KAGRA
Suspension Thermal Noise

GWADW 2012

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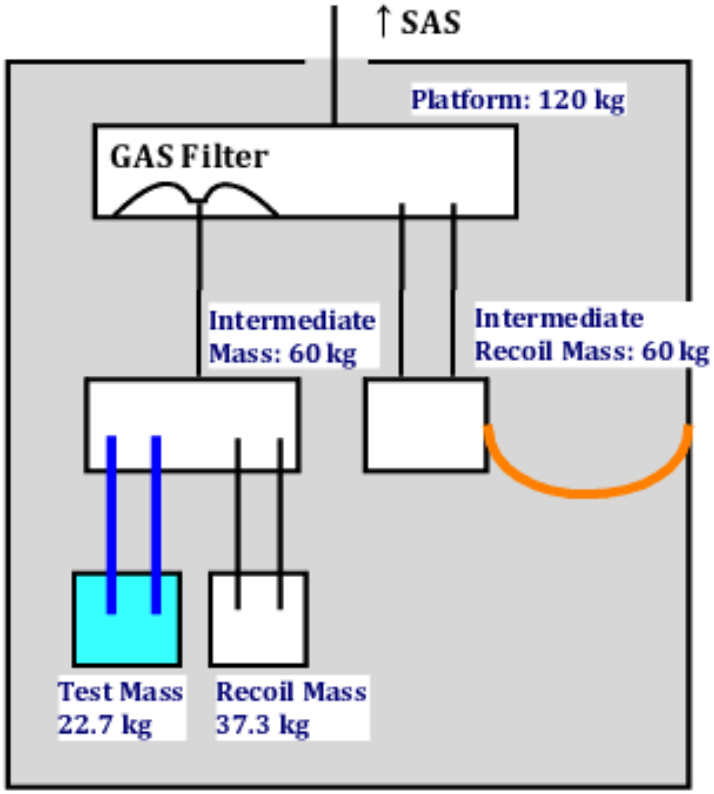
	PF	IRM	IM	RM	TM
Fiber Material	Maraging	Tungsten	Maraging	BeCu	Sapphire
Material Loss	1e-4	1e-4	1e-4	1e-6	2e-7
Fiber length	3 m	40 cm	40 cm	30 cm	30 cm
Fiber Φ [mm]	2.2	0.6	1.4	0.7	1.6
Dilution factor	-	79	71	72	6.7



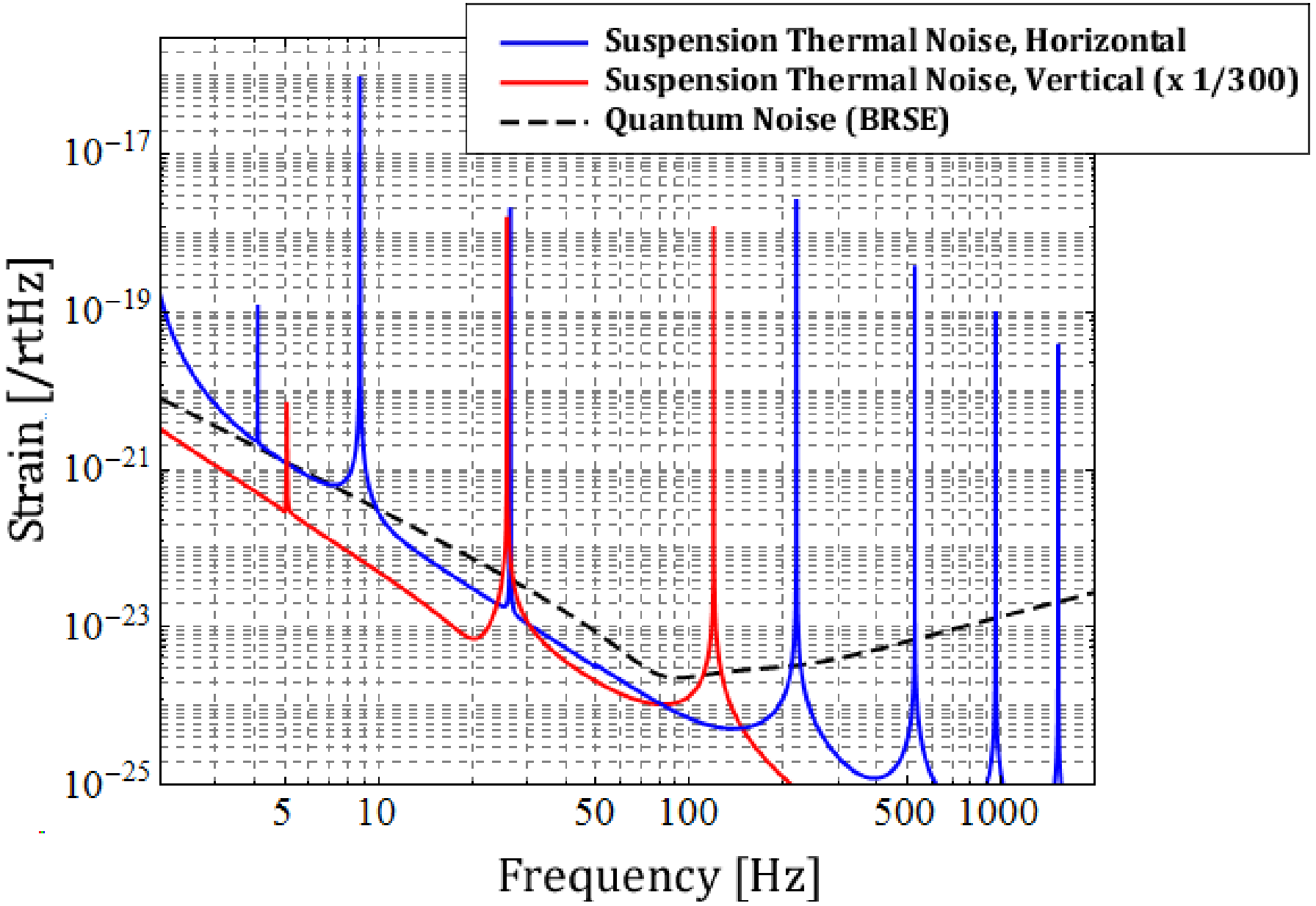
GAS freq = 0.4 Hz, Q=100
HV Coupling=1/300

