KAGRA

- **Underground** and **Cryogenic** interferometric 3 km gravitational-wave detector at Kamioka, Japan
- KAGRA signed MoA with LIGO/Virgo, October 2019.
- **KAGRA runs as PR-FPMI, under final noise-hunting for joining O3.**

Hisaaki Shinkai (Osaka Inst. Tech.)
KAGRA Scientific Congress, board chair
on behalf of KAGRA collaboration
Fourth 2nd generation detector on the Earth

more precise GW source localization
more certain GW source parameters
more chances to hunt GW events
more ideas for GW researches
more man power
more burden
KAGRA collaboration

110 groups, 14 countries
390+ active members

Default-author list 2018 has 200 members.
+100 collaborators in the past 12 months.
+40 collaborators in the past 6 months.

Organize Face-to-Face meeting
3 times (April/August/Dec) / year

F2F December 2019 @ RESCEU, Japan
F2F April 2020 @ ICRR, Japan
F2F Aug. 2020 @ Toyama, Japan

Organize International Workshop
twice / year

KIW5 Feb. 2019 @ Perugia, Italy
KIW6 June 2019 @ Wuhan, China
KIW7 May 2020 @ NCU, Taiwan
July?

http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA
Status of KAGRA

Organization of KAGRA, KSC (KAGRA Scientific Congress)

Hisaaki Shinkai (Osaka Institute of Technology); March 12, 2020 @ LVK meeting March 2020 telecon

KAGRA Scientific Congress (KSC) organization chart 2019/November 22

- * Hisaaki Shinkai
- ** Hideyuki Tagoshi
- * Hisaaki Shinkai, Ray-Kuang Lee
- Hirotaka Yuzuhara (PD)
- Tomohiro Yamada (Student)

KSC board

* Hideyuki Tagoshi
+ WGs chairs/vice chairs
+ Hisaaki Shinkai (board)

Sharing information & idea

EO

KSC board

Detector Characterization and Data Quality Committee  sec 3.2

Yuki Inoue

Masatake Ohashi (vice PI)

Yoshio Saito (SEO proj. manager — retires March)

Shinji Miyoki (new SEO proj. manager — from April)

Board (2019/8-2021/8)

Takaaki Kajita (PI)

SEO

Compact Binary Coalescence

Continuous Wave

Burst Wave

Stochastic Wave

Computing & Software

Calibration

Detchar

Data Analysis Committee (DAC)

* Hideyuki Tagoshi
  Kipp Cannon
  Hyung-Won Lee
  Tsunne Li

* Yousuke Itoh
  Kazuhiro Hayama

* Guo-Chin Liu
  Sachiko Kuroyanagi

* Ken-ichi Oohara
  Takahashi
  Kazuki Sakai

* Yuki Inoue
  Keiko Kokeyama
  Takahiro Yamamoto

Joint Review Committee  sec 2.5

Yuki Inoue

Calibration Committee  sec 3.3

Joint Meeting Committee  sec 3.6

Hisaaki Shinkai, Ray-Kuang Lee

Joint Run Planning Committee  sec 3.1

Shinji Miyoki, Yousuke Itoh

Joint Computing and Software Committee  sec 3.4

Ken-ichi Oohara, Nobuyuki Kanda

Joint Detection Committee  sec 3.7

Nobuyuki Kanda

Detector Characterization and Data Quality Committee  sec 3.2

Keiko Kokeyama, Takahiro Yamamoto

Joint Editorial board  sec 3.5

LIGO Identity and Access Management team

Hirotaka Takahashi

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Board (2019/8-2021/8)

Takaaki Kajita (PI)
Status of KAGRA

KAGRA collaboration papers

An arm length stabilization system for KAGRA and future gravitational-wave detectors


arm length stabilization
Class. Quantum Grav. 37 (2020) 035004 [arXiv:1910.00955]

Vibration isolation

KAGRA collaboration papers

Prospects for Observing and Localizing Gravitational-Wave Transients with Advanced LIGO, Advanced Virgo and KAGRA

Observing Scenario Paper revision

Several review articles in PTEP, July-August 2020

submitted to PTEP [arXiv:1908.03013]

iKAGRA data analysis

+ Several review articles in PTEP, July-August 2020

Hisaaki Shinkai (Osaka Institute of Technology); March 12, 2020 @ LVK meeting March 2020 telecon
Joint Research MoA signed LIGO-Virgo-KAGRA

October 4, 2019 @ Ceremony of MoA signing

Individual KAGRA members who have worked with existing LIGO-Virgo working groups during O3a, or on analysis of O3a data, may petition to be included as authors.

When after KAGRA > 1 Mpc & satisfy the validation by JRPC, “LVK” full-author publication starts.

Otherwise, KAGRA collaboration members will become authors on LIGO-Virgo observational papers for O3b (and beyond) on October 1, 2020.

