Awestruck: on the Nobel Prize for Physics

The 2017 Nobel Prize for physics has been awarded to the LIGO-VIRGO collaboration for their detection of gravitational waves arising from the merger of two black holes. Gravitational waves are ripples in the fabric of spacetime caused by cataclysmic events in the universe such as colliding black holes or neutron stars. Though extremely violent, when these disturbances reach far-off regions in space and time the signals are weak and require extremely sensitive detectors to sense them. The very first detection of gravitational waves was made in September 2015, a signal of a black hole merger 1.3 billion years ago. In other words, the signals took that long to travel to Earth. Hence the observatory offers a way of looking back in time to unravel mysteries pertaining to the early days of the universe's existence. Since then, the LIGO-VIRGO collaboration has detected such signals four times. Just as astronomy offers a way of mapping the visible objects in the universe, gravitational wave astronomy is now a science of the near future whereby black holes, neutron stars and more such objects may be mapped. Rainer Weiss, who identified sources of noise that could drown the signal, gets one-half of the prize. Barry C. Barish's main contribution in scaling up the project and Kip Thorne's vision in guiding the large group of researchers are no less important, and in fact are aspects that capture the marvel of coordination in the LIGO-VIRGO collaboration.

An example was the effort made to bring some coherence into the source modelling. Even though the detector had been built and was functional, the theory had to be developed. In order to coordinate this, Dr. Thorne invited researchers from around the globe to Caltech in the United States, and over a year and a half thought about the models of the source that had to be calculated. An ensuing paper published in *Physical Review Letters*, titled "The Last Three Minutes", described issues of source modelling. Several Indians, including Bala Iyer and Sanjeev Dhurandhar, were involved in this work. It was then that Dr. Thorne realised that numerical models of relativity that could be fed into the computer and solved were needed. He roped in groups from the U.S. and Germany to develop numerical gravity. In addition to two detectors of LIGO, the Advanced VIRGO came online on August 1 this year. The advantage of having three detectors is that the location of the source can be determined more accurately. With the Japanese KAGRA detector set to go online in 2019 and LIGO India set to join in 2024, the possibility of using gravitational wave astronomy to look back in time, at the very origin of the universe, becomes a real possibility. When realised, this operation would owe, in no small measure, to the time spent in organising and focussing, even directing, the efforts of the large group of researchers, numbering over a thousand.

Rajasthan's ordinance shields the corrupt, threatens the media and whistle-blowers

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