APPLICATION NOTE

Max Planck Institute of Quantum Optics

Have you ever seen a 14-meter (46-foot) long optical table system?

by Edina Poelchen

Photo credit: Thorsten Naeser / MPQ

TMC CleanTop optical tops are available in individual sections up to 1.5m x 4.8m (5 x 16'). However, complex beam-path requirements often call for much larger sizes. TMC developed a unique process to achieve this by joining individual tops, but without compromising stiffness, damping, or flatness across joints.

Joiner plates connect the tops to each other, and are precision machined matched sets of 20 mm (0.75") thick, massive steel with dowel pins used to maintain alignment. The plates are welded to the table's top and bottom skins along the full length of the joiner plate.

Once joined, the tables behave like a monolithic structure.

Affirming the success of this approach, three important scientific research projects recently launched at the Max Planck Institute of Quantum Optics. They are supported by a total of 20 TMC optical tables joined in different configurations, one of which consists of 12 tables and reaches a length of 14 m (46 feet)!

A new Light Source for Attosecond Physics

Studies in attosecond (1x10-18 seconds) physics need highly specialized light sources. The ACCORD laser system that is now under development in the Laboratory for Attosecond Physics at the Max Planck Institute of Quantum Optics is such a dedicated source. The current version of the system emits 100,000 light pulses per second, each with an energy equivalent to 2 millijoule and packed into 40 femtoseconds.

In the next phase, the researchers at LAP plan to reduce the duration of each pulse to 5 fs. These laser pulses will then be utilized to generate pulse lengths in the attosecond regime, which are brief enough to capture the ultrafast dynamics of electrons on sub-atomic scales.

Photo credit: Thorsten Naeser / MPQ

The institute's research project is supported by TMC's joined optical table system consisting of 12 optical tables.

Photo credit: Thorsten Naeser / MPQ

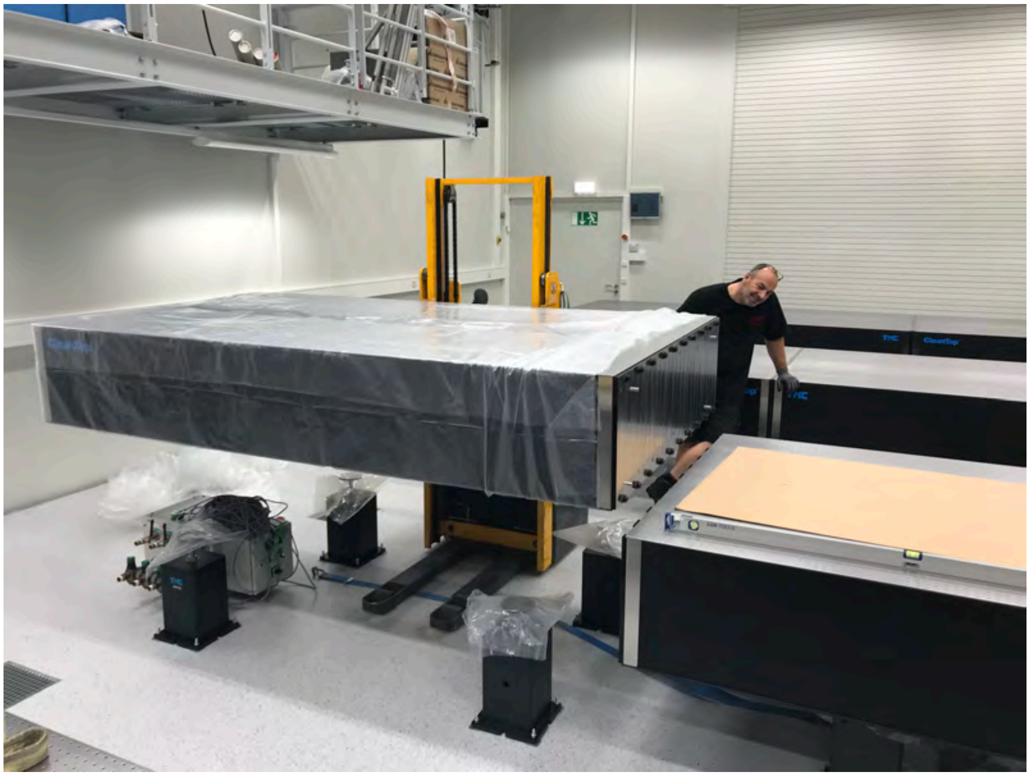

Photo credit: Norbert Henze – TMC/AMETEK

An exciting moment during the installation process, when the big tops of the joined table system are aligned to each other. On the side of the top you can see the welded joiner plates.

