



f2fmeeting@ICRR

3-Aug, 2011

# Status of International Collaboration



**KAZUAKI KURODA**

# Objective and fruit of international collaboration



- Importing technical advances and manpower
- Exchanging know-how to make advanced techniques possible
- Cultivating the research ground for collaborative observation in near future
- Stimulating students and young researchers to let them be interested in this field of gravitational wave
- Let us be experienced in different cultures in the world in doing physics



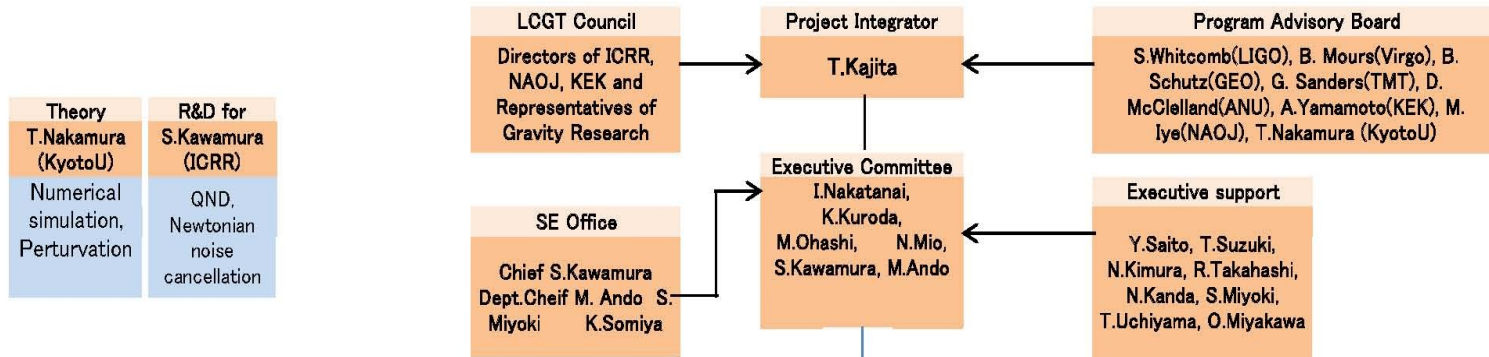
# Note1: Membership of LCGT Collaboration



- Large part of collaboration members consists of members who belonged to the previous collaboration at the time when the construction was approved in June, 2010
- Guideline for entering LCGT Collaboration
  - Recommendation by collaboration member
  - Presentation at f2f meeting
  - Approval in the meeting by 2/3 of the all participants
- PD or graduate students are automatically approved if their supervisor is approved and the supervisor wants to include them



# Note2: LCGT organization



<b>Theory</b> T.Nakamura (KyotoU)	<b>R&amp;D for</b> S.Kawamura (ICRR)
Numerical simulation, Perturbation	QND, Newtonian noise cancellation

<b>SE Office</b>
Chief S.Kawamura Dept.Cheif M. Ando S. Miyoki K.Somiya

<b>Executive support</b>
Y.Saito, T.Suzuki, N.Kimura, R.Takahashi, N.Kanda, S.Miyoki, T.Uchiyama, O.Miyakawa

<b>Data Analysis</b> Kanda (OCU)	<b>Tunnel</b> Uchiyama (ICRR)	<b>Facility Support</b> TBD	<b>Vacuum</b> Y. Saito (KEK)	<b>Vibration Isolation</b> Takahashi (NAOJ)	<b>Cryogenics</b> T. Suzuki (KEK)	<b>Mirror</b> Mio (UT, AMS)	<b>Main Interferometer</b> Aso (UT, Phys)	<b>Digital System</b> Miyakawa (ICRR)	<b>Analog Electronics</b> Moriwaki (UT, AMS)	<b>In/Out optics</b> Telada (AIST)	<b>Laser</b> Mio (UT, AMS)	<b>Auxiliary Optics</b> T. Akutsu (NAOJ)	<b>Geophysics Interferometer</b> Araya (UT, ERI)
Data analysis, method, analysis, data control	Design, Construction, Safety management, Local liaison	Clean environment, Powerline, Mechanical sound noise, internet	Specify, Ordering, Procure, Assembling, Vacuum test, Installation	Design, Ordering, Procure, Installation	Design, Ordering, Procure, Installation	Design (room temperature), Ordering, Procure, Substrate for cryogenic mirror	Interferometer control (length, alignments, lock procedure)	Design of digital system, manufacture, adjustment	Design, Manufacturing, Adjustment	Design, Manufacture, Installation (Laser - PRM)	Development, Manufacture, Installation	Interface of optical systems	Compensation of baaseline length change



