# Activity Report of Commission J

**July 11, 2018 to April 26, 2019**

April 26, 2019

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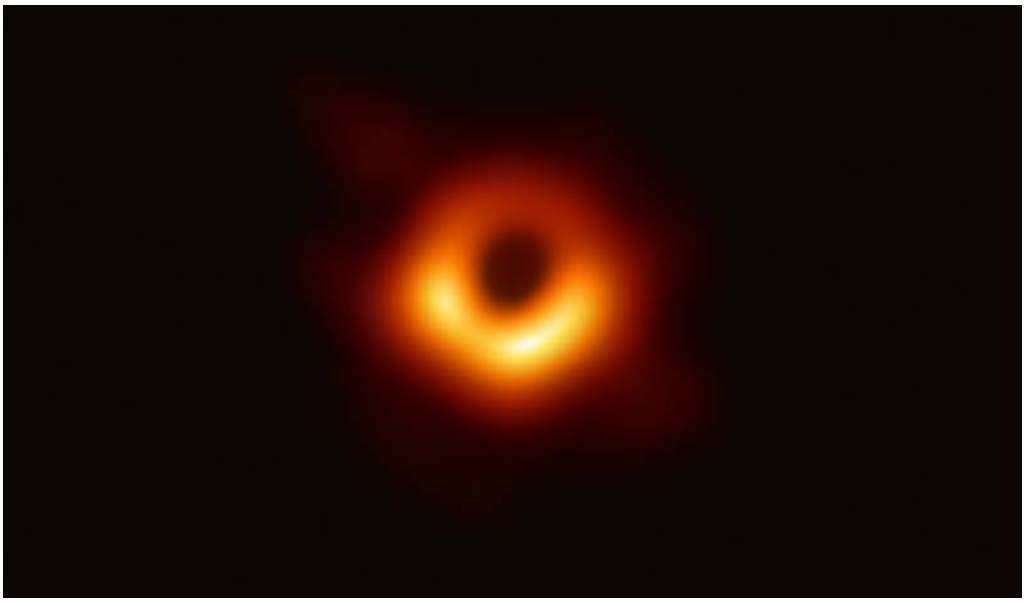
## EHT project

- EHT press release (April 10, 2019)

### *Astronomers Capture First Image of a Black Hole*

**An international collaboration presents paradigm-shifting observations of the gargantuan black hole at the heart of distant galaxy Messier 87**

The Event Horizon Telescope (EHT) - a planet-scale array of eight ground-based radio telescopes forged through international collaboration - was designed to capture images of a black hole. Today, in coordinated press conferences across the globe, EHT researchers reveal that they have succeeded, unveiling the first direct visual evidence of a supermassive black hole and its shadow.



Scientists have obtained the first image of a black hole, using Event Horizon Telescope observations of the center of the galaxy M87. The image shows a bright ring formed as light bends in the intense gravity around a black hole that is 6.5 billion times more massive than the Sun. This long-sought image provides the strongest evidence to date for the existence of supermassive black holes and opens a new window onto the study of black holes, their event horizons, and gravity. Credit: Event Horizon Telescope Collaboration

## Activities of meetings

- **VLBI Science in SKA Age**

  Date: 2018/7/22-23

  Location: NAOJ, Mitaka

  Since VLBI observation techniques can achieve ultra-high spatial resolution (micro to milliarcsecond) that can not be realized with any other method. Many of Scientific results have been obtained by VLBI, such as motions of matter around AGN jets, proto-stars or late-type stars are captured as moving images. On the other hand, they have always been plagued by poor sensitivity. To realize VLBI observation on a global scale by adding a VLBI function to SKA1 (aperture: 0.1 million square meters, construction will start from 2020, scientific verification in 2024 and public observation in 2027), it will be possible to far surpass the existing VLBI observation network in terms of both sensitivity and spatial resolution. Therefore, as part of the future plan study at the VLBI conference, we will hold a study conference focused on the science realized by Japan contributing to the addition of the VLBI network to SKA1.

- **NOEMA/30m Workshop**

  Date: 2018/7/24-25

  Location: NAOJ, Mitaka

  The NOEMA (NOrthern Extended Millimeter Array) interferometer is currently the most advanced millimeter array in the Northern Hemisphere. The maximum angular resolution of NOEMA is ~0.5 arcsecs at an observing wavelength of 1.3 mm (230 GHz), with receivers operating at 3mm, 2mm, and 1mm. The number of antennas is expected to reach 12, and the sensitivity of the full NOEMA is expected to be 45-65% of ALMA. The 30-meter single dish telescope is equipped with a series of heterodyne receivers and continuum cameras operating at 3, 2, 1, and 0.9 millimeters. The main goal of this 2-day workshop is to introduce NOEMA/30m to the Japanese community and to discuss possible science cases through a series of invited/contributed talks given by our community members. Speakers are invited to express their opinion on how NOEMA/30m time will enhance their immediate and long term science productivity, based on the assumption that NAOJ gains access to NOEMA/30m time in the near future. We encourage young scientists to take advantage of this opportunity and actively voice their opinion.

- **Science Workshop on the 30-m THz Telescope in the Antarctica ~Star-Planet formation~**

  Date: 2018/9/12

  Location: NIPR, Tachikawa

  The Antarctic Astronomical Consortium is promoting a plan to construct a 30m class THz telescope in the inland part of Antarctica where the observation conditions are the best on the ground. For this time, with the support of the National Institute of Polar Research Research

Meeting, we will hold a research meeting focusing on the formation of star and planet systems with the THz telescope.

