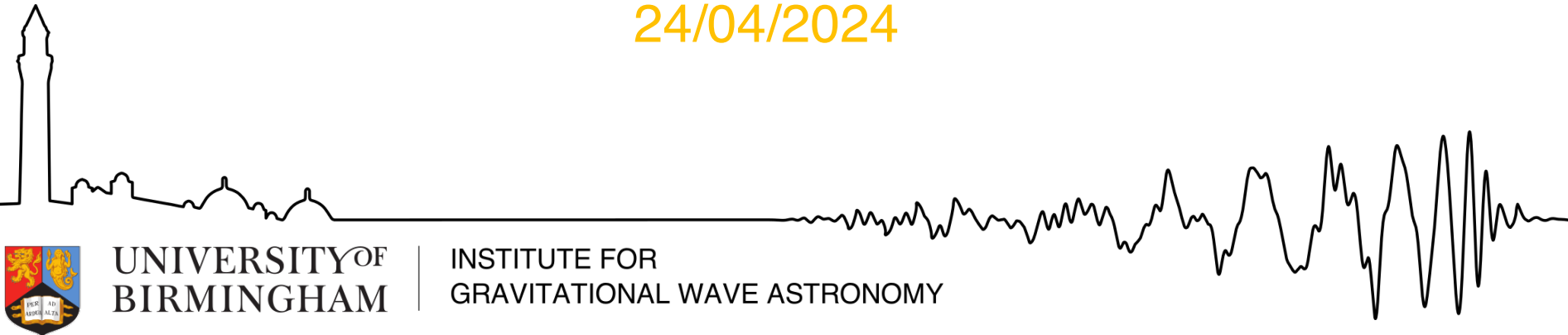


# Cosmic Explorer: cryogenics

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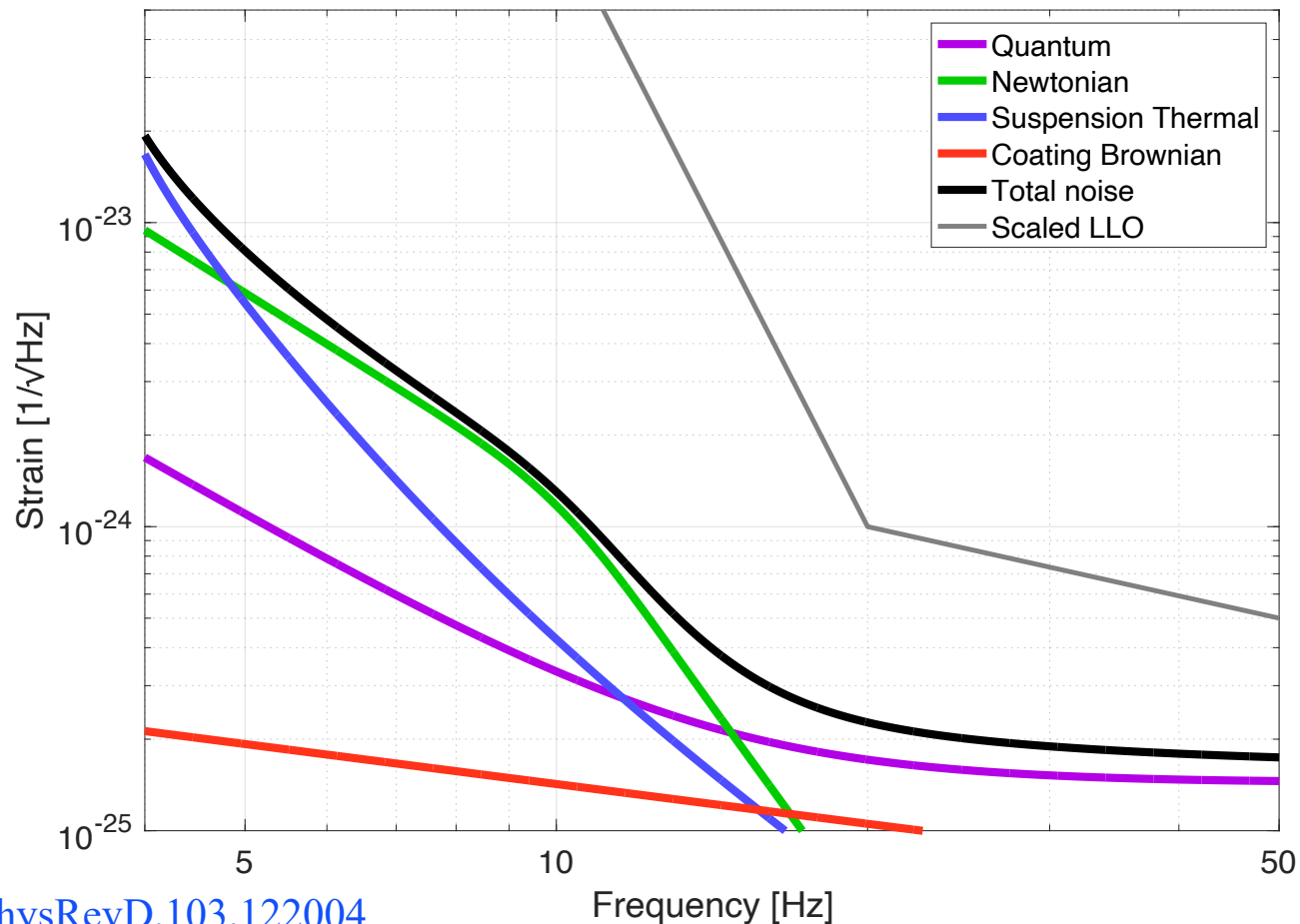
# Overview

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- Thermal noises
  - » Suspension
  - » Coating
  - » Substrate
- Shot noise

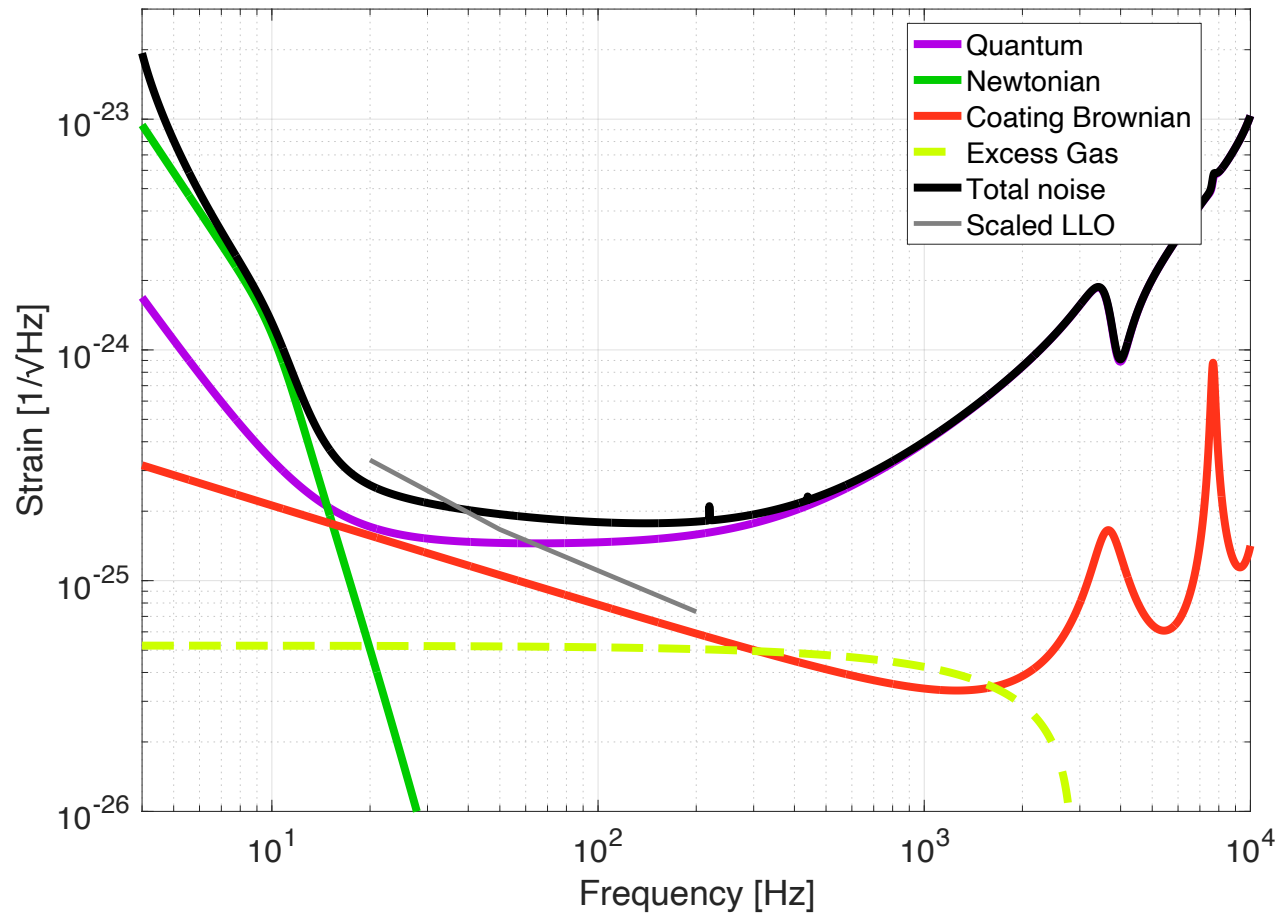
# Suspension thermal noise

- Fused silica may be good enough



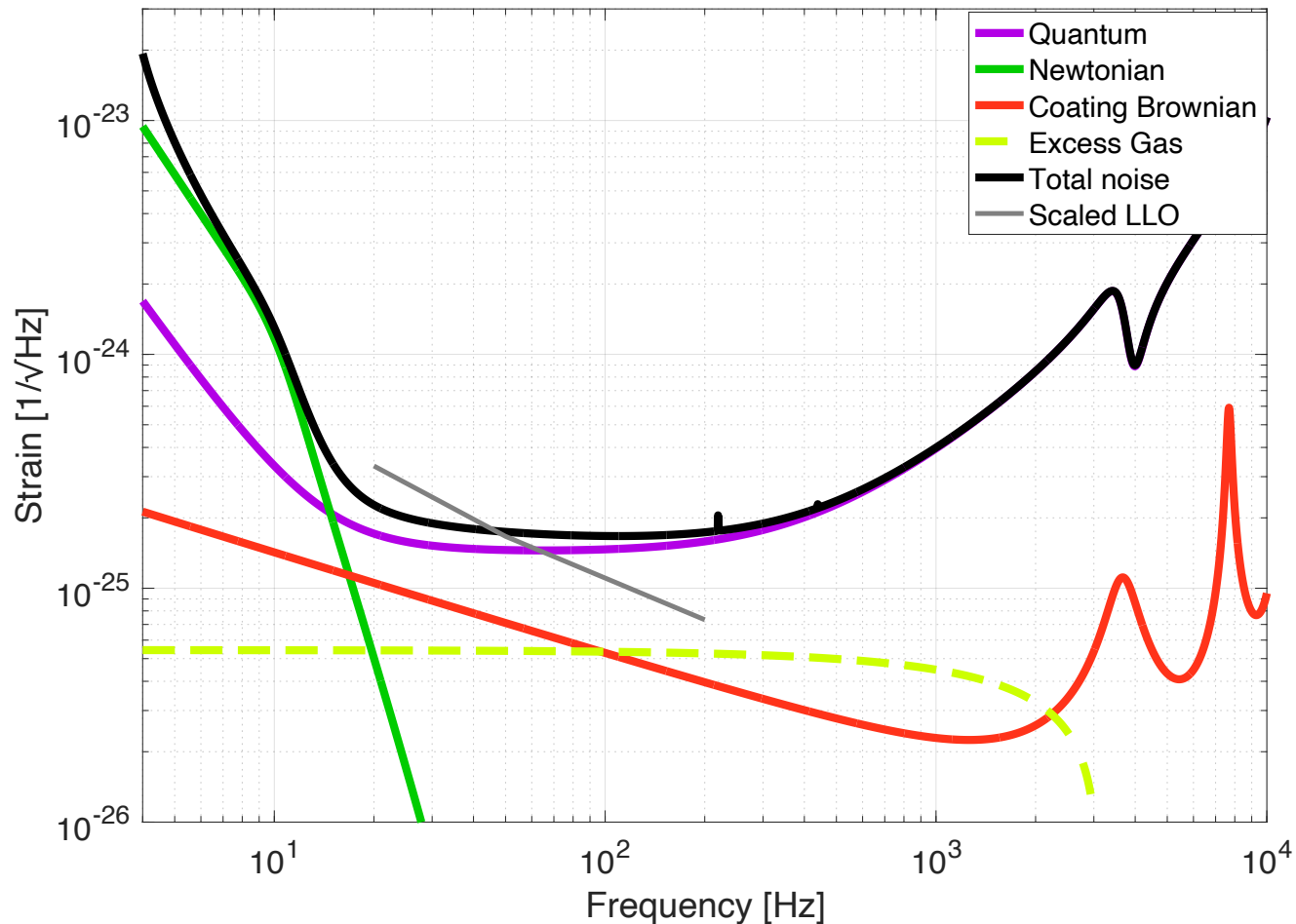
# Coating noise

- will still be a problem for 40 km



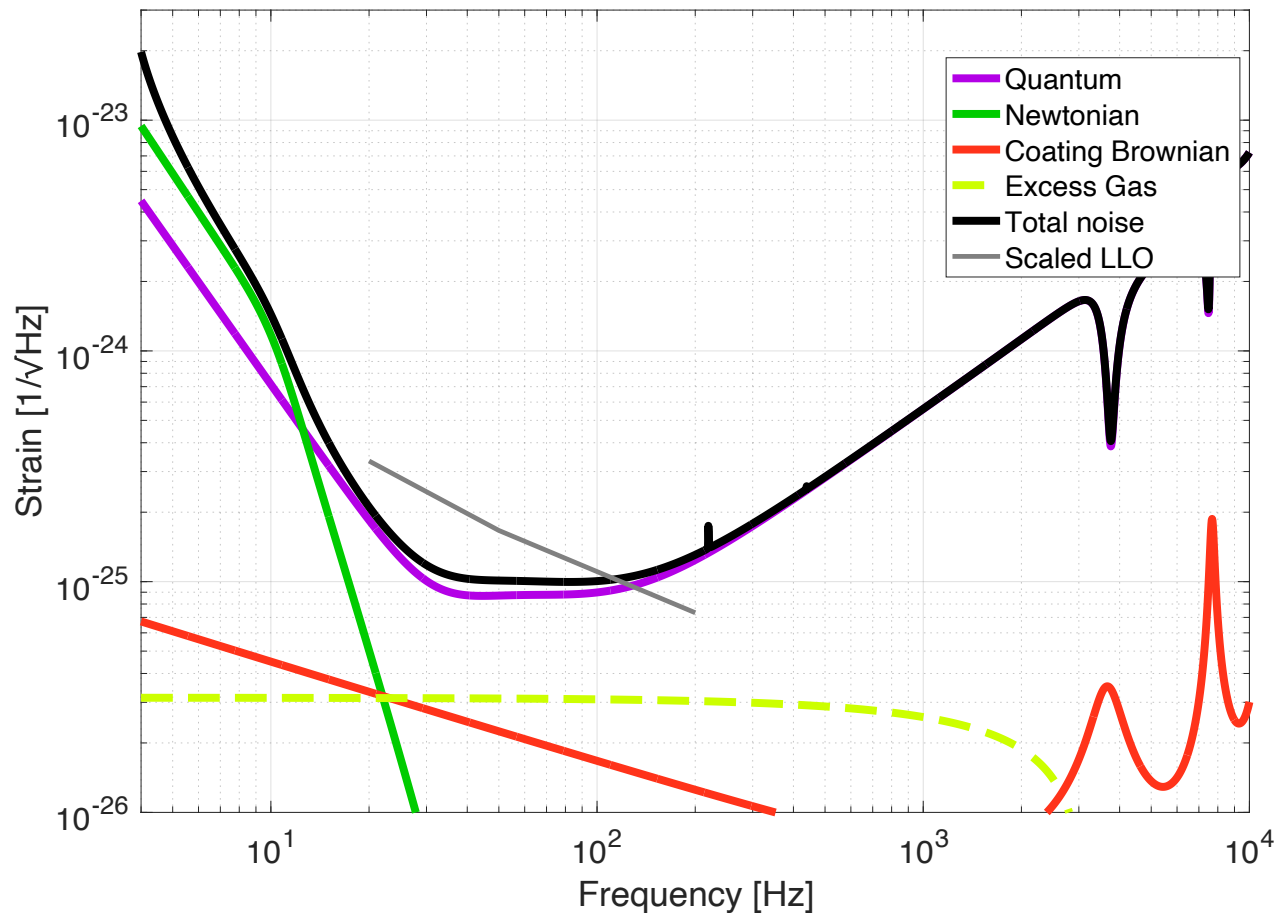
# Coating noise

- May increase the beam size



# Coating noise

- Cryogenics should help, especially for higher power



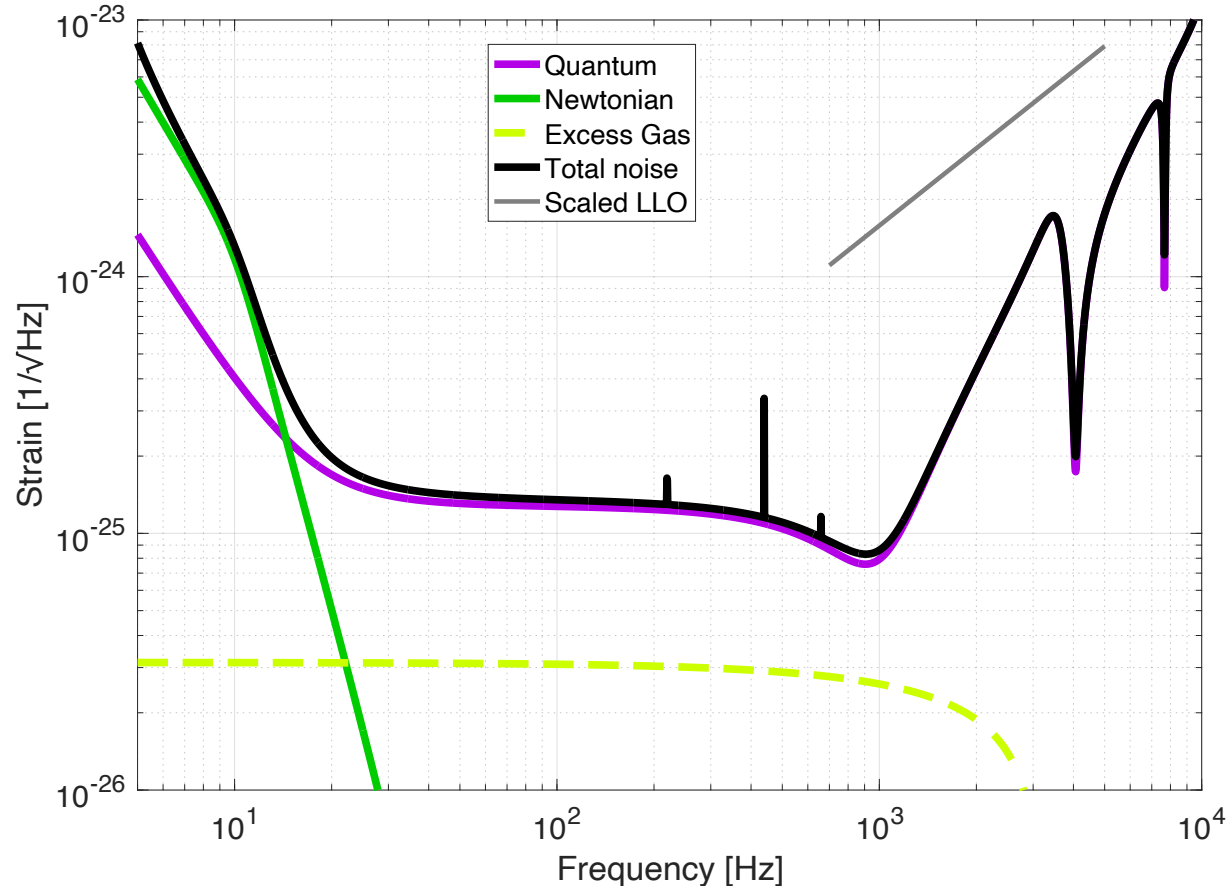
# Higher power

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- Parametric instabilities
- Thermal lensing is good at 20 K

# Power handling

- Thermal conductivity of silicon / sapphire is  $\sim 10^4$  W/m/K
- May remove 3 W of power for ribbon tension of 100 MPa





# Summary

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- Cryogenic may help with coating noise and
- Shot noise