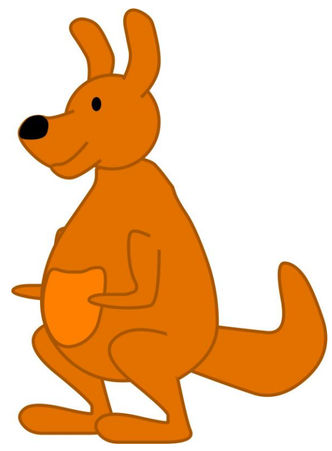
ASPIRE GW Program

Japanese-Australian Bilateral Program
~ Quantum Control for GW Astronomy ~



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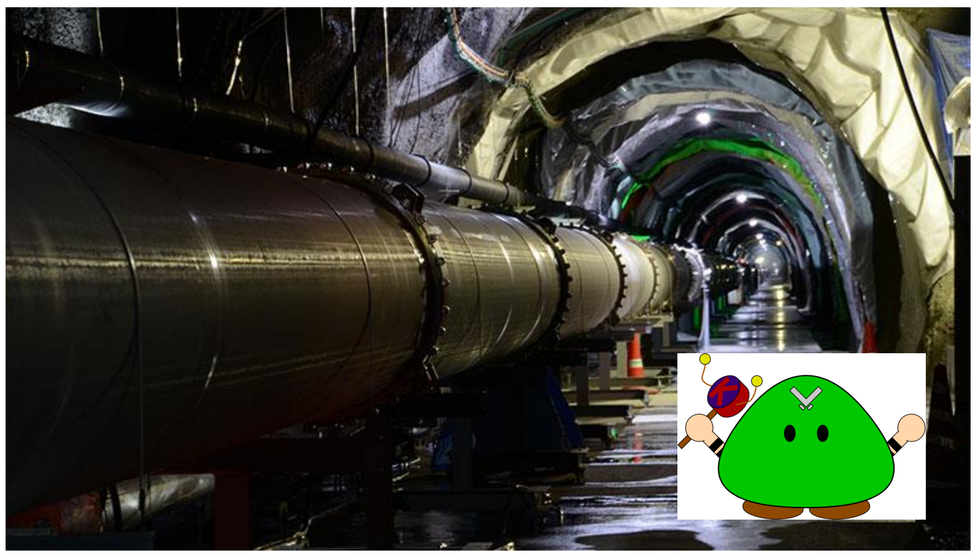
KAGRA

An underground, 3km long interferometer with 1064nm laser and 23kg sapphire mirrors cooled to 20K. One of the upgrade plans, **KAGRA+**, is to improve sensitivity at 3~4 kHz to observe BNS mergers.



OzGrav

GW research team in Australia. It anticipates to build a new 4km long interferometer, **NEMO**, with 2um laser and silicon mirrors radiatively cooled to 120~150K, aiming at observation of BNS mergers.

ASPIRE Bilateral Program

ASPIRE is a JST program with 5M AUD in 5 years. Through the collaboration, starting from Feb 2024, we will discuss a possible joint project to observe GW from hyper NS. We also focus on promotion of young researchers and outreach.
PIs: *K.Somiya* (Tokyo Tech), *D.McClelland* (ANU), Co-I: *M.Ando* (U Tokyo), *D.Ottaway* (Adelaide), *B.Slagmolen* (ANU), etc.

Proposed collaboration items

#1 Study of NEMO/KAGRA+
Coodrinators:
D.McClelland, B.Slagmolen, D.Ottaway, Y.Aso, S.Miyoki, M.Ando, K.Somiya, etc.

