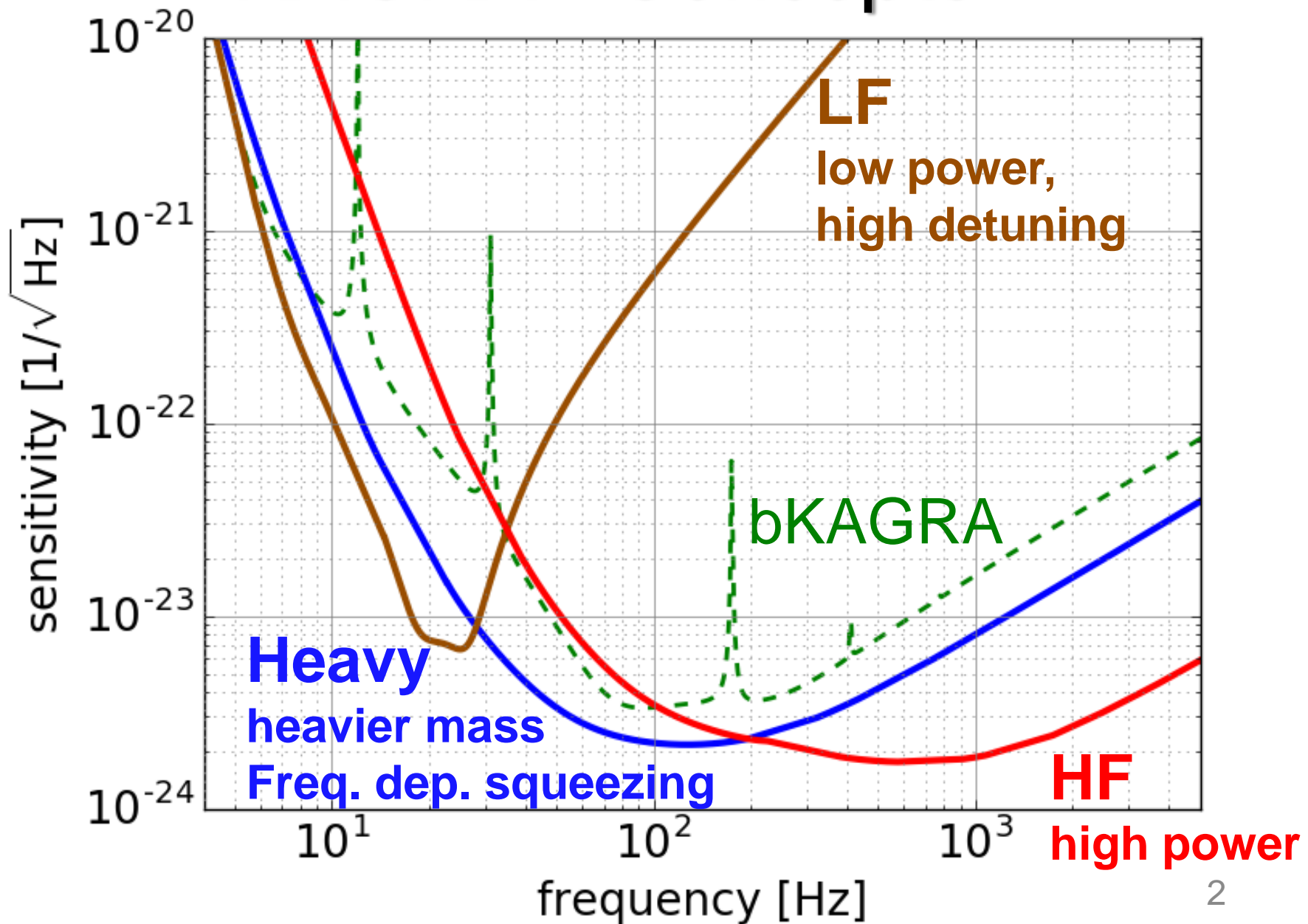


Summary of Issues for KAGRA+

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KAGRA+ Concepts



Issues for LF

- Technical excess noises in low frequency
controls noise
scattered light
Newtonian noise ...
- Too much scientific focus? (IMBH)

→ a bit more broader band?
variational configuration?

* Common issue
Any coating improvement?

Issues for Heavy

- Availability of heavier mass mirror
sapphire (A-axis? composite mirror?)
silicon (new issue: laser wavelength)
- Feasibility of heavier mass suspension (~100 kg)
- Feasibility of frequency dependent squeezing at KAGRA site (~100 m filter cavity)

* Common issue
Any coating improvement?

Issues for HF

- Availability of high power laser ($> \sim 500$ W)
pre-stabilizing system must be \sim kW compatible
- Or higher gain power recycling ($> \sim 100$)
- Parametric instability
- Alignment instability (unstable pole at ~ 5 Hz)
higher alignment control bandwidth might be OK for HF
- Thermal aberration of the mirror