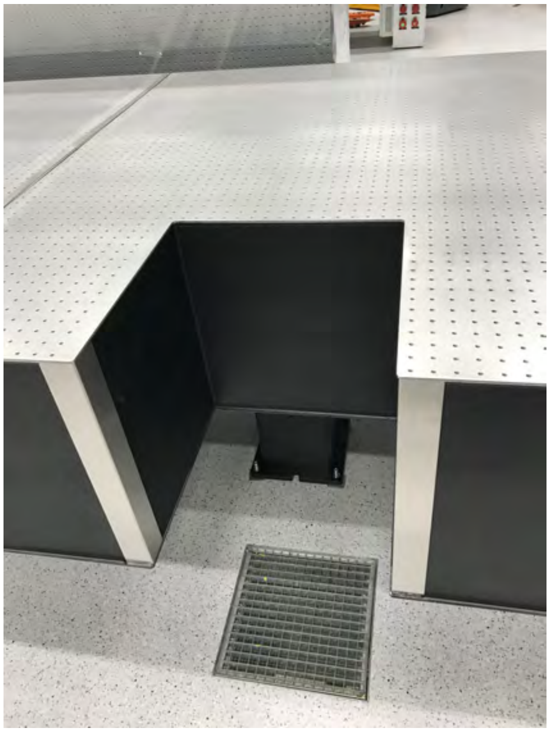

Photo credit: Norbert Henze - TMC/AMETEK

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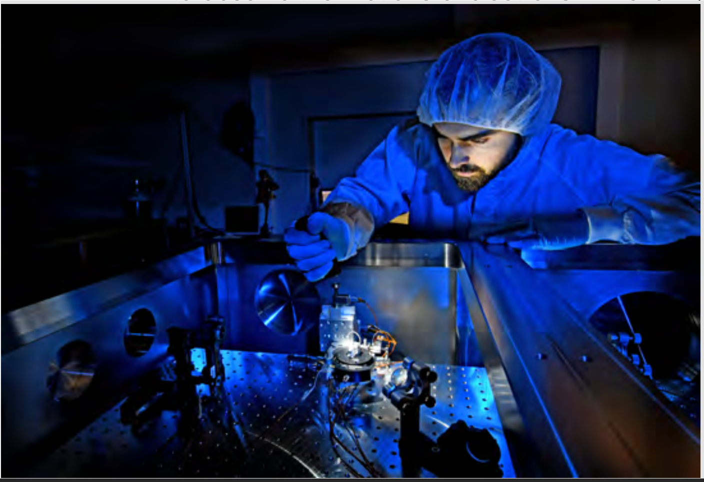
A new Home for Optical Solitons*

*Source: Max Planck Institute of Quantum Optics: A New Home for Optical Solitons, link.

The Laboratory for Attosecond Physics (LAP), which is run jointly by the Max Planck Institute of Quantum Optics (MPQ) and the Ludwig-Maximilian University of Munich (LMU) for the first time generated dissipative optical solitons in passive free-space resonators.

A soliton or solitary wave is a self-reinforcing solitary wave packet that maintains its shape while it propagates at a constant velocity (Wikipedia). It means, a soliton moves undisturbed on its solitary way, without changing its shape or velocity in the slightest. Solitons' self-stabilizing properties explain their immense significance to the field of laser optics, particularly the generation of ultrashort light sources.

This achievement enables researchers to characterize the dynamics of subatomic processes – and, in particular, to observe the motions of electrons – in even greater detail than was possible hitherto.



"This new technique opens a path towards further significant advances in the pulse power and stability attainable with such systems, while at the same time reducing the complexity of the experimental setup," says Dr. Ioachim Pupeza, leader of the group responsible for the new work in the LAP

Development of new enhancement cavities at the Laboratory for Attosecond Physics
Photo and text credit: Thorsten Naeser / MPQ

Attosecond Photoelectron Spectroscopy Accelerated*

*Source: Max Planck Institute of Quantum Optics: Attosecond Photoelectron Spectroscopy Accelerated, link.

It may sound counterintuitive, but capturing the ultrafast motions of subatomic particles, like tracking the dynamics of electrons, is actually very time-consuming and often takes weeks.

Although the advent of ultrafast photoelectron spectroscopy made it possible to observe the motions of electrons in atoms on attosecond scales, application of the technique has been limited by the need to collect large datasets.

MEGAS is a research collaboration between the Laboratory of Attosecond Physics (LAP) at the Max Planck Institute of Quantum Optics (MPQ), the Ludwig Maximilian University of Munich (LMU), and the Fraunhofer Institutes for Applied Optics and Precision Engineering and for Laser Technology have overcome this obstacle and has significantly reduced the duration of their experiments from several days to a matter of minutes. They have developed a new source of attosecond laser pulses in the extreme ultraviolet (XUV) region of the electromagnetic spectrum. The set-up allows them to generate trains of high-intensity attosecond pulses at a rate of 18.4 million per second.

"This advance is of considerable significance for research on condensed-matter systems. It also opens up new opportunities for the investigation of local electric fields in nanostructures, which are of great interest for applications in future information processing with lightwaves," – explains Dr. Ioachim Pupeza, project leader

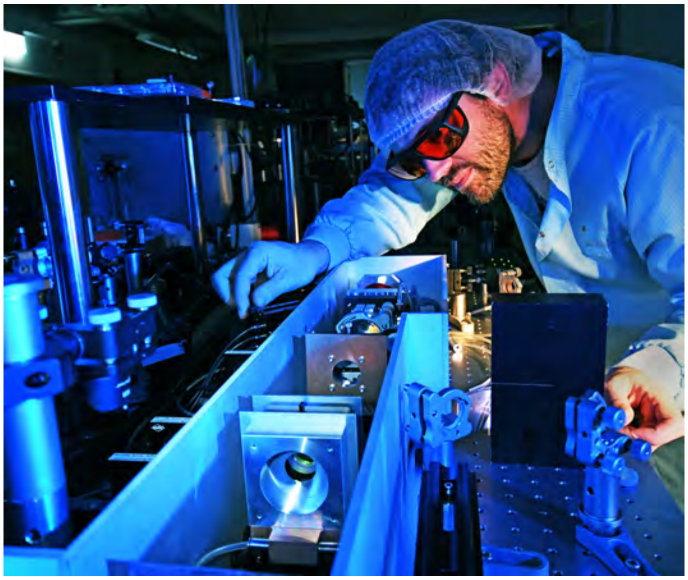


Photo and text credit: Thorsten Naeser / MPQ

The core element of their new technique is a novel enhancement resonator. Ultrashort, near-infrared laser pulses delivered to the cavity at a rate of 18.4 million per second are converted into extreme ultraviolet atto-second pulse trains, which are ideally suited for experiments in electron dynamics.

TMC appreciates the opportunity to contribute to these scientific achievements by providing high-end Optical Table workspaces.