#2-4 Development of new ASC
Coodrinators:
D.Ottaway, D.Brown, K.Somiya, M.Eisenmann, K.Kokeyama

#3-2 Quantum teleportation
Coodrinators:
Y.Nishino, M.Page, K.Komori

#2-1 120K Si interferometer
Coodrinators:
C.Zhao, C.Blair

#2-5 Thermal Compensation
Coodrinators:
D.Ottaway, D.Brown

#4-1 Low-freq sensors and control
Coodrinators:
B.Slagmolen, M.Ando, T.Washimi, T.Yokozawa, K.Somiya

#2-2 2um laser
Coodrinators:
D.Ottaway, J.Eichholz

#2-6 Single Photon Detection
Coodrinators:
TBD

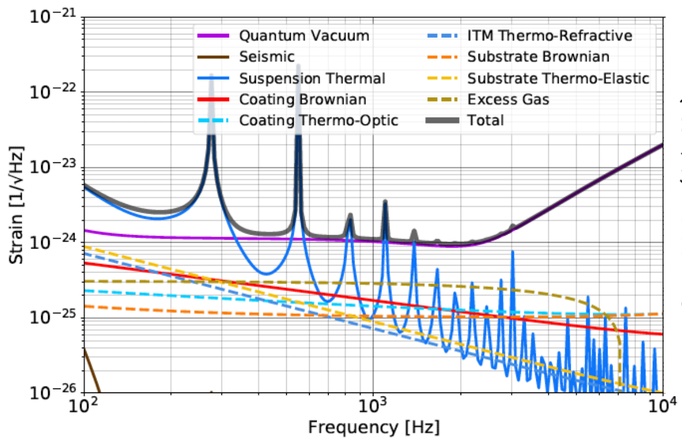
#4-2 Levitation system for MQM
Coodrinators:
K.Somiya, J.Twamley, Y.Michimura

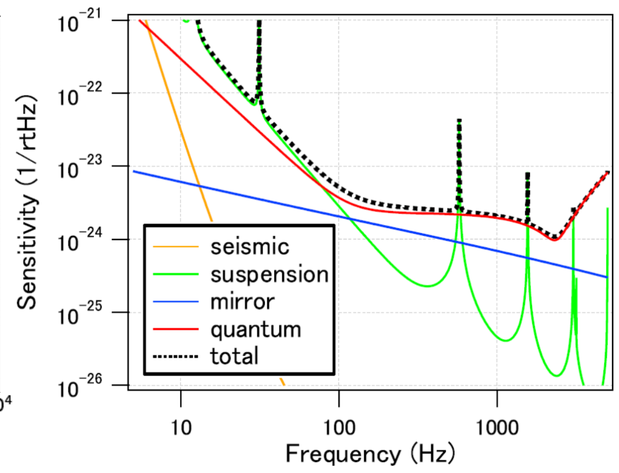
#2-3 Crystal mirror characterization
Coodrinators:
Y.Aso, M.Eisenmann, J.Eichiholz, D.Chen, T.Tomaru

#3-1 Intracavity quantum filters
Coodrinators:
K.Somiya, K.Suzuki, K.Komori, M.Page, T.McRae, C.Zhao

KAGRA commissioning
Coodrinators:
S.Miyoki, T.Ushiba

Data analysis with CNN
Coodrinators:
TBD





	arm length	arm power	squeezing	SRC	temperature
NEMO	4km	4.5MW	7dB	354m	123K/150K
KAGRA+	3km	3.4MW	6dB	66m	22K

Strain sensitivity curves of NEMO[1] (left) and KAGRA+[2] (right). It is said that we need 1e-24 at 3-4kHz to see a clear footprint of BNS merger remnant. Both satisfy the requirement but the bandwidth is larger with NEMO owing to a higher laser power and longer SRC.

Reference [1] K.Ackley et al., Publ. Astron. Soc. Aust. 37, e047 (2020)
[2] K.Somiya, presentation at KIW8 (2021)

Summary

Both **NEMO** and **KAGRA+** aim to observe BNS merger remnants that are said to appear at 3-4kHz, making use of the advantages of cryogenic test masses and long SRC technique. The goal of the bilateral program is to address common challenges and potentially unify ideas for building a single high-frequency GW detector, either in Australia or Japan.