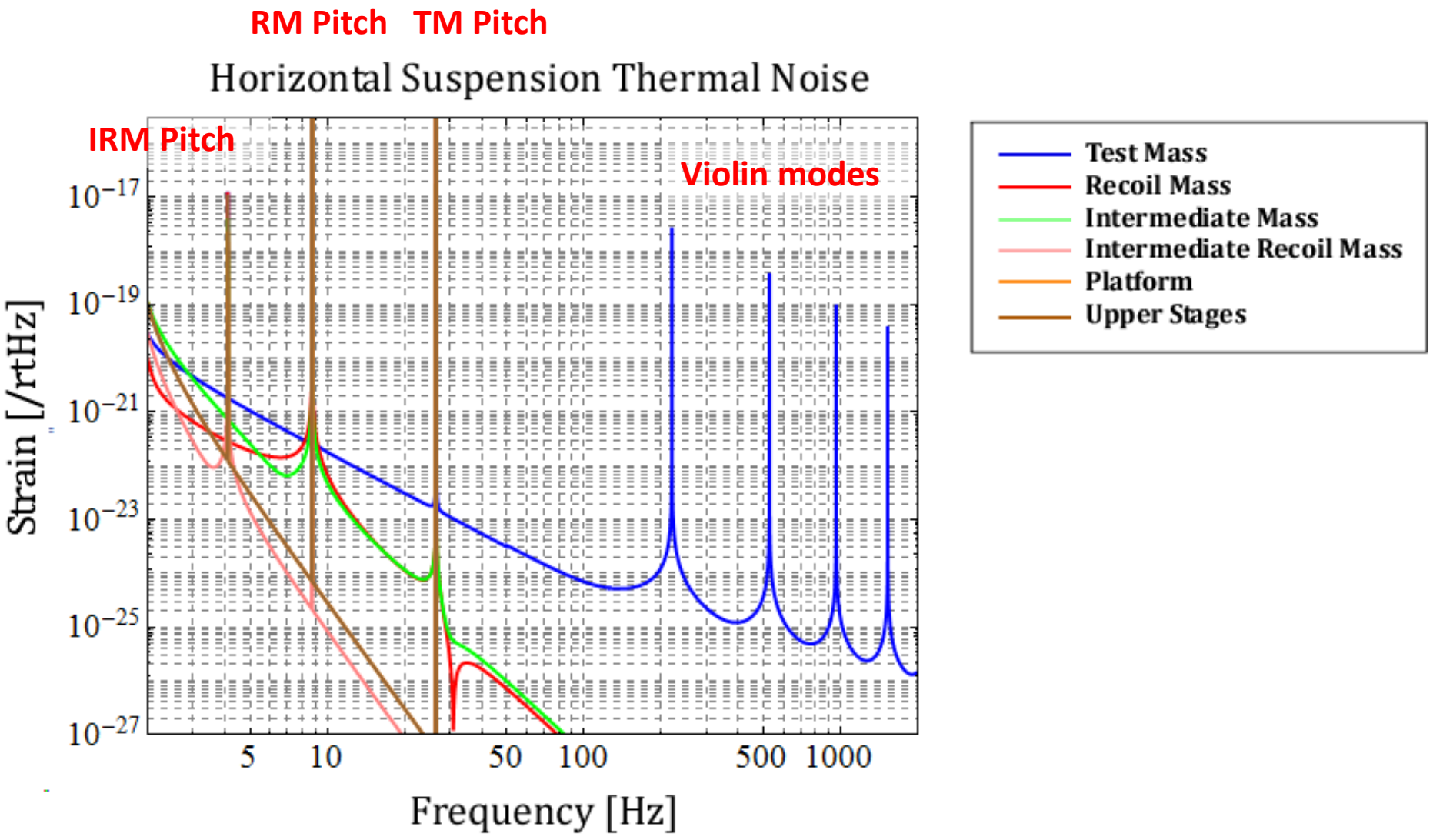
Fluctuation-Dissipation-Theorem

$$S_{\mathrm{th}}(\omega) = -\frac{4k_{\mathrm{B}}T}{\omega}\,\mathrm{Im}[H(\omega)]$$