## Note 3: MOU between three domestic organizations



- Original agreement among ICRR, KEK and NAOJ was established in 1995 as three directors memorandum for TAMA project
  - Renewed every two years
- Revised in 2007 as MOU between three organizations: ICRR, NAOJ, and KEK

# Academic Exchanges with other projects



- **LIGO Laboratory**
  - Quarter request
  - Support to collaboration with researchers of LSC
- **EGO/Virgo**
  - Exchange technical information and R&D for ET
- **GEO (Glasgow)**
  - Exchange technical information and R&D for ET
- **Shanghai United Center for Astrophysics**
  - Advanced study for next generation techniques
- **GEO(AEI) in preparation**
- **University of Sannio in preparation**
- **Tsing-Hua University (Taiwan) in preparation**



# Collaboration with LIGO



- History (reported last meeting)
  - Riccardo seconded in November, 2010
  - Rana stayed in December, 2010
  - LIGO mirrors rent (on-going)
  - Design tools for interferometer
  - Digital control system
- DCC access to obtain software and hardware information developed so far in LIGO
- Mirror design by H. Yamamoto
- ...

# Collaboration with Virgo/EGO



- **ICRR-Virgo meeting (1<sup>st</sup> week of November, 2010)**
  - Francesco Fidecaro, Raffaele Flaminio, Benoit Mours, Fulvio Ricci visited ICRR
  - Discussion to support from Virgo
- **Exchange of academic agreement with EGO/Virgo**
  - Director of EGO: Federico Ferrini
  - Scientific director of Virgo: JeanYves Vinet

Italy-Japan conference will be held in this October  
in Tokyo (ICRR)



## Collaboration with GEO

- MOU between Glasgow University and ICRR has been already exchanged
- MOU between AEI and ICRR is on progress
- Urgent R&D items:
  - Technical information on design of suspension system
  - Mechanical loss improvement on optical coating



# Collaboration with SUCA



- Professor Ni organized the collaboration
- Academic agreement between SUCA, Shanghai Normal University and ICRR, UT
- Ongoing researchers:
  - Advanced study of interferometer technology
  - Data analysis

# Collaboration with University of Sannio



- Preparation of exchange of academic agreement
- Exchange of researchers under IRSES program
- R&D on optical coating and SAS



## Collaboration with NIKHEF



- Jo van den Brand, Alessandro Bertolini, Eric Hennes intend to work on SAS for LCGT
- Jo is ICRR research collaboration member approved in FY 2011
- R. Takahashi and T. Sekiguchi visited Jo's laboratory to check the product of SAS in this February



# Collaboration with ET group



- IRSES program of young researcher exchange between EU and Japan is highly possible to be approved (named ELiTES (ET-LCGT ···)) 2012-2015
- Cryogenics and SAS
  - Property of coating at cryogenic temperature
  - Suspension system for cryogenic
  - Highly sophisticated anti-vibration system
  - ···

# Collaboration with 3<sup>rd</sup> Generation detector in US

- Warren Johnson actively proposing the collaboration research on cryogenic system developed under NSF grant
- Practical design and test of underground interferometer may be useful for the 3<sup>rd</sup> generation detector in US
- Exchange young researchers for future advancement

# Collaboration with KGWG & KIAS



- **Bilateral researcher exchange program**
  - Prof. Yoon represents Korean group and Prof. Kawamura for Japanese side. Both are funded for 2012-2014
- **Laser & Optics**
- **Data Analysis**

# Summary of International Collaboration



- International collaboration is indispensable both to construct LCGT and to do physics by LCGT
- ICRR has implicit contract with NAOJ and explicit MOU with KEK to conduct the LCGT project
- Ongoing to exchange academic agreements with overseas projects for efficient promotion of LCGT project
- Applying funds for promotion of international collaboration
- Attracting young researchers to LCGT project by stimulating interests of basic science by gravitational wave physics