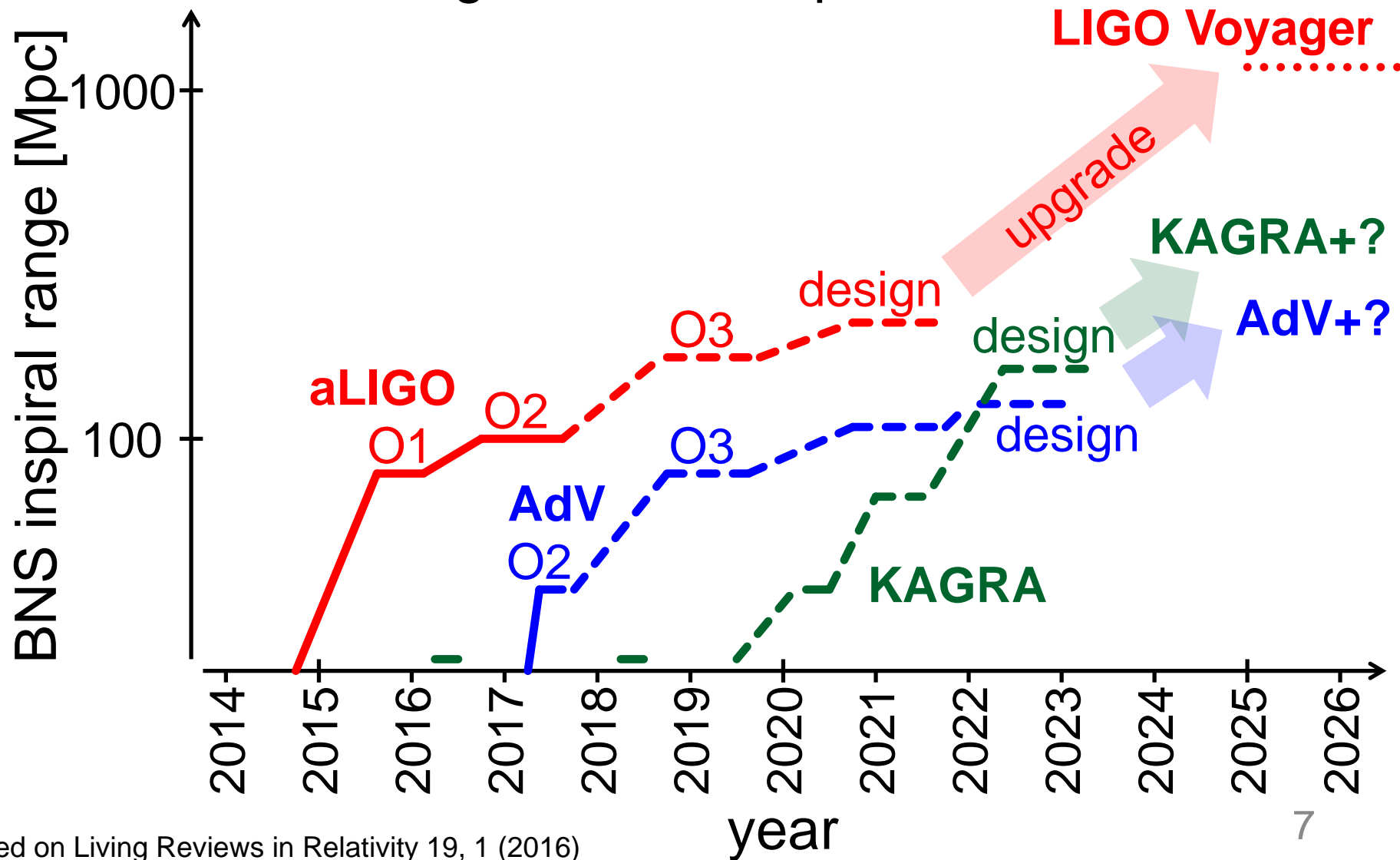
→ Squeezing?

* Common issue
Any coating improvement?

Supplementary Slides

Expected Sensitivity Growth

- From Observing Scenario Paper



KAGRA Cryopayload

Provided by T. Ushiba and T. Miyamoto

Platform
(SUS, 65 kg)

Marionette
(SUS, 22.5 kg)

Intermediate Mass
(SUS, 20.1 kg,
16.3 K)

Test Mass
(Sapphire, 23 kg,
21.5 K)

3 CuBe blade springs

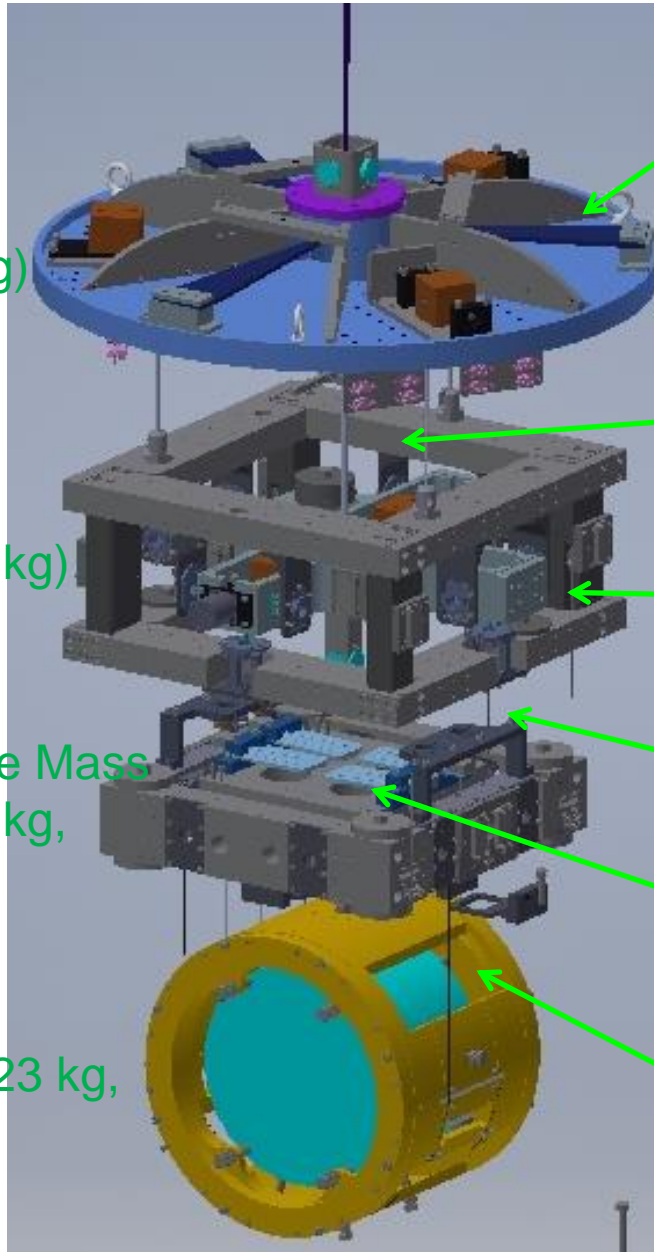
MN suspended by 1 Maraging steel fiber
(35 cm long, 2-7mm dia.)
MRM suspended by 3 CuBe fibers

