

Press release

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Gravitational waves detected with help from high-purity quartz glass from Heraeus

Optical quartz glass contributed to the LIGO team's success in demonstrating that Einstein's gravitational waves do exist

By supplying a super-high-tech material of quartz glass for gravitational wave detectors, Heraeus contributed to the proof of Einstein's general theory of relativity. At a press conference yesterday, experts from the LIGO (Laser Interferometer Gravitational-Wave Observatory) Scientific Collaboration in the United States announced their sensational detection of gravitational waves, a discovery sure to be nominated for a Nobel Prize. The researchers struck gold with the help of a pair of enormous L-shaped antennas, one in Livingston, Louisiana, the other in Hanford, Washington. The scientists detected a faint ripple in space-time and recorded signals caused by a collision of two black holes.

Quartz glass from Heraeus played a special role in the LIGO experiments, which used gravitational wave detectors to investigate one implication of Einstein's theory of relativity. Gravitational waves – “wrinkles” in the space-time continuum – are emitted by distant astrophysical events such as supernovas, neutron stars and black holes. Gravitational wave detectors utilize highly sensitive optical interferometers with perpendicular arms 4 km (2.5 miles) long. They function as a photon reservoir and contain quartz glass with extremely high transmission values and optical homogeneity. The optical components of the instruments, which are essential for the measurements, contain Heraeus Suprasil® 3001. “We have greatly improved the absorption in our quartz glass, thereby making a significant contribution to improving the instrument's sensitivity. This makes the gravitational wave detector extremely sensitive,” says Ralf Takke, Vice President Optics at Heraeus Quarzglas. These antennas have now detected exceedingly rare evidence of gravitational waves.

Quartz glass optimized via special assignments

Dr. Ralf Takke has been working with this exceptional material for over 30 years. As head of R&D activities during the 80s and 90s, he and his staff created many new types of quartz glass and found new applications for it. “For projects such as the LIGO experiment, we often have to stretch the very limits of what is technically feasible,” states Takke. It's precisely this type of extraordinary project that brings added value – and not just for the company. “We constantly use these special assignments and technological challenges to build in-house know-how and expand our expertise in manufacturing precision, high-performance quartz glass,” explained the quartz glass expert. “Experiments help us improve our understanding of the material.”

Suprasil 3001® is optically isotropic, highly homogenous and suited primarily for manufacturing multidimensional optics such as prisms, extremely curved lenses, beam splitters, beam controlling systems and retro reflectors. For these reasons, this type of quartz glass is best suited for high-energy lasers that operate in the near infrared range. Everyday

applications include diode lasers in the field of medical technology, materials processing and spectroscopic optics.

Gold and platinum also at work in discoveries in space

Heraeus has also contributed to highly precise experiments in space. As part of the joint international LISA (Laser Interferometer Space Antenna) project, the European Space Agency (ESA) is searching for evidence of the gravitational waves that Einstein posited in his general theory of relativity. Also on board their satellites: perfectly identical cubes made of a special gold/platinum alloy from Heraeus, with edges 50 millimeters in length. These precious proof masses will allow researchers to measure minute changes in distance likewise caused by gravitational waves, despite their small magnitude. The preliminary experiments are now underway, and the two cubes should float free in space for the first time in mid-February.

Heraeus, the technology group headquartered in Hanau, Germany, is a leading international family-owned company formed in 1851. With expertise, a focus on innovations, operational excellence and an entrepreneurial leadership, we strive to continuously improve our business performance. We create high-quality solutions for our clients and strengthen their competitiveness in the long term by combining material expertise with technological know-how. Our ideas are focused on themes such as the environment, energy, health, mobility and industrial applications. Our portfolio ranges from components to coordinated material systems which are used in a wide variety of industries, including the steel, electronics, chemical, automotive and telecommunications industries. In the 2014 financial year, Heraeus generated product revenues of €3.4 bn and precious metal revenues of €12.2bn euros. With around 12,600 employees worldwide in more than 100 subsidiaries in 38 countries, Heraeus holds a leading position in its global markets.

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