

IIT-Gn leads gravitational wave research in India

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A GROUP of research scientists at the Indian Institute of Technology, Gandhinagar, was part of the LIGO Scientific Collaboration that discovered gravitational waves or ripples in spacetime, confirming a major prediction of Albert Einstein's 100-year-old general theory of relativity.

Under the aegis of Indian Initiative in Gravitational-wave Observations (IndIGO) — a consortium of scientists from nine research institutes and universities in India who worked towards the groundbreaking discovery — Anand Sengupta led three UG students, one post-doctoral fellow and two Ph.D students at IIT-Gn to help the research.

They were part of larger Laser Interferometer Gravitational-wave Observatory (LIGO) Scientific Collaboration comprising more than 1,000 scientists from universities in the USA and 14 other countries. IIT-Gn scientists are co-authors on the landmark discovery paper along with 35 scientists from other IndIGO institutions.

"Almost everything we know about the universe has been through detection of light at different wavelengths," said Sengupta. "As gravitational waves carry different kind of information than light, this discovery has thrown open a fundamentally new way of observing the universe."

He explained that these waves are faint and challenging to detect. Special data processing techniques are needed to detect them in the noisy detector



Anand Sengupta and his team from IIT-Gn. *Express*

data channels.

LIGO was originally proposed as a means of detecting these gravitational waves in the 1980s by a group of scholars and researchers, while IndIGO was formed in 2009 by a group of researchers with expertise in theoretical and experimental gravity, cosmology and optical metrology, who were keen to promote gravitational wave research in the country with a dream of realising an advanced detector in India.

"Scientists from IIT Gandhinagar's gravitational wave group have lectured at various colleges and universities all over India to communicate the excitement of this new field of research within the larger community of students. Now, efforts should be made to build an advanced detector in India (LIGO-India) which can increase our science capability by several folds. We need hardware to augment this global effort and for doing data analysis and theoretic calculations. Currently efforts in this direction are ongoing at the Tata Institute of Fundamental Research in Mumbai and a plan

for a prototype detector has been made at the highest-level of the government," averred Sengupta.

From its inception, Sengupta played a key role in the IndIGO's interaction with the LIGO Scientific Collaboration as the nominated principal investigator of this Indian group and served the nascent community in this capacity till 2014. Sengupta also played a key role in IndIGO's efforts of setting up collaboration wide computational facility at IUCAA (Pune), and in IndIGO's community building efforts by organizing workshops and schools.

Over the past four years, IIT-Gn became a partner in the global efforts for detection of gravitational waves by participating in the development of sensitive search algorithms using a network of terrestrial detectors and their deployment over automated data analysis workflows using high-throughput computing technology. Scientists at IIT-Gn are also working on automated followup of gravitational wave events using robotic telescopes in the electromagnetic spectrum.