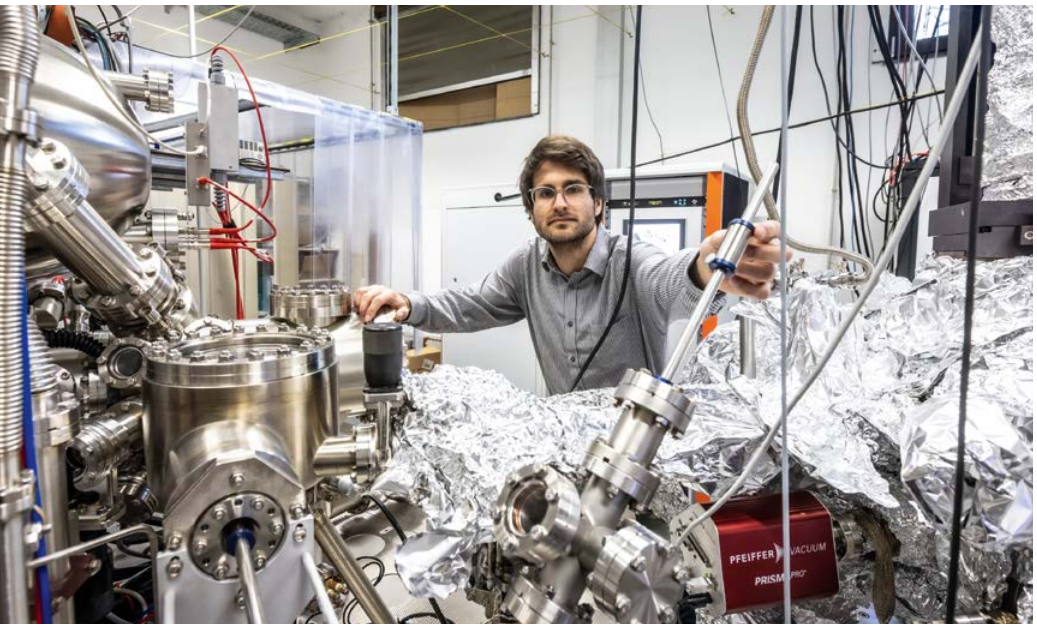

Marcus Ossiander conducts research on ultrashort processes.
Lunghammer – TU Graz

From the "Horribly Bad Band" to Ultrafast Physics

Marcus Ossiander investigates physical processes in the attosecond range – a trillionth of a second. Why is he interested in these short periods of time and what path led him to ultrafast or attosecond physics?

Birgit Baustädter

In his school days, Marcus Ossiander built guitar amplifiers with friends for their shared and, by his own admission, "horribly bad band". "Back then, we were more interested in building the amplifiers than in playing guitars," he says today with a laugh. "Two of them are now electrical engineers, one has ended up in mechanical engineering and I am a physicist. That says a lot."

ULTRAFAST PHYSICS

After all the amplifiers had been built and examined, Ossiander worked on ultrafast physics at the Max Planck Institute of Quantum Optics in his doctoral thesis. This branch of physics is concerned with generating ultrashort light pulses with which ultrashort processes can be observed and analysed. This includes, for example, the process of when a solar cell absorbs a photon. Through these new observational possibilities, ultrafast physics can contribute, for example, to making solar cells more efficient: "The first 10 to 20 femtoseconds (a femtosecond is a quadrillionth of a second) are crucial. If we can make solar cells even two per cent more efficient in the process, that adds up to a huge advance in the mass of solar cells we will need."

META-OPTICS

In his postdoc, he turned to meta-optics. In the process, the physicist develops new, very specialised lenses that allow certain examinations to be done. Like his current project, for example, for which he received an ERC Starting Grant from the European Research Council, which is now funding it. The team led by Ossiander is developing a new type of microscope that can observe processes in the attosecond range (one trillionth of a second). They achