

The community of astronomers is growing Malaysia and organizing their first steps towards a solid Malaysian Astronomical Society. The area of radioastronomy is growing on par, and so it is in particular the VLBI field. Here we present the Malaysian current VLBI status and future plans. Our local community is raising VLBI experts both from the scientific as well as from the technical and engineering points of view. Malaysian VLBI researchers are active in fields involving, but not limited to, AGN physics, masers, solar astronomy, clusters of galaxies, or dark matter, among others. Scientific collaboration and partnership with other (south) east asian regions and the East Asian Observatory (EAO) has also started. Malaysia has moved forward in the signing of a Memorandum of Agreement with the Shanghai Astronomical Observatory (SHAO) and Xiamen University Malaysia (XMUM) for the acquisition and operation of a VGOS radio telescope which will be expected to start its construction in the location of Jelebu in the near future. Malaysia is moving towards its readiness by finalizing VLBI tests with the UPSI pathfinder antenna.

BACKGROUND

Although Malaysian astronomy can be traced back to the 14th century, astronomy programs were only introduced in 1990s. Mazlan Othman was Malaysia's first astrophysicist (PhD in 1981). As of 2019, there are 20 astronomers registered under the IAU in Malaysia. The Global Malaysian Astronomical Convention (GMAC) in 2020 gathered more than 100 astronomers.

Radio astronomy pioneered by Zamri Zainal Abidin (PhD, University of Manchester) and Zainol Abidin Ibrahim. The Radio Cosmology Research Laboratory was established in Universiti Malaya (UM) in 2005 and is currently the only radioastronomy laboratory in Malaysia. The group has currently 1 Postdoc, 4 PhDs and 9 MSc students registered involved in the following topics:

- Dark matter
- Galactic rotation curves
- Galaxy cluster dynamics
- Active galactic nuclei & black holes
- Star Formation
- The cosmic web
- Solar radio bursts
- Fast radio bursts
- Radio astronomy instrumentation

PATHFINDERS

Half-Wave Dipole Antenna (HWDA) Array



The HWDA array was designed by the Chinese Academy of Sciences, Yunnan Astronomical Observatory (YNAO). Through a research collaboration with UM, a replicate of it was constructed in UM at the selected site on its campus. The ultimate goal is to have a VLBI array between the antennas in YNAO and UM.

UPSI-UM 7.3m Radio Antenna



The first radiotelescope observatory in Malaysia was constructed at the grounds of Universiti Pendidikan Sultan Idris (UPSI). The 7m diameter L-band radio dish is currently undergoing interferometric fringe testing with China and Japan. This joint research kickstarts Malaysian radio astronomers effort to use VLBI technique together with their East Asian collaborators.

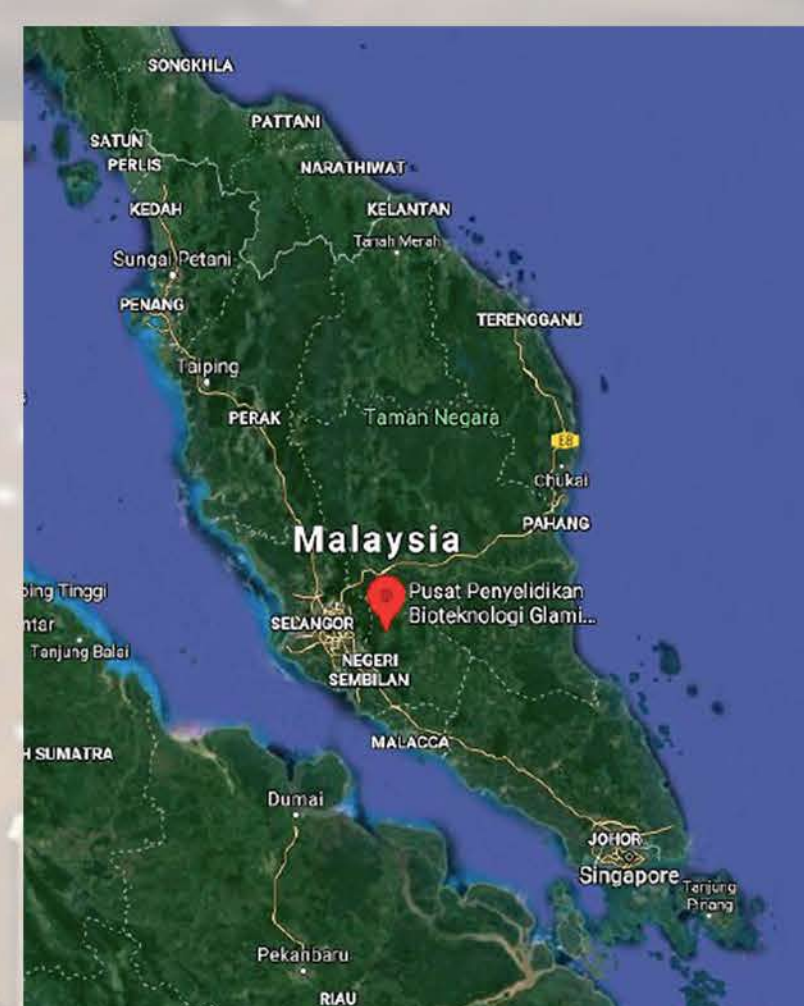
ON THE ROAD FOR VLBI

The next step is the installation of a VGOS facility in the UM biotechnological Research Center (UMBRC) in Jelebu, one of the driest places in Malaysia.