Heat link attached to MN

IM suspended by 4 CuBe fibers
(24 cm long, 0.6 mm dia)
IRM suspended by 4 CuBe fibers

4 sapphire blades

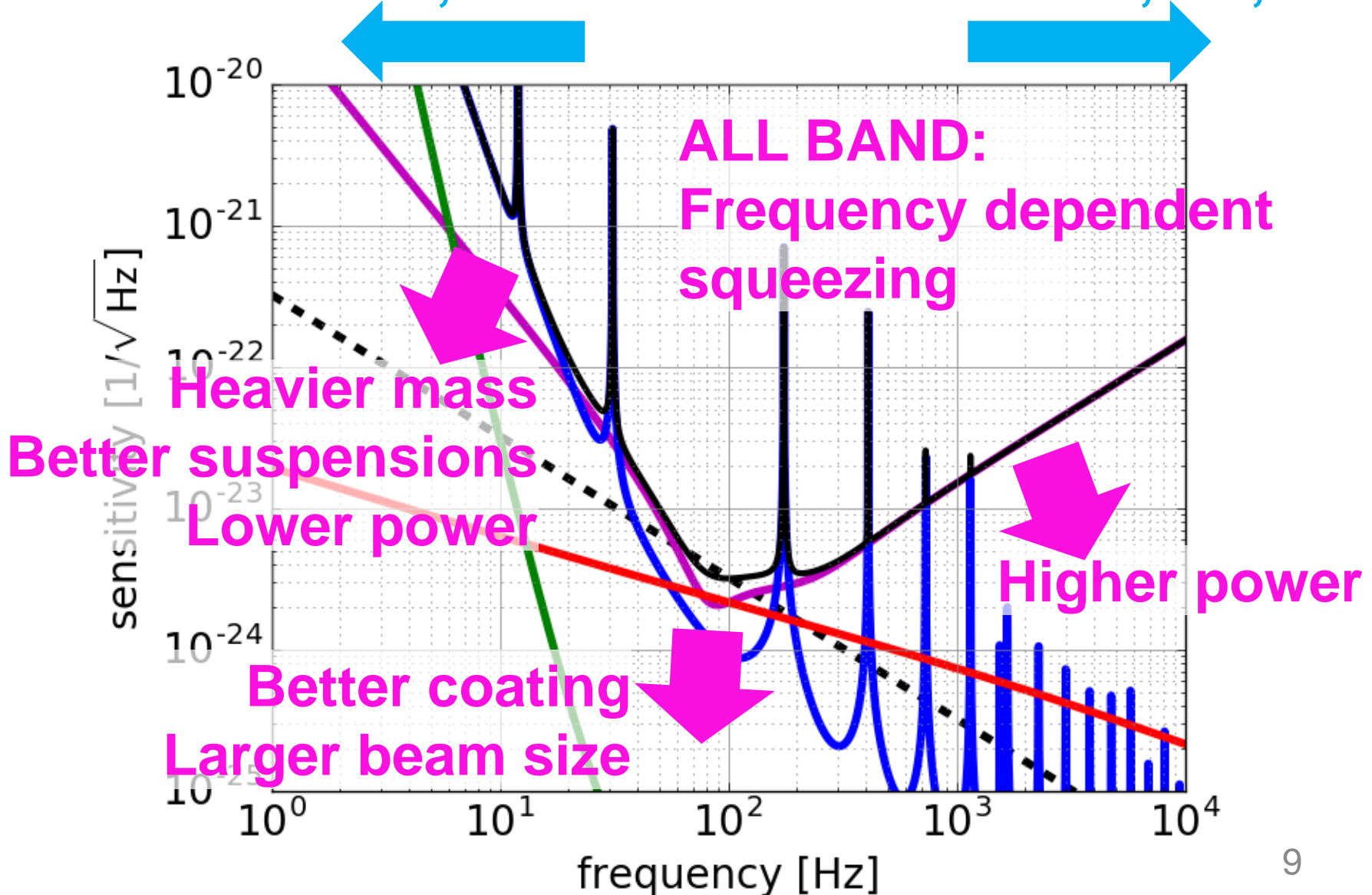
TM suspended by 4 sapphire fibers
(35 cm long, 1.6 mm dia.)
RM suspended by 4 CuBe fibers



Effect in Sensitivity

Heavier mass BHs, etc.

