

# *Thermal noise of LCGT interferometer*

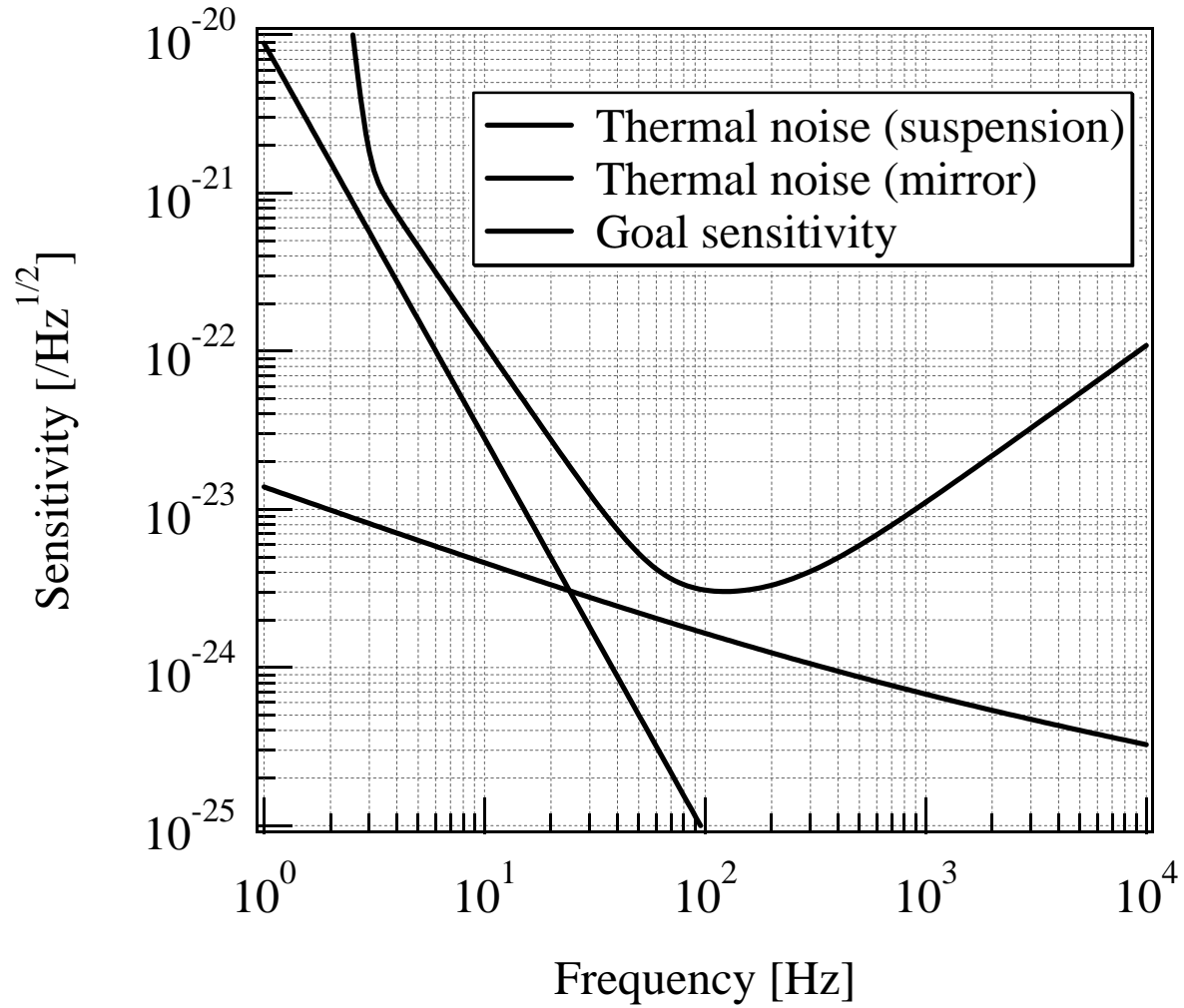
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***The meeting of LCGT design working group  
@Hongo campus, University of Tokyo***

# Goal sensitivity of LCGT



# *1. Mirror*

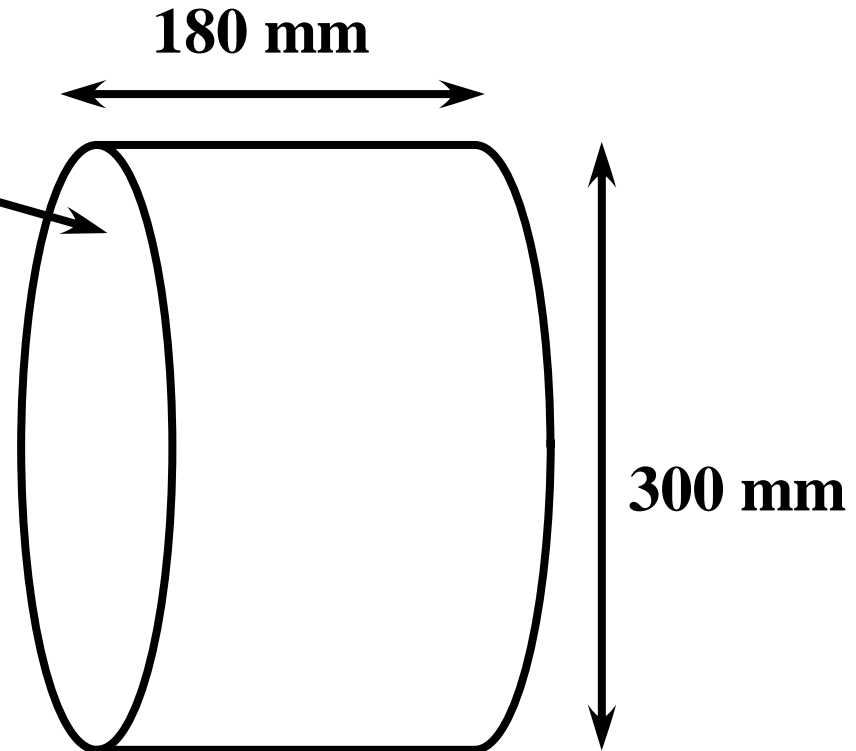
## 1-1. Specification

Sapphire, **20K**  
(Uchiyama)

Beam radius : **30 mm**

**26.8 mm @ Front mirror**

**46.4 mm @ End mirror**



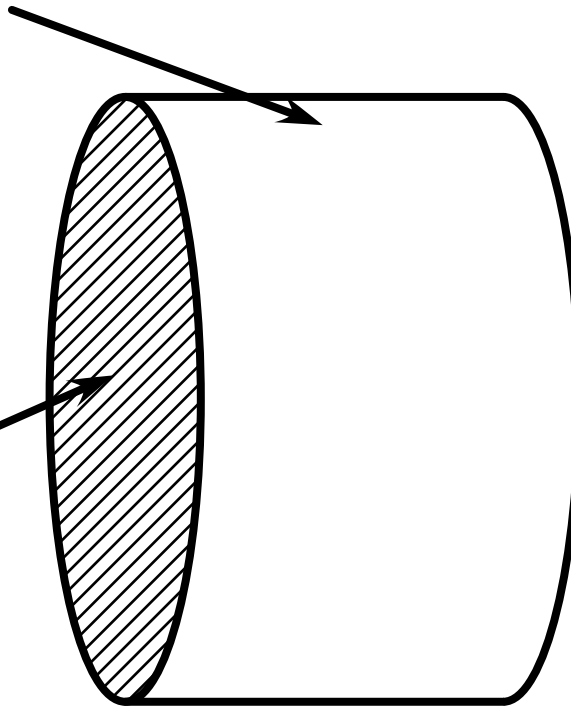
## 1-2. Mechanical loss

### Substrate

(i) structure :  $Q=10^8$  (Uchiyama)

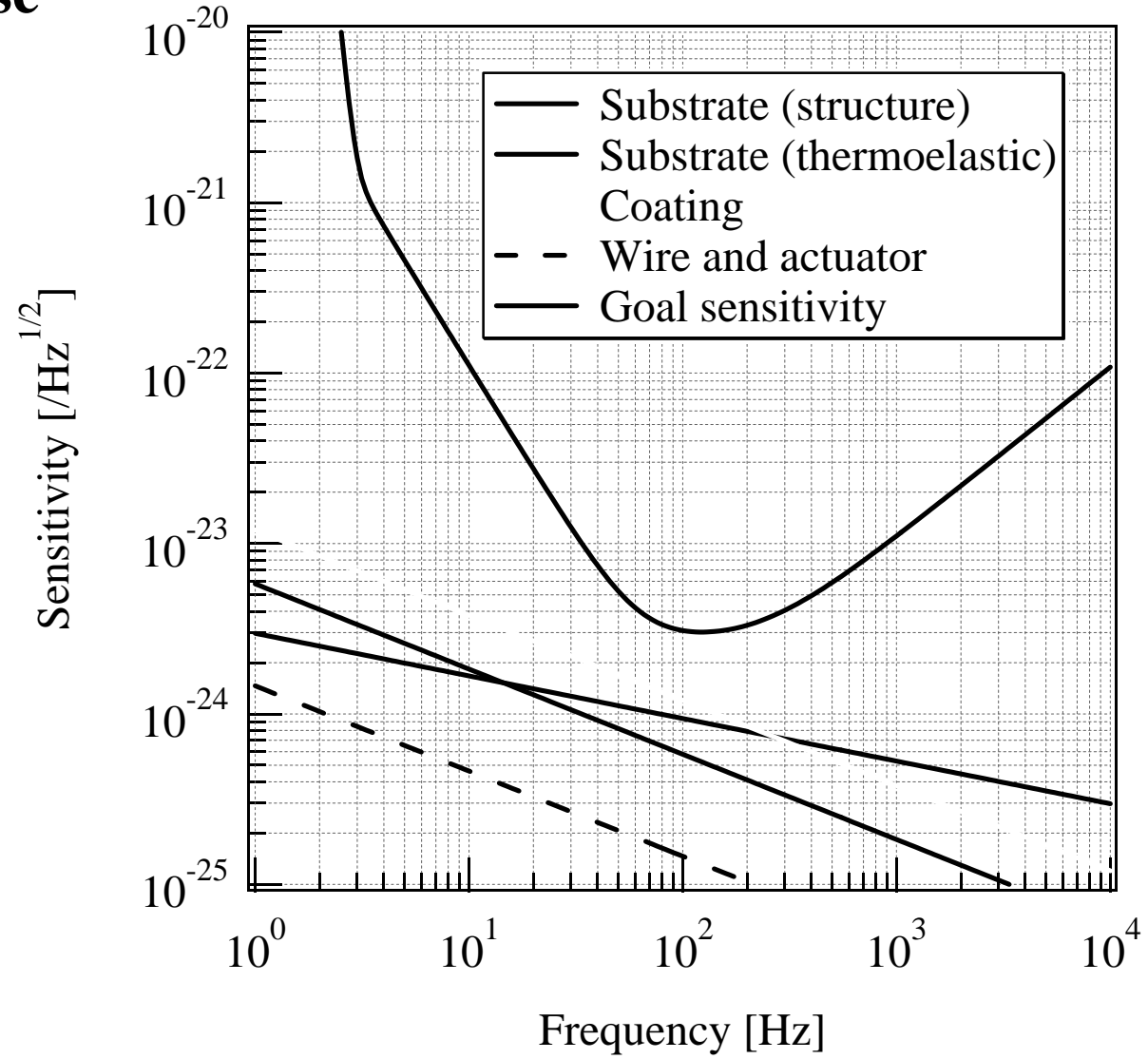
(ii) thermoelastic

Coating :  $\phi=4*10^{-4}$   
(Yamamoto)



Wire clamps and actuator:  
 $Q=10^7$  (Miyoki)

### 1-3. Thermal noise





## **1-5. Future works**

**Measurement of the loss of wire clamps and actuator**

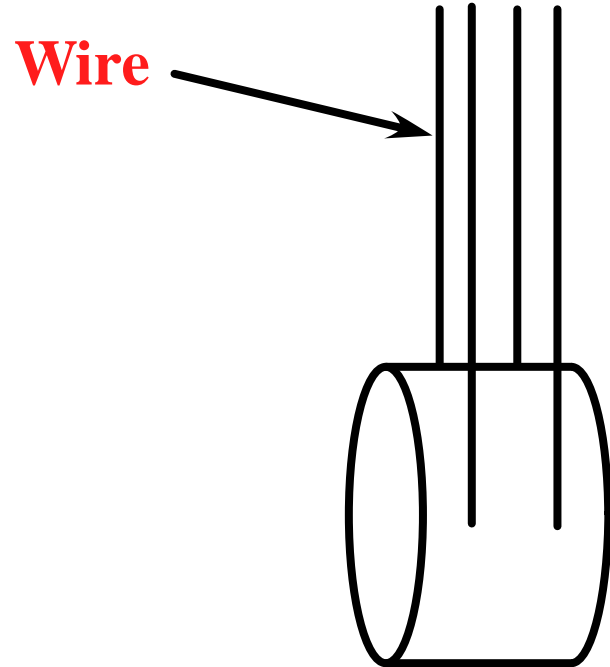






## 2-3. Wire

(i) Q-values



$Q$  of wire :  $5 \cdot 10^6$  (Uchiyama)

$Q$  of pendulum :  $1.2 \cdot 10^8$

$Q$  of violin :  $6 \cdot 10^7$



### **(iii)Observable distance of binary coalescence**

#### **Width of violin peaks**

**1st (111 Hz) :**

**2nd (221 Hz) : 2.3 Hz**

**3rd (332 Hz) : 1 Hz**

**4th (443 Hz) : 0.6 Hz**

#### **Observable distance**

**without violin peaks : 255 Mpc**

**violin peaks : Mpc (event rate : )**

**split : 245 Mpc ? (event rate : -11% )**





### **(iii) Solutions**

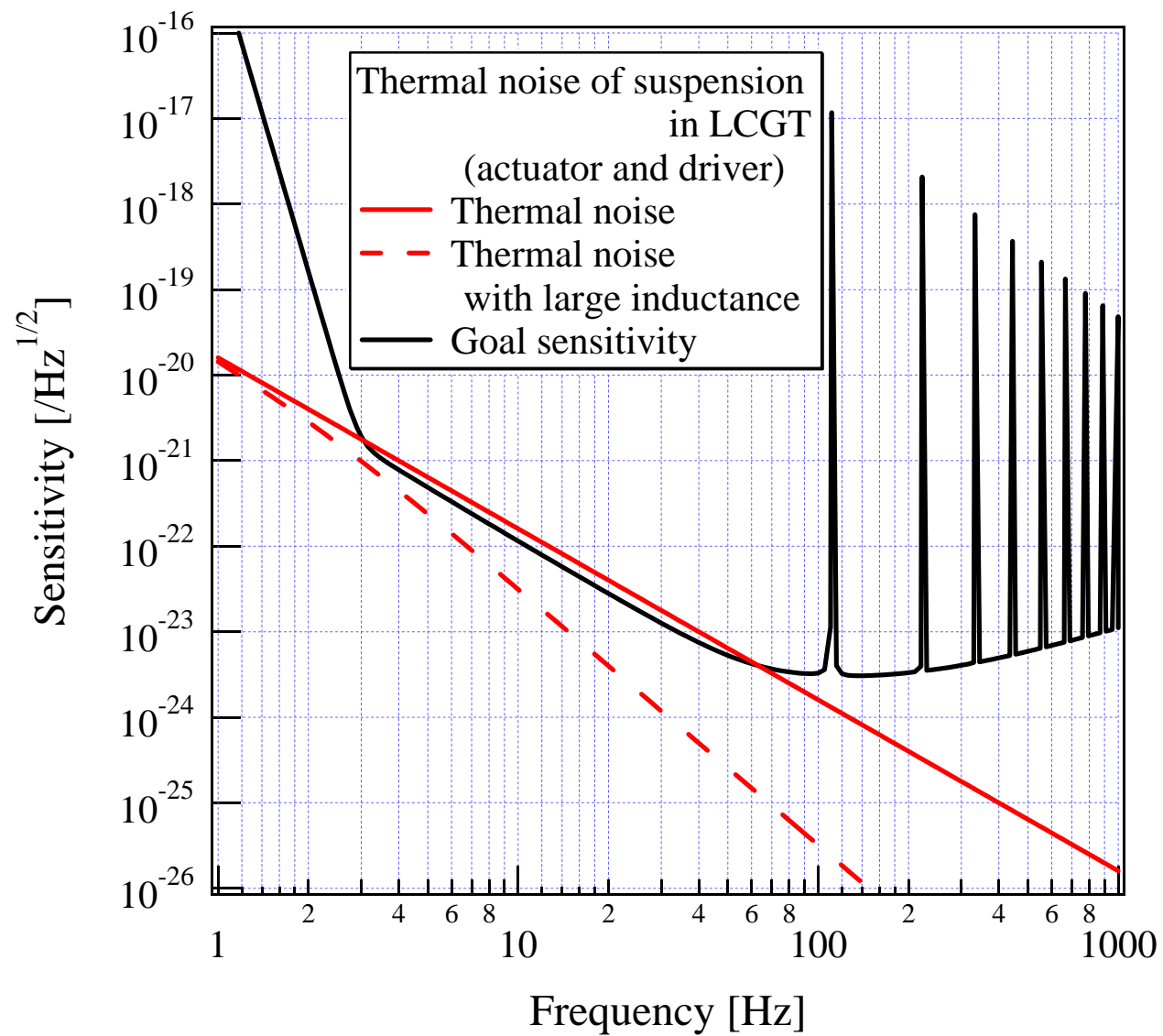
**(1) Larger resistance :**

**(2) Larger max of current :**

**driver noise and heat**

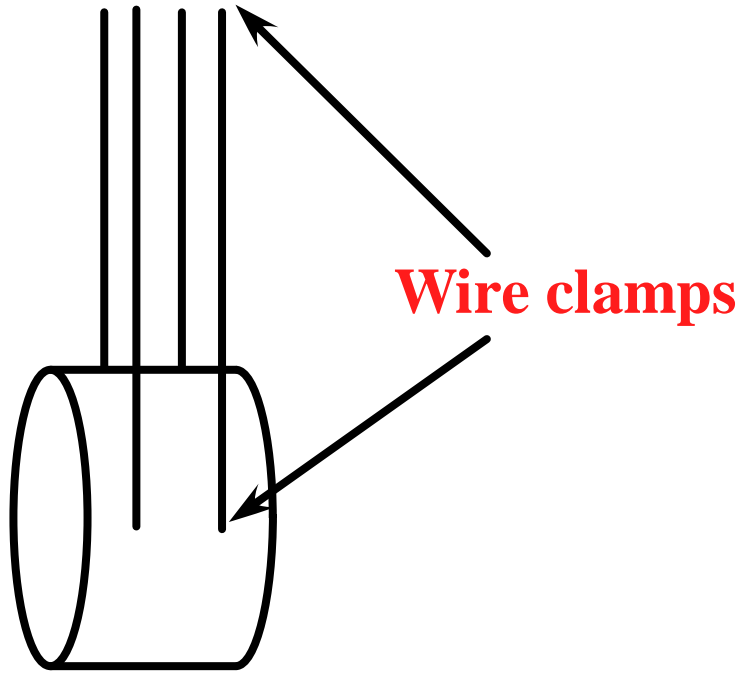
**(3) Cryogenic driver :**

**(4) Larger inductance :**





## 2-5. Wire clamps



Unknown



Lower limit of  $Q$

Thermal noise

= **Radiation pressure noise @ 10 Hz**

$Q$  of pendulum :  $2 \cdot 10^7$

$Q$  of violin :  $1 \cdot 10^7$

Observable distance : **242 Mpc** (event rate : **-9%**)

(248 Mpc)