This is a Joint Project lead by Universiti Malaya together with Xiamen University Malaysia and Shanghai Astronomical Observatory aiming for geodetic observations towards IRCF and astrophysical VLBI studies (masers, AGNs,...)

Preliminary Project Timeline:

- 2019: MOU UM-SHAO
- 2020: Location discussions & planning
- 2020: MOA UM-XMUM-SHAO
- 2021: Soil investigation & logistic preparations
- 2022: Site Preparation
- 2022: VGOS Manufacturing & Delivery
- 2022-2023: Telescope Assembly
- 2023-2024: First Light



RESEARCHERS



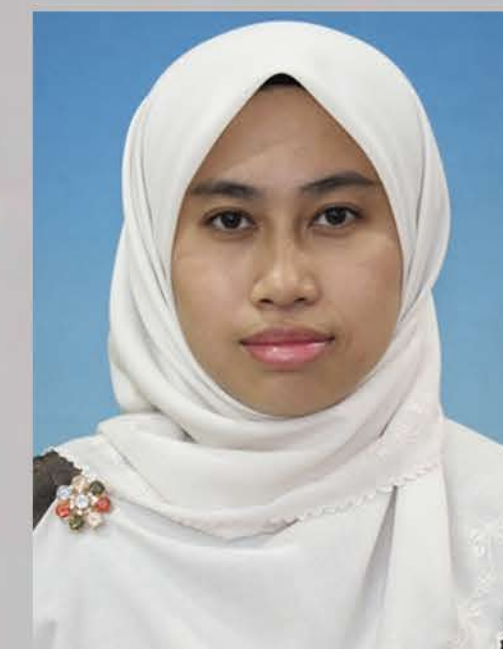
Zamri Zainal Abidin



Juan Carlos Algaba



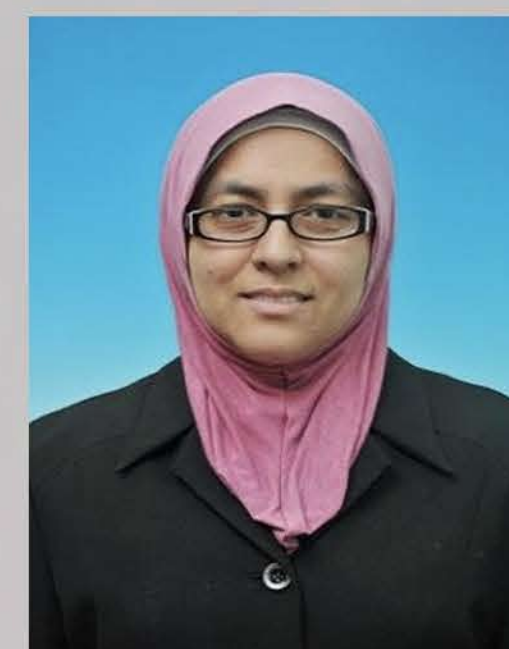
Zainol Abidin Ibrahim



Norsiah Hasim



Ungku Ferwani



Noraysiah Mohd Shah



Mahidzal Dahari



Farah Ramadhani

COMMITTEES & COLLABORATIONS

MEASOOC

The Malaysia-EAO Observer Consortium (MEASOOC) is a committee recognized by EAO via a MOU signed between EAO and UM on January 17, 2019. By this MOU, EAO invites all members of MEASOOC to be on the Observer Status with the EAO. As Observer, they can access all the facilities, which EAO operates, as well as other facilities, which EAO will have access to. EAO acknowledges UM as the official institutional contact point for the collaboration, with Radio Cosmology Research Lab in UM as the contact point for official communication.

RAFCOM

Malaysia is a member of Radio Frequency Committee for Asia Pacific (RAFCAP) region since 2003. Radio Astronomy Frequency Committee of Malaysia (RAFCOM) was setup in April 2021. RAFCOM aims to report on RFI surveys and RQZ setup, acts as collective approach to MCMC, and discuss contributions and gather information for RAFCAP/IUCAF/WRC etc.

ACTIVITIES

- 2019: 1st Malaysian VLBI Workshop
- 2020: CASA Pipeline for ALMA data
- 2021: UM-NARIT Bilateral Symposium
- 2021: Exploring Galaxies with MaNGA
- 2022: JCMT Malaysia Users Meeting
- 2022: 2nd Malaysian VLBI Workshop (Join us!)

FUTURE PLANS

- Gearing up radio all cosmology lab topics towards future potential VLBI
- Discussion with XAO for low frequency VLBI
- ATCA in preparation for future VLBI with Australia

REFERENCES

Nature Astronomy, Volume 4, 1115 (2020)
sites.google.com/view/radiocosmologylaboratory