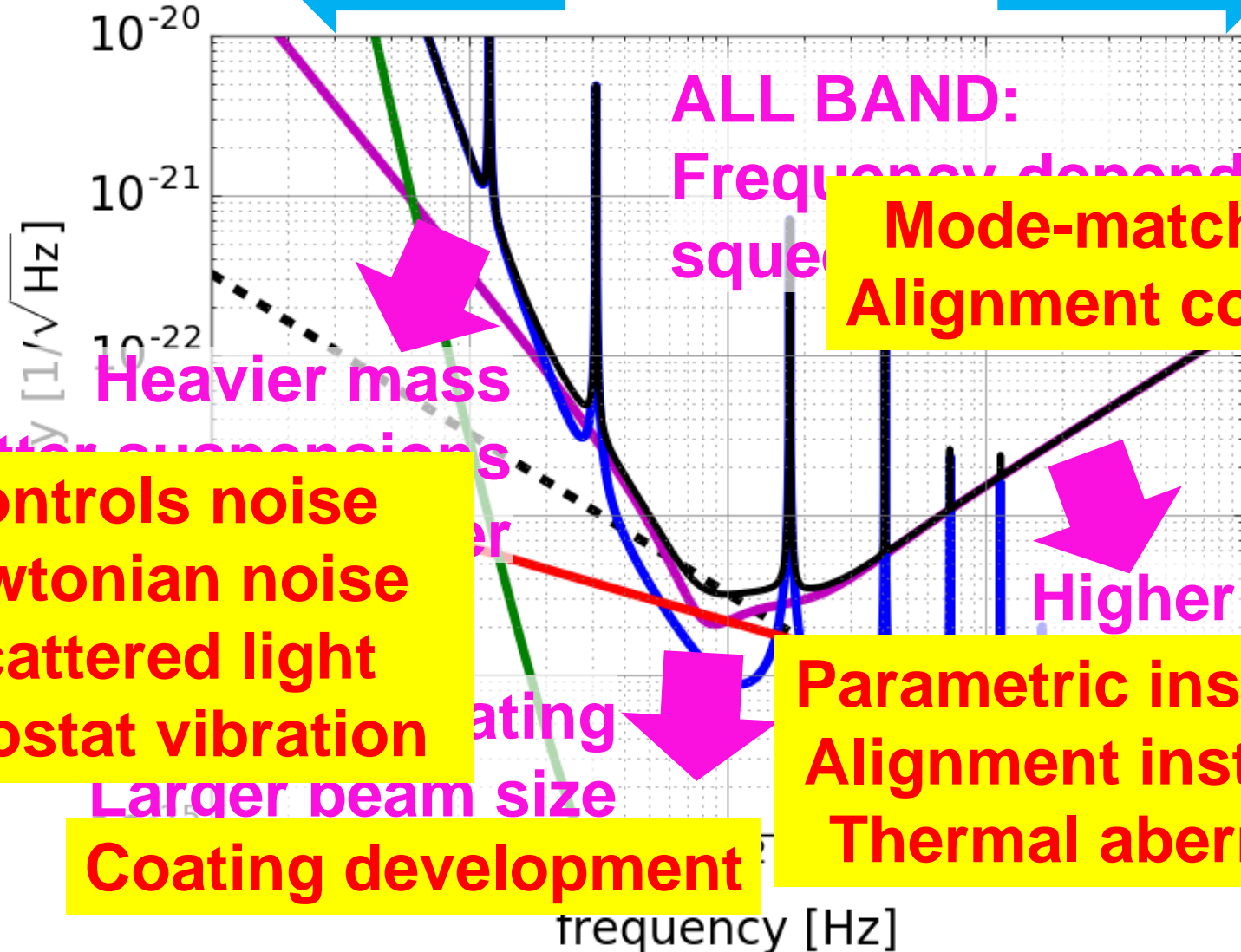
EOS of NS, SN, etc.



Technical Difficulty

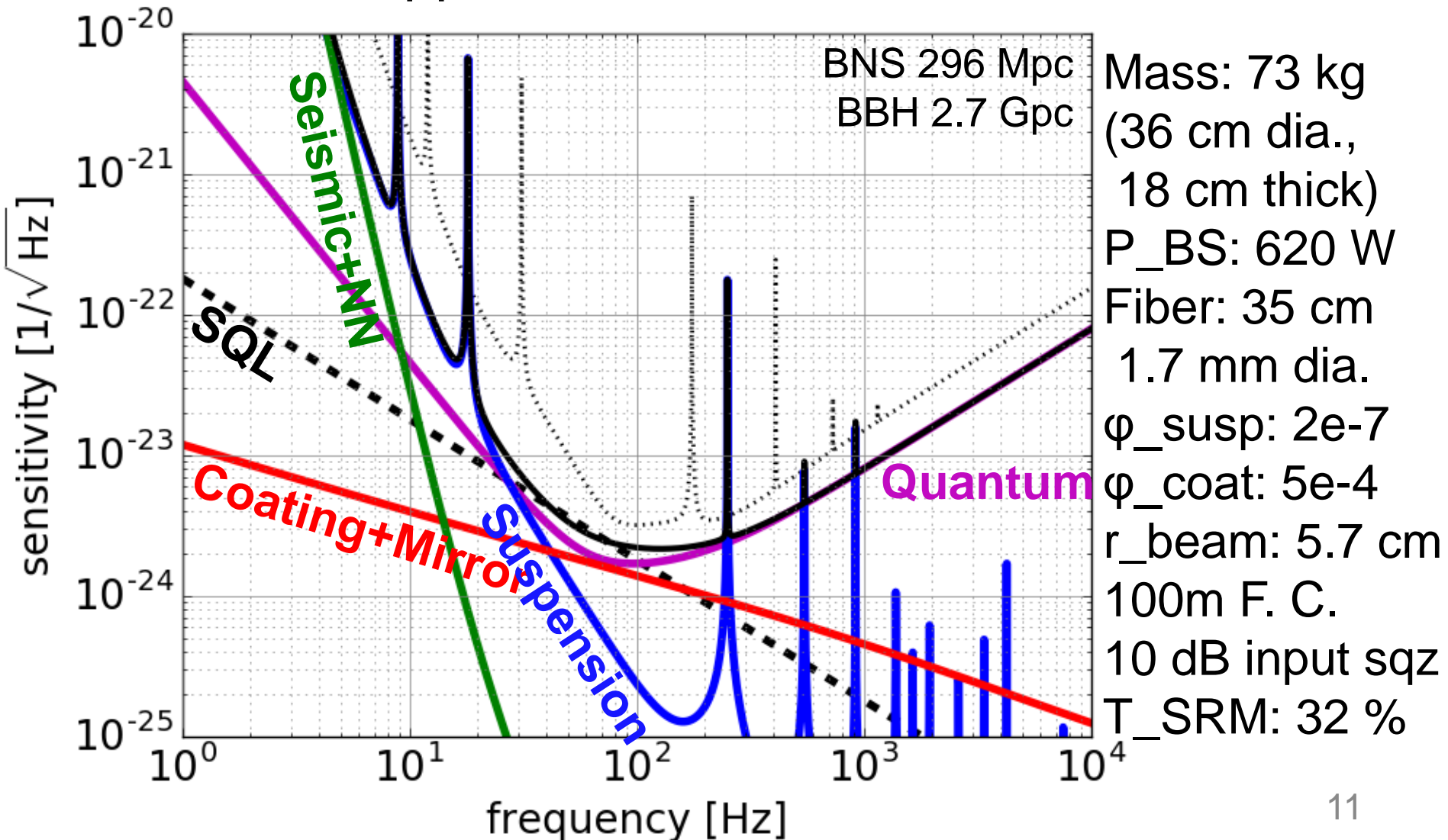
Heavier mass BHs, etc.

