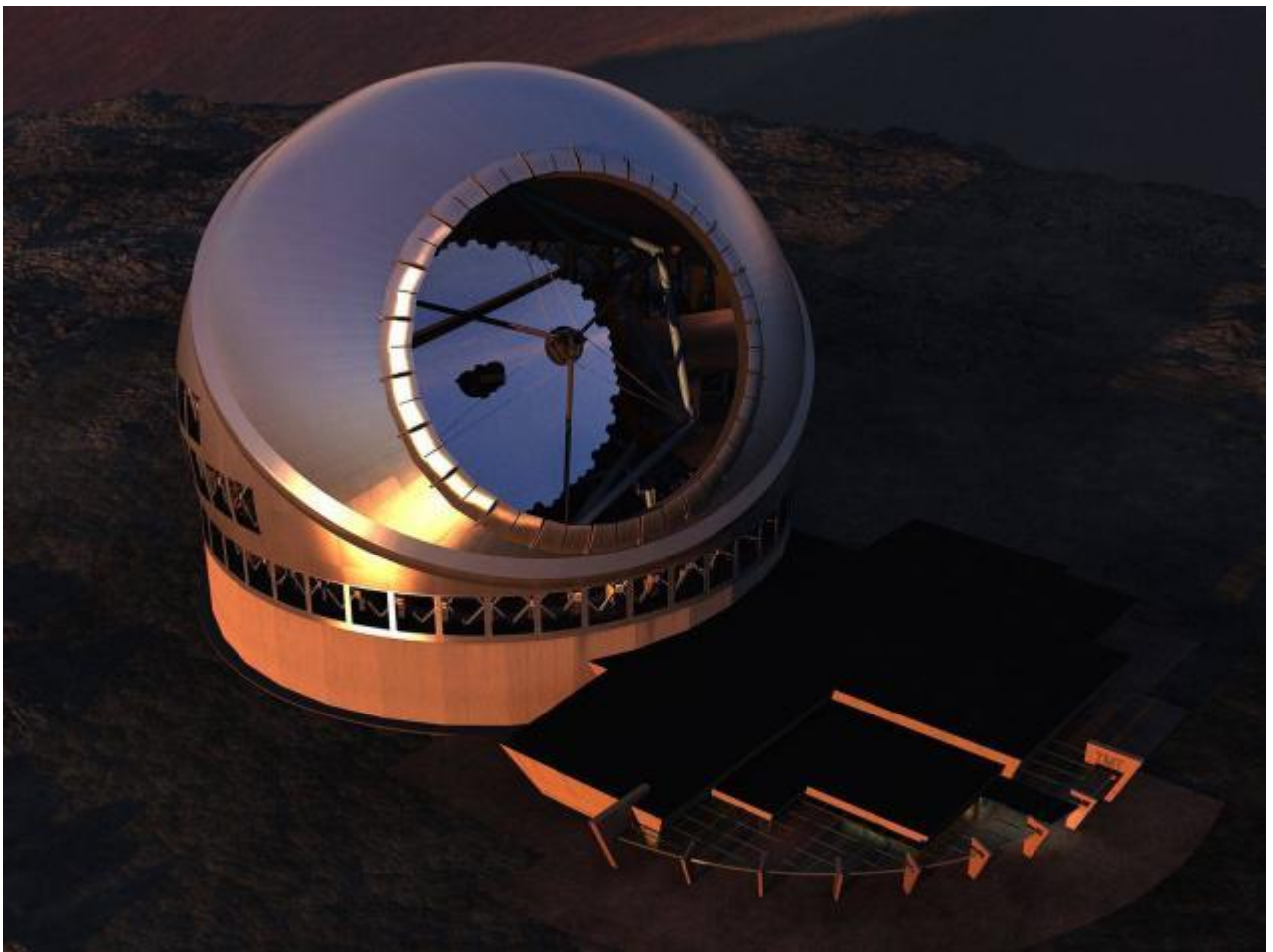


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## Master Partnership Pact signed for Giant 30-m Optical Telescope

R. Ramachandran



Thirty Metre Telescope. Photo: Special Arrangement

### Canada, China, India, Japan and the U.S. sign the pact in Hawaii

Early on Friday, at about 8-30 a.m. India time, the Master Partnership Agreement (MPA) for the construction of the \$1.5-billion Thirty Metre Telescope (TMT), what would be the world's largest optical and infrared telescope, was signed by the five partner countries —

Canada, China, India, Japan and the U.S. — in Hawaii, the site for the proposed telescope. The in-principle approval of India's participation in the TMT project was accorded in 2010 itself ([The Hindu, June 26, 2010](#)). India also hosted a meeting of the Board of Directors of the project in New Delhi which laid the road map towards the TMT construction (*The Hindu*, January 23). However, a go-ahead from the legal section of the External Affairs Ministry (to sign the MPA, which had to be done before the end of the month, had not come in till Wednesday.

