanical loss of the coatings

A Kelvin probe is being used to measure surface charge on samples of silica

To get more meaningful measurements the Kelvin probe was calibrated using a method first used by Davies (1967)



Charge mitigation by glow discharge is also being researched

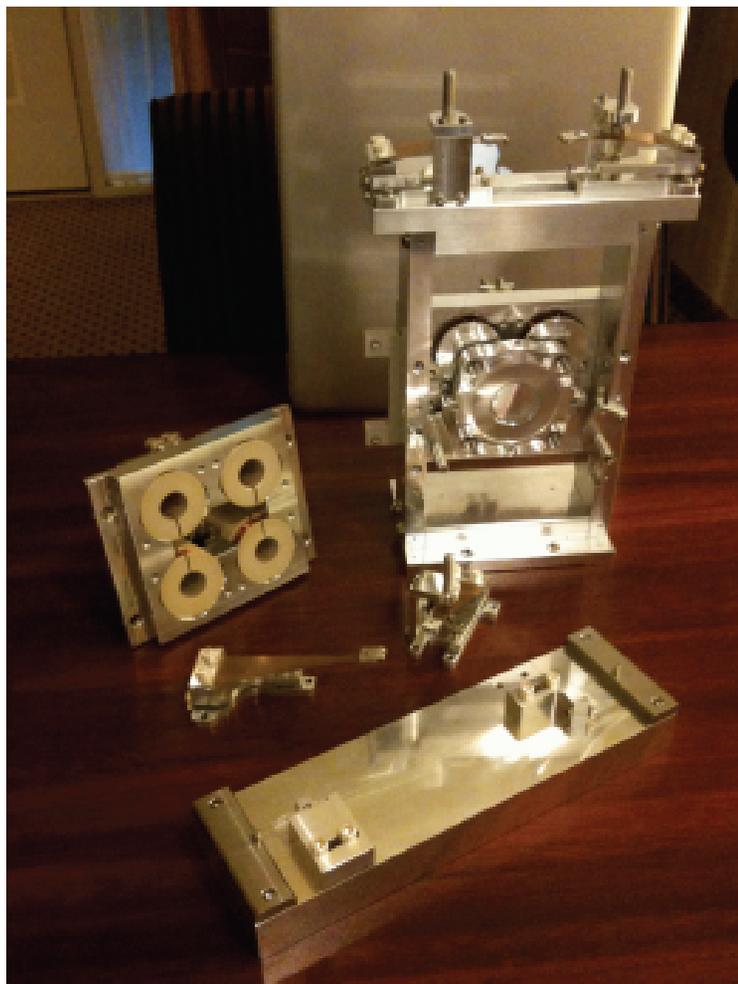
An AC glow discharge creates a flow of both positive and negative charge carriers

A PID controlled glow discharge is currently being investigated in order to achieve a reproducible method of removing both positive and negative surface charge

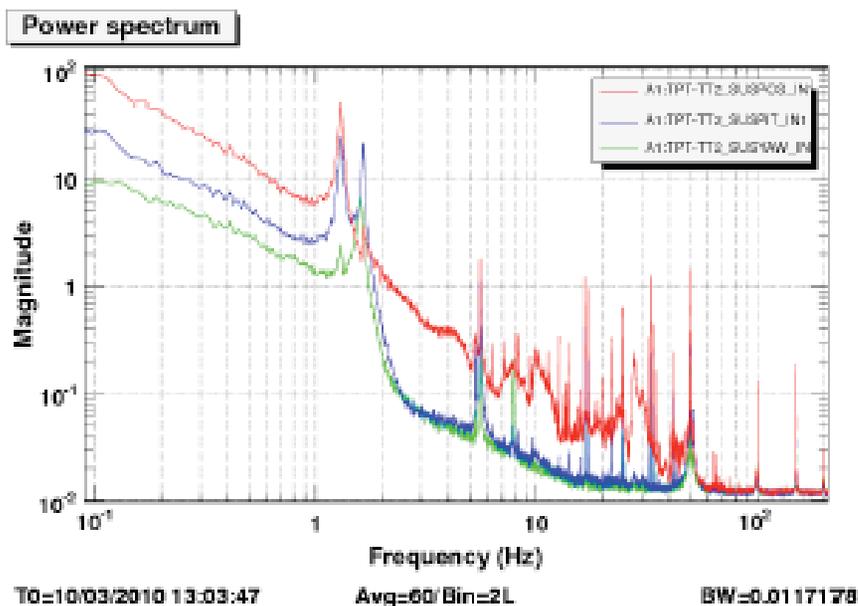


Tip-Tilt Mirror for aLIGO

Bram Slagmolen, Adam Mullavey, David McClelland



Show and tell (no touching)



G1000329-v1

- Steve Penn – Reducing the mechanical loss in silica and niobia/silica mirror coatings
- Bill Kells – The character of interferometer cavity mirror coherent scatter loss
- Elisabetta Cesarini – Mechanical characterization of “uncoated” and “Ta₂O₅-single-layer-coated” SiO₂ substrates”
- Giovanni Losurdo – Silicate bonding properties: investigating through thermal conductivity measurements
- David Feldbaum – HPFL work at LLO
- Namjun Kim – Solid-state NMR studies of oxide coating materials

Schedule of Discussions

- After break Today– Scatter Research Plans
- Tuesday 14:00 – 15:00 Cancun Room – Coating Thermal Noise and Coating Runs
- Tuesday 16:45 – 17:30 Cancun Room – Charging Research Plans
- Thursday Afternoon/Friday Morning – Coating Modeling Workshop – Caltech campus
 - Talk to me about rides from hotel
 - Let me know if you want to go to dinner Thursday night
 - Choice of Mahi-mahi, Sole, or Chicken
 - \$36, can pay me in advance