EOS of NS, SN, etc.



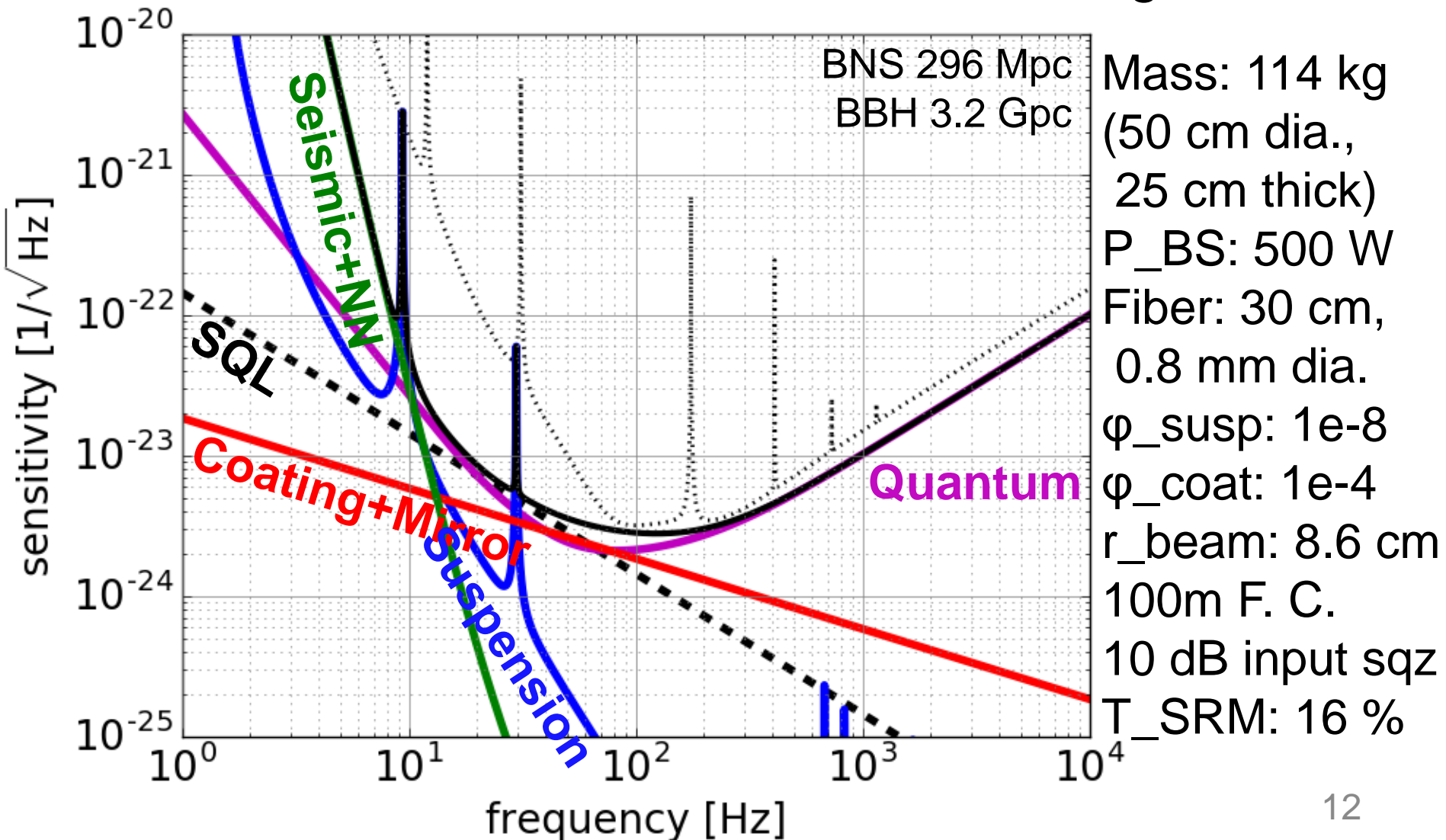
KAGRA+ Sensitivity: Blue

- Heavier sapphire and heavier IM, 20 K



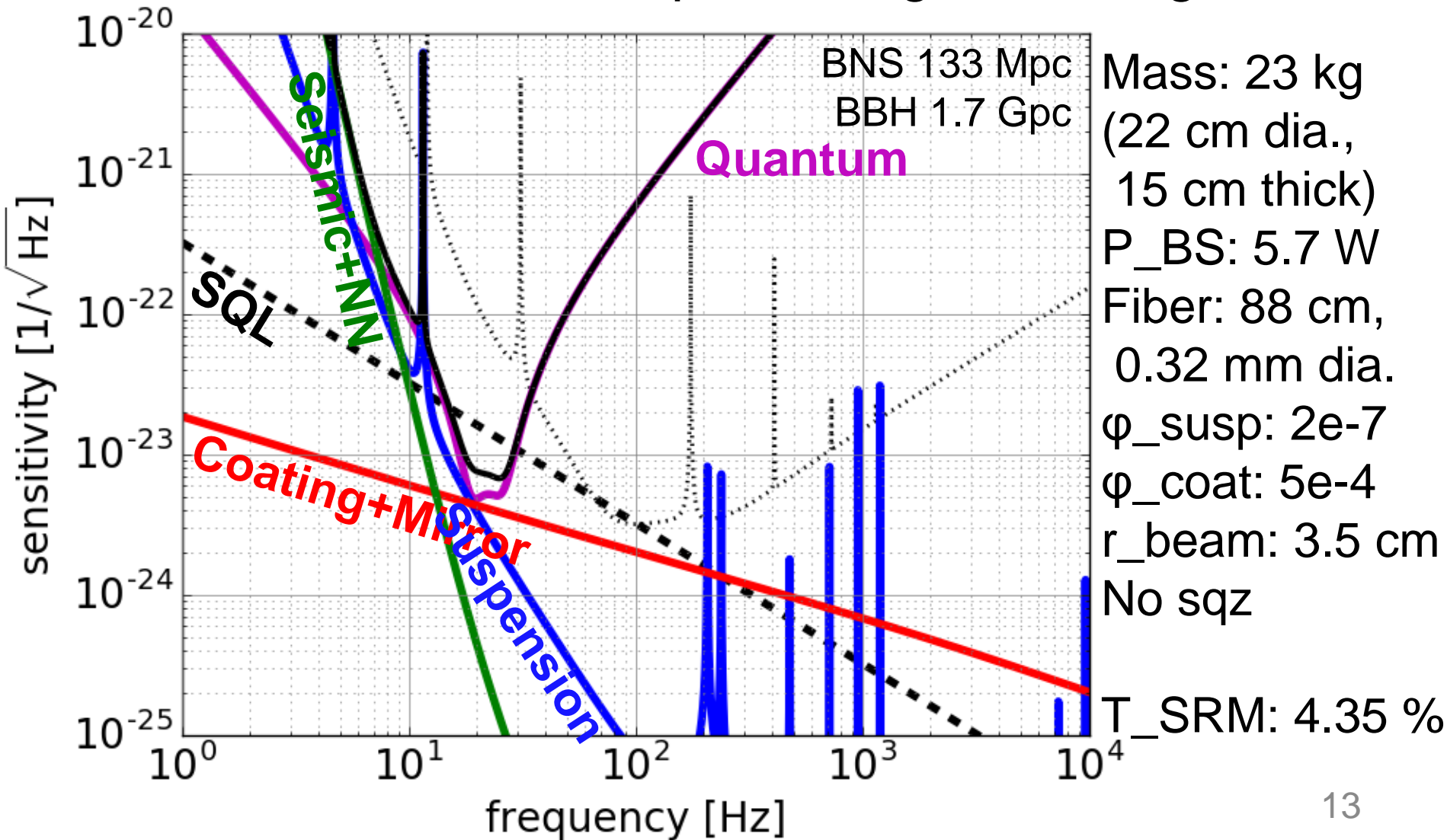
KAGRA+ Sensitivity: Black

- Silicon 123 K, 1550 nm, radiative cooling



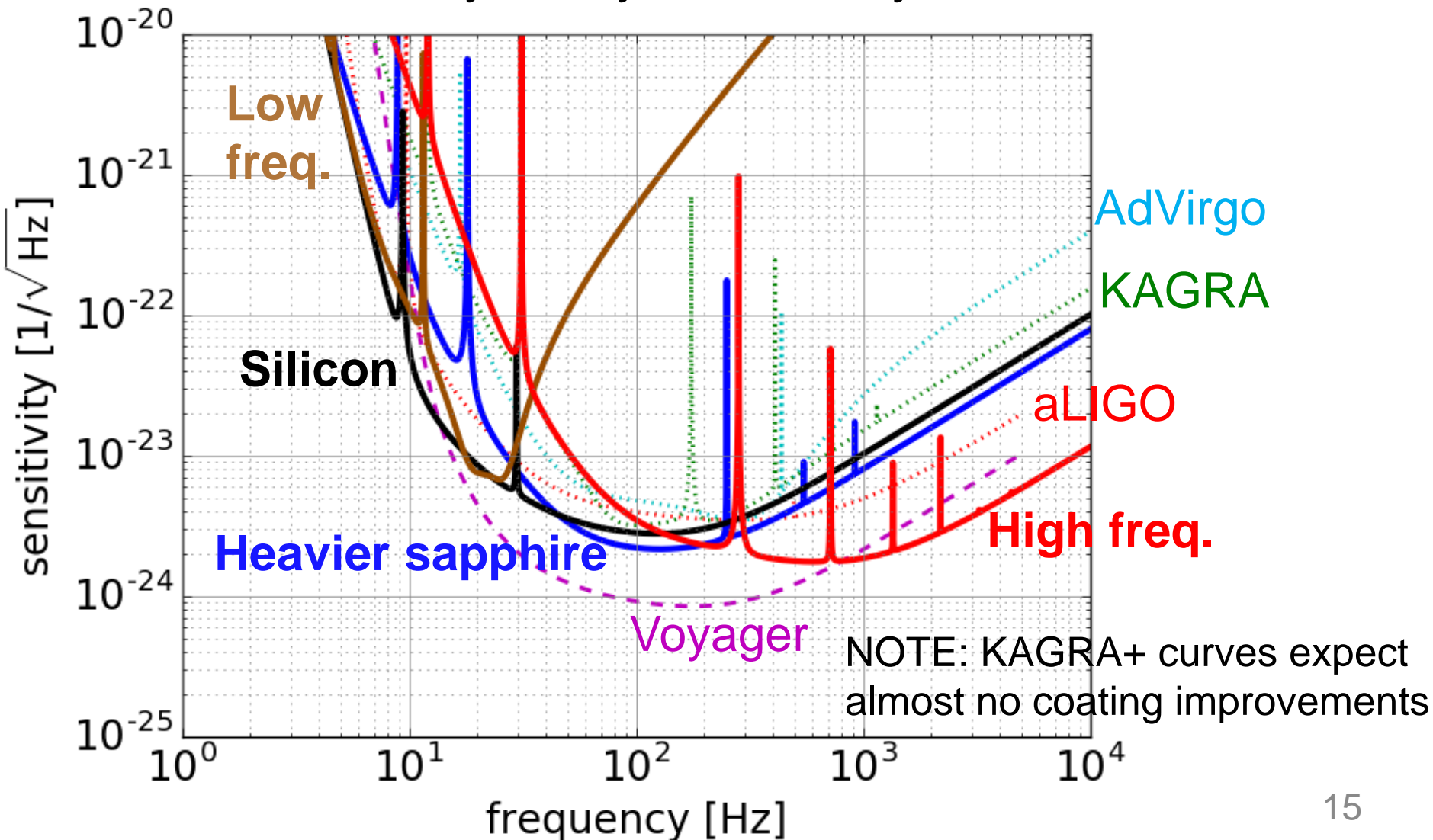
KAGRA+ Sensitivity: **Brown**