The Department of Science and Technology (DST), the main government agency coordinating the Indian participation, immediately authorised P. Sreekumar, the Director of the Indian Institute of Astrophysics (IIA), Bangalore, the nodal Indian institution, to sign the agreement and transmit it to the ongoing meeting of the Board of Directors in Hawaii. The same was scanned and sent to B. Eswar Reddy of the IIA, one of the Indian representatives in the Board of Directors attending the current meeting.

Besides the IIA, the other participating institutions in the TMT-India Programme are the Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, and the Aryabhata Research Institute of Observational Sciences (ARIES), Nainital. While the IUCAA functions under the UGC, the other two are under the DST.

With the signing of the MPA, India will be moving from its current observer status to a full-fledged partner in the project and will be a member of what is called the TMT Collaborative Board. This Board will eventually be replaced by a Governing Board, which will manage the TMT International Observatory on behalf of its partners. "We are part of every decision of the project development," said Dr. Reddy. "The next stage is signing of the same document by the financial authorities to move forward with ground-breaking at Mauna Kea, Hawaii, the home for the TMT," he added. The telescope will be located just below the summit at Mauna Kea at a height of 4,050 m.

The main promoters of this international project are Caltech and the University of California in the U.S. and the Association of Canadian Universities for Research in Astronomy (ACURA), with China, India and Japan providing additional financial and technical support in return for participation in its construction and observation time. The construction is expected to begin next year and the telescope is expected to become operational in 2022.

India is a 10 per cent partner in the project, which implies a financial commitment of about Rs. 1,000 crore. Much of India's contribution will be in-kind. Indian institutes and the industry are collaborating to build much of the telescope's control systems, whose estimated value is about Rs. 600 crore, said Dr. Reddy who is also the Programme Director for TMT-India. The DST and the Department of Atomic Energy (DAE) will jointly fund the Indian component. According to the arrangement, Indian astronomers will get observational time in proportion to India's share in the total project cost. It may be pointed out here that the financial sanction is yet to be obtained. According to T. Ramasami, Secretary, DST, the Finance Ministry's sanction will be needed only next year.

At present, India has three 2 m class optical-IR telescopes and a 3.6 m telescope waiting to be commissioned. The apertures of the current ground-based large optical-IR telescopes are in the 8-10 m range, though other bigger ones like the TMT are also on the anvil, the 39 m European Extremely Large Telescope (E-ELT) in particular. Though the Indian astronomical

community has been using the existing 8-10 m class telescopes, such usage has largely been limited to individual efforts.

The TMT, which belongs to what are called the “new technology” telescopes, was proposed after the enormous success of the first new technology telescope, the twin 10 m Keck telescope on Mauna Kea. The TMT will also be a segmented mirror telescope with its primary 30 m mirror made up of 492 hexagonal segments of 1.44 m each. Precisely aligned, these segments will work as a single reflective surface of 30 m diameter. The TMT has a collecting area of 650 sq. m. and will have observational windows from UV to mid-IR wavelengths (310 nanometres to 28 micrometres). Its large collecting area makes it 81 times more sensitive (measure of the faintest signal that it can detect) than the current largest ground-based telescopes.

### **Ground-based telescope**

Like all ground-based observatories, TMT is limited in spatial resolution by the atmospheric turbulence. While the 30 m primary mirror builds on the technological and operational experience of the Keck Telescope, it will be the first ground-based telescope to incorporate the technology of Adaptive Optics (AO) as an integral component of the telescope. AO refers to systems designed to sense atmospheric turbulence in real time, make the appropriate corrections to the beam and enable true image on the ground limited only by optical diffraction. The AO capability will enable the TMT resolve objects by a factor of 3 better than the 10 m-class telescopes and 12 times better than the Hubble Space Telescope (HST).

According to Dr. Reddy, India’s contributions will include fabrication of edge sensors, which sense relative displacement of segments due to gravity and temperature while tracking objects in the sky. This information is relayed to actuators which move the segments so that all the 492 segments act as a single monolithic mirror to provide the best possible image of objects in the sky. India has the responsibility to build the entire actuator system. The companies involved in the project include General Optical Asia Ltd. (GOAL), Puducherry, Avasarala Technologies, Bangalore and Godrej, Mumbai.

“We have taken up prototype manufacture of both the edge sensors and actuators. The first batch of them were made and passed rigorous tests at Jet Propulsion Lab (JPL). USA,” said Dr. Reddy.

### **‘India designing mirror coating system’**

“Godrej and Avasarala have taken up segment support assembly, a very complicated system on which the primary mirror segments sit. Also, India is designing a mirror coating system and exploring the possibilities of setting up a unit to polish 100 segments to the project,” he added. India may also provide a part of the 492 mirror segments.

Keywords: [Master Partnership Agreement](#), [Thirty Metre Telescope](#), [infrared telescope](#), [TMT project](#), [Mauna Kea](#), [ground-based telescopes](#)

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