Hisakiki Shinkai (Osaka Institute of Technology); March 12, 2020 @ LVK meeting March 2020 telecon
under commissioning for joining O3

Target = 10 Mpc ; at least 1 Mpc for joining O3

May, 2019: Completed installations
Aug., 2019: First lock of FPMI (0.4 kpc)
Dec., 2019 : Engineering Run 7 days
Jan., 2020: First lock of PRFPMI *
Feb. 4, 2020: OMC, DC readout ready (40 kpc)
Feb. 14, 2020: 394 kpc
Feb. 18, 2020: 426 kpc
Feb. 25, 2020: Observation run (2 weeks)
Mar. 5, 2020: 504 kpc
Mar. 9, 2020: 594 kpc

… to be continued

* We appreciate many LV colleagues, especially Stefan Ballmer, Valery V. Frolov, Keita Kawabe, Rana Adhikari, Jenne Driggers, Adam Mullavey, Sheila E. Dwyer, & Anamaria Effler for their onsite help.
Status of KAGRA

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Status of KAGRA

observation run in February 2020

Feb. 25 — Mar. 10 (2 weeks) [Maintenance: Tue 0:00-8:00 UTC]

- longest lock: 10 h 28 m (2-5 hours typically)
- max. sensitivity: 594 kpc (March 9)
- duty cycle: 74.7% (locked, ave 13 days)
  51.4% (obs, ave 13 days)

http://klog.icrr.u-tokyo.ac.jp/osl/?r=13432
https://monitor.ligo.org/gwstatus

*To=09/03/2020 14:01:00 *Avg=50/Bin=2L

BW=0.374994
Current Concerning Issues

* **Asymmetry of Finesse** (~10%) due to difference of transmissivity of ITMx & ITMy
  - OK for O3, hope to be fixed by O4

* **Polarization (sapphire birefringence)** due to inhomogeneity of ITMx & ITMy
  - no replacements for O3. May be the same in O4
  - PR gain = 10 as designed

* **Frosting of Mirrors** due to incompleteness of vacuum
  - re-heat, outgas, and re-cool
  - not go to 20K, but 250K

A sapphire mirror. 22cm diameter, 15cm thick and 23kg weight
KAGRA readiness check by JRPC / Schedule

https://wiki.ligo.org/LSC/JRPComm/Agenda2020Feb20

* READY

☑ LDG access, GraceDB access
☑ State vector defined and documented
☑ DQSEGDB: capability to upload/readback segments to the DB
☑ Web page to see the status of the interferometer
☑ Procedure for RRT including KAGRA
☑ Low-Latency Transfer of KAGRA data to CIT/Virgo

* ON-GOING

☐ KAGRA IdP (Gakunin), An authentication issue to use REST API in GraceDB AP
☐ h(t) calibration and reconstruction reviewed; uncertainty budget
☐ DetChar/DQ: event validation
☐ High-Latency strain data transfer between KAGRA and LIGO-Virgo

Schedule

Feb. 25 — Mar. 10 (2 weeks) [Maintenance: Tue 0:00-8:00 UTC]
Mar. 10 — Mar. 24 (2 weeks) commission/noise-hunt
Mar. 24 — Apr. 30 Observation (hopefully as O3)
## Status of KAGRA

### KAGRA Data Analysis

<table>
<thead>
<tr>
<th>Joint Works</th>
<th>Original Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC * Participation to PE rota (if KAGRA data are available, use them)</td>
<td>CBC * Off-line analysis of KAGRA data</td>
</tr>
<tr>
<td>* Contribution to gstlal and other pipelines</td>
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<tr>
<td>CBC * KAGALI MCMC pipeline</td>
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<tr>
<td>* GPU accelerated Nested sampling</td>
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<tr>
<td>Burst * Off-line follow-up analysis</td>
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<tr>
<td>* Original pipeline</td>
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<tr>
<td>others * Kyoto NSNS waveform (tidal deformability)</td>
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<tr>
<td>* machine-learning approach</td>
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<tr>
<td>* Testing GR</td>
<td></td>
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<tr>
<td>* QNM, echo, polarization, …</td>
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</tbody>
</table>

**Future Joint Works**

Hisaaki Shinkai (Osaka Institute of Technology); March 12, 2020 @ LVK meeting March 2020 telecon
Current Concerning Issues

* **shibboleth problem** between KAGRA and LV systems

- LDG access
- GraceDB access
- KAGRA IdP (Gakunin)
- An authentication issue to use REST API in GraceDB AP
- JGWdoc access  
  (temporarily, using a common account)

https://www.gakunin.jp/en
Target Sensitivity & Schedule

- **O3 -> O4**
  - Cryo-Payload repairing (~ Sep)
  - ETMY tower repairing (~ Sep)
  - Signal Recycling
  - mirror coating (?)
  - install laser beam baffles
  - KAGALI pipeline
  - etc

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“Scenario Paper” [1304.0670ver2020Jan]
Living Rev Relativ (2018) 21:3
https://doi.org/10.1007/s41114-018-0012-9
Status of KAGRA

- **Underground** and **Cryogenic** interferometric 3 km gravitational-wave detector at Kamioka, Japan
  - **KAGRA signed MoA with LIGO/Virgo, October 2019.**
  - **KAGRA runs as PR-FPMI**
  - **Feb 25 - Mar 10: Obs Run**
    (max 594 kpc, duty cycle 74+% lock, 51+% obs, longest lock 10.5 hrs)
    **Now: under final noise-hunting for joining O3.**
  - **Mar 24 - Apr 30: join O3, hopefully (> 1 Mpc and more)**

Thanks for your warm welcomes.
Thanks for your helps.
Thanks for your patience.