- Same test mass, low power, high detuning, 20 K



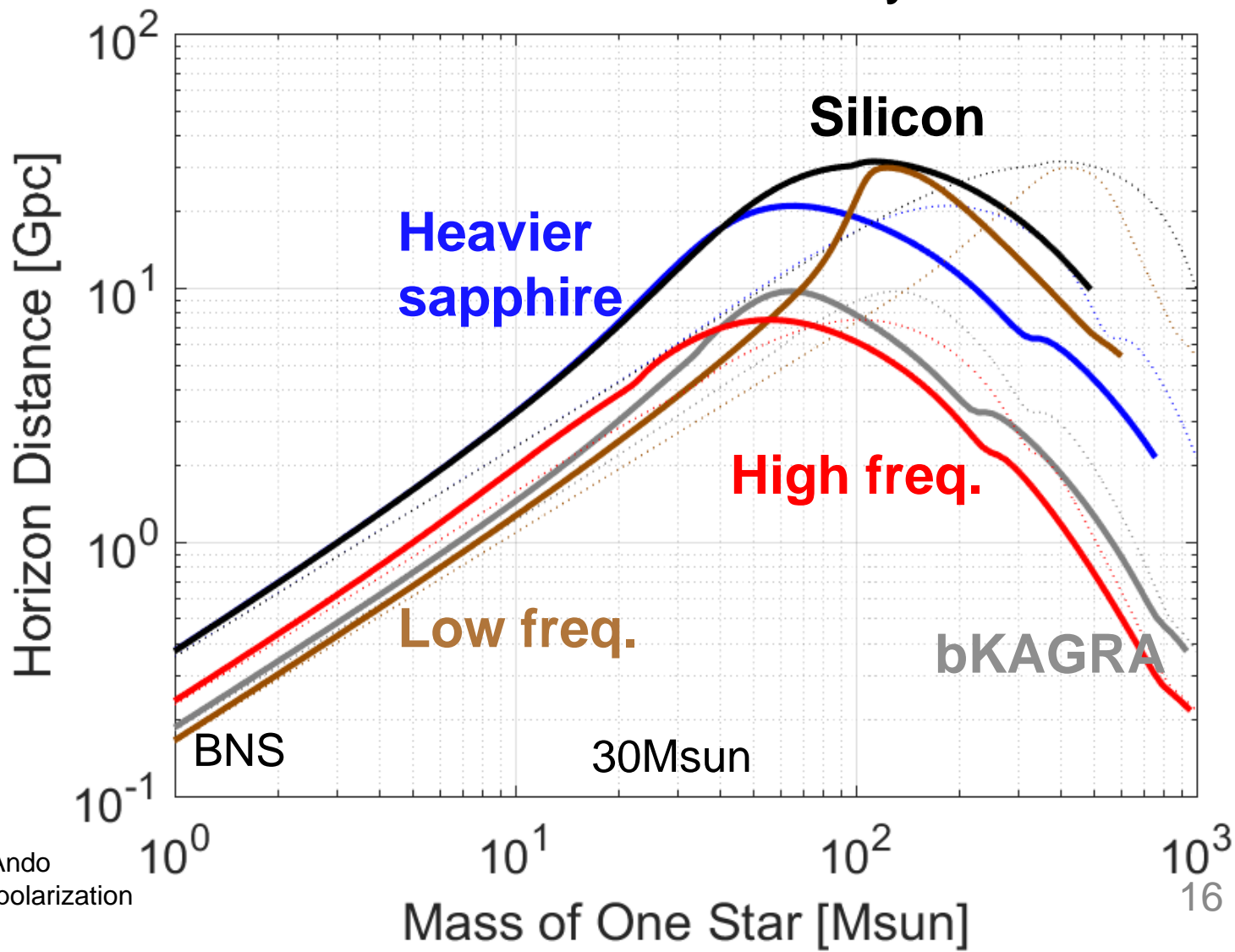
Sensitivity Comparison

- Also feasibility study necessary



Astrophysical Reach Comparison

- Science case discussion is necessary

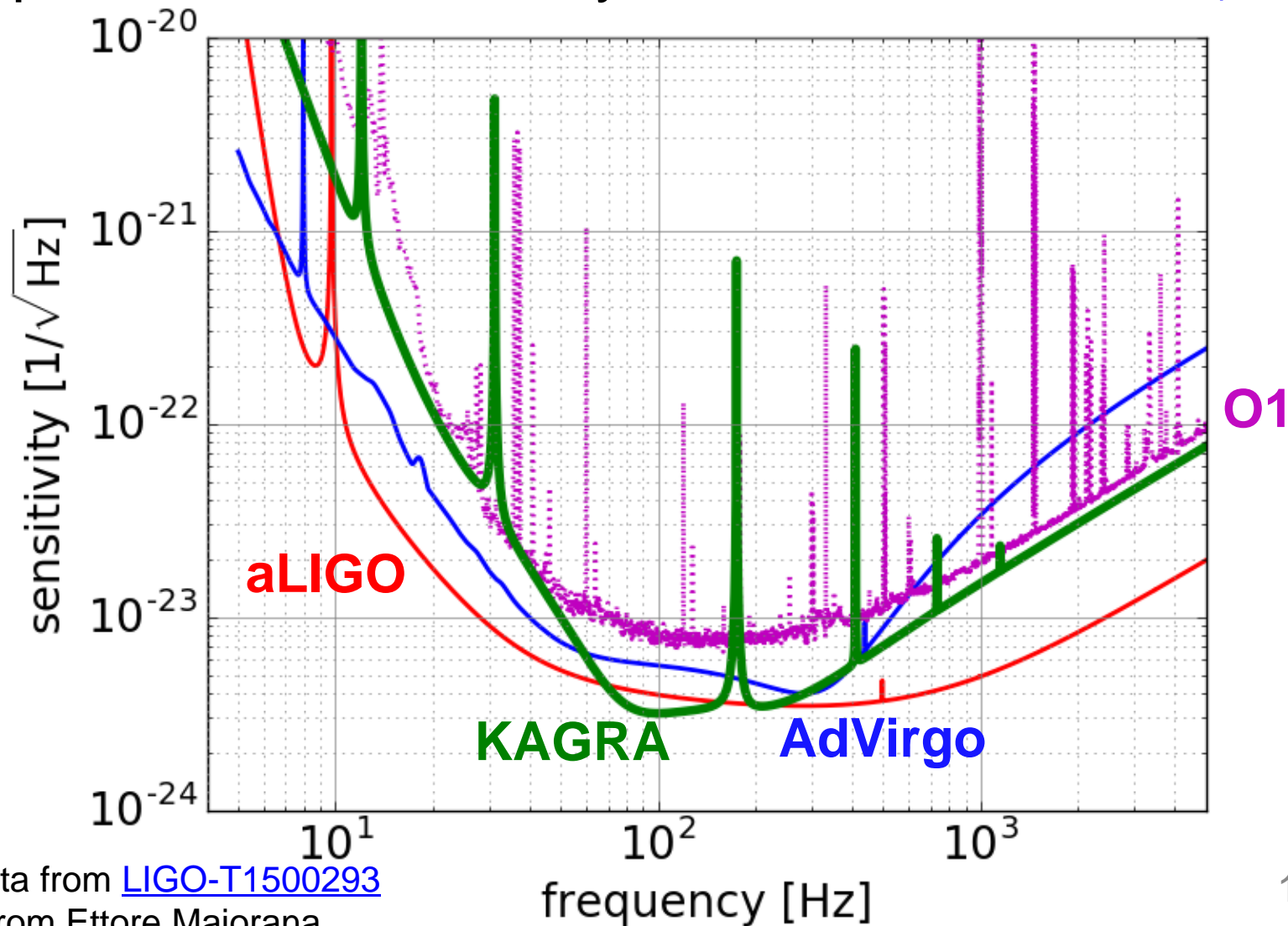


2G/2G+ Parameter Comparison

	KAGRA	AdVirgo	aLIGO	A+	Voyager
Arm length [km]	3	3	4	4	4
Mirror mass [kg]	23	42	40	80	200
Mirror material	Sapphire	Silica	Silica	Silica	Silicon
Mirror temp [K]	22	295	295	295	123
Sus fiber	35cm Sap.	70cm SiO ₂	60cm SiO ₂	60cm SiO ₂	60cm Si
Fiber type	Fiber	Fiber	Fiber	Fiber	Ribbon
Input power [W]	67	125	125	125	140
Arm power [kW]	400	700	710	1150	3000
Wavelength [nm]	1064	1064	1064	1064	2000
Beam size [cm]	3.5 / 3.5	4.9 / 5.8	5.5 / 6.2	5.5 / 6.2	5.8 / 6.2
SQZ factor	0	0	0	6	8
F. C. length [m]	none	none	none	16	300

KAGRA vs Other 2G

- Updated AdV sensitivity from [CQG 32, 024001 \(2015\)](#)



Spectra data from [LIGO-T1500293](#)

AdV data from Ettore Majorana

2-3G Sensitivity Comparison