- **General Meeting of the Radio Astronomy Forum**

  Date: 2018/9/19

  Location: Hosei University, Koganei

- **16th Mizusawa VLBI Observatory Users Meeting in 2018**

  Date: 2018/9/25-26

  Location: NAOJ, Mitaka

  Mizusawa VLBI Observatory has proceeded astrometric observations with VERA to unveil 3-D spatial/velocity structures in the Milky Way Galaxy and its dynamical evolution. On the basis of the activity, we have accelerated a development of KaVA (KVN and VERA Array) and EAVN (East-Asian VLBI Network), and as a result an open-use of EAVN has been initiated since 2018B semester (observations will be allocated from 2018 September). We emphasize that the development of EAVN will promote the KaVA Large Programs in research fields of Star, AGN, and High-mass star formation, which have been initiated since 2016. In this users meeting, we will discuss about not only exciting scientific results with VERA/KaVA/EAVN but also future prospects of Mizusawa VLBI Observatory especially in 2022 and beyond. We hope that references below will be helpful to accelerate these discussions: EAVN will be further developed on the basis of future collaborations with JVN (Japanese VLBI Network), FAST 500-m (China), and TNRT 40-m (Thailand) radio telescopes, leading improvement of sensitivities and observable frequencies; Synergy with Gaia DR2 (opened in 2018 April) and SKA (now constructed and its operation will be initiated in 2027) has been expected.

- **SNR workshop 2018**

  Date: 2018/10/9-10

  Location: Nagoya University

  Supernova remnants (SNRs) are the most energetic objects not only in our Galaxy, but also in external galaxies, and have been observed at various wavelengths from radio to gamma-rays. One of the most spectacular features of SNRs is the fast moving expanding shells whose velocity is measured as ~3000-10000 km/s. Recent observations of the shells in X-rays as well as radio continuum emission have provided a wealth of information on their physical and kinematical properties. It is also remarkable that the dense interstellar medium interacting with the shocks is likely playing a key role to produce X- and gamma-rays as shown by comparisons with HI/CO and dust emission. Theoretical works on acceleration and escape of cosmic rays in SNRs are unveiling details of cosmic-ray acceleration/propagation by magneto-hydro-dynamical numerical simulations, which will be compared with observations. In the present workshop, we invite observers and theorists to stimulate active interaction and

exchange of ideas on SNRs.

- **Workshop on Interstellar Matter 2018 (ISM2018)**
  Date: 2018/11/14-16
  Location: The Institute of Low Temperature Science, Hokkaido University
  The aim of this compact workshop is to offer an opportunity for exchange of current research results of physics and chemistry of astronomically-relevant atoms, molecules, and ions in both gas and condensed phases. Toward the development of interactive activation among astronomical observations, theoretical calculations, and laboratory experiments, participants from wide fields, physics, chemistry, planetary sciences, and astronomy, are welcome to this workshop.

- **ALMA Workshop: From Disk to Solar System**
  Date: 2018/11/21-22
  Location: WTC Conference Center Tokyo

- **VLBI Consortium Symposium 2018: VLBI in SKA Age**
  Date: 2018/12/1-2
  Location: Kumamoto University

- **19th East Asia Submillimeter-wave Receiver Technology Workshop &**
  **5th Riken-NICT Joint Workshop on Terahertz Technology**
  Date: 2018/12/11-13
  Location: Kwansei Gakuin University

- **East Asian ALMA Development Workshop 2018**
  Date: 2018/12/14-15
  Location: Osaka Prefecture University
  The main goal of the workshop is to discuss and identify development items that are critical in the long term development and operation of the ALMA telescope. The topic of this year's workshop is “wide IF”. Since the hardware/software development is intimately connected to future science requirements, active participation by scientists is highly encouraged.

- **East Asian ALMA Science Workshop 2018**
  Date: 2018/12/17-19
  Location: I-site Namba (Osaka Prefecture University)
  The main aim of this workshop is to continue to promote and stimulate international collaboration among the researchers in the EA partners, by reviewing and sharing the most recent ALMA science results in all relevant fields of astronomy. We plan to hold discussion

sessions to promote closer communication among the researchers in related fields.

- **Radio Astronomy Forum Symposium 2018: Future Science of Radio Astronomy**
  Date: 2018/12/20-21
  Location: NAOJ, Mitaka

- **2018 ALMA/45m/ASTE Users Meeting**
  Date: 2018/12/26-27
  Location: NAOJ, Mitaka

- **Ibaraki University Workshop: Transient/Variable Event and Radio Follow-up**
  Date: 2019/2/27-28
  Location: Ibaraki University

- **First circular of SOKENDAI-UST Asia Winter School (SAWS) 2019: Star and Planet Formation: Key Questions and Challenges**
  Date: 2019/2/27-3/1
  Location: NAOJ, Mitaka

- **Star formation with ALMA: Evolution from molecular clouds to protostars**
  Date: 2019/3/4-6
  Location: Nagoya University

- **Workshop: Polarimetry in the ALMA era: a new crossroads of astrophysics**
  Date: 2019/3/25-29
  Location: NAOJ, Mitaka