

*CLEAN ROOM  
WORLD RECORD*

6 **A**n anyone wishing to listen in on the music of the universe needs fine instruments – instruments such as those installed in LIGO. On September 14<sup>th</sup>, 2015, the twin detectors of the U.S. Laser Interferometer Gravitational-Wave Observatory (LIGO) detected gravitational waves. It was a world first – and people in the village of Ruthe near Hanover, Germany celebrated. The reason for celebrating was that nearby, there is another trap for such space-time vibrations – which were first predicted by Albert Einstein. At GEO600, researchers – including those from the Max Planck Institute for Gravitational Physics – investigate new detection techniques that will then be used in other, larger detectors around the world.

All such instruments are based on the principle of interferometry. This involves splitting laser light into two beams, which are then directed at right angles away from each other along two long arms. At their ends, they are reflected back again by mirrors and finally recombine and overlap with each other. From the resulting interference pattern, scientists can tell whether or not a gravitational wave has passed through the equipment. Such measurements are extremely challenging, and, as a result, the interior of GEO600 resembles a clean room in a virology laboratory. All personnel are required to wear protective goggles and specialized overalls, as a single speck of dust would compromise the sensitive measurements.

The laser beams run through two 600-meter stainless steel tubes that, together with the tank (on the left in the picture), form part of a sophisticated vacuum system. The optical table in front of the three researchers generates “squeezed light.” This is one of the tricks the scientists employ to increase the sensitivity of a gravitational-wave detector. It mutes noise caused by quantum effects in the laser light by a factor of 2! With that, the GEO600 has set a new world record.



# ON LOCATION

---



7

PHOTO: FRANK VINKEN FOR MPG