Assuming T = 20 K

Suspension Thermal Noise Estimation

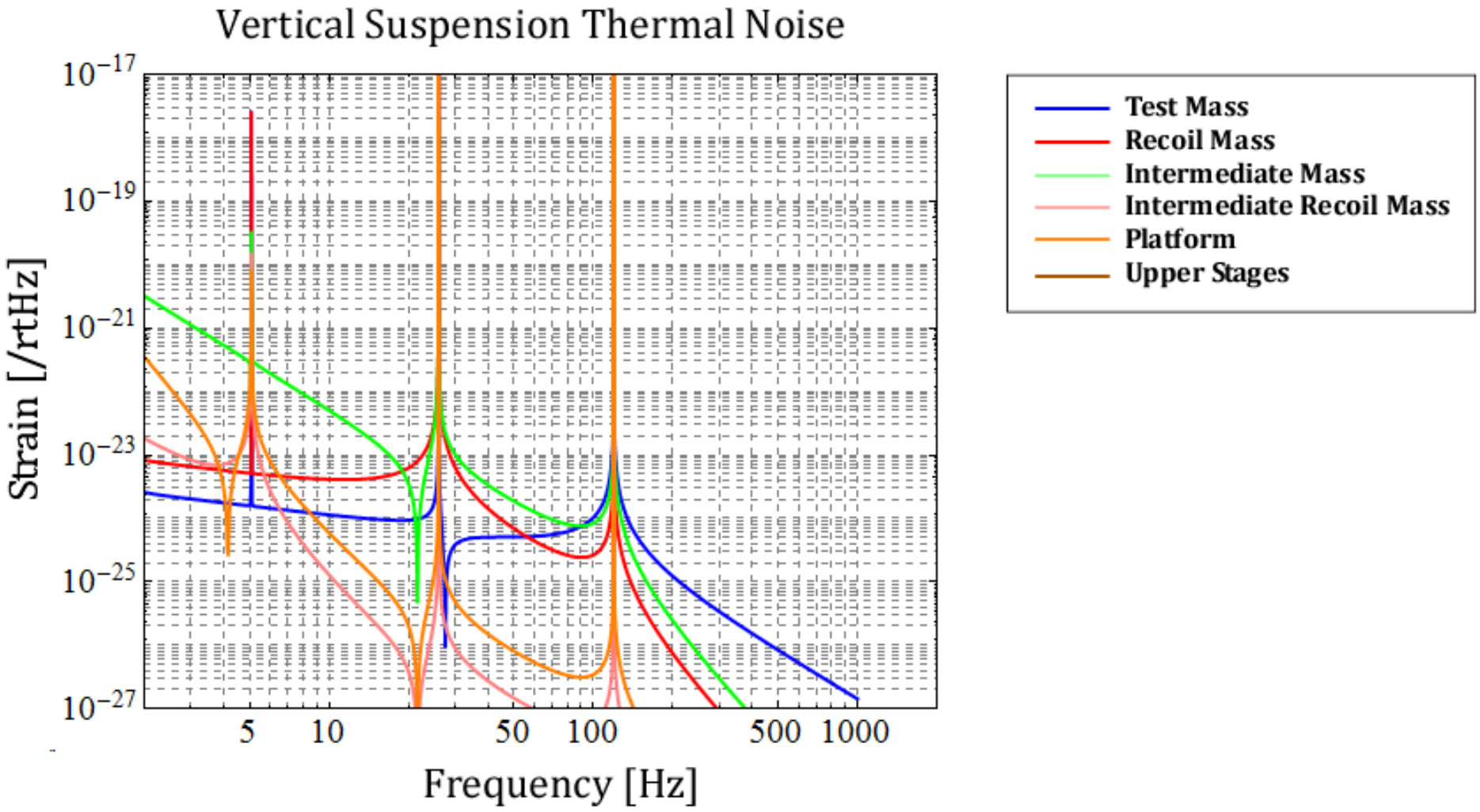



RM Pitch
TM Pitch
Horizontal Suspension Thermal Noise
IRM Pitch
Violin modes
Test Mass
Recoil Mass
Intermediate Mass
Intermediate Recoil Mass
Platform
Upper Stages
Strain [/rtHz]
10^{-17}
10^{-19}
10^{-21}
10^{-23}
10^{-25}
10^{-27}
5
10
50
100
500
1000
Frequency [Hz]

IRM Wire Bounce

RM Wire Bounce

TM Wire Bounce



Standard GAS Filter F0 v.s. Q

$$a \bullet f^2 + b \bullet e^{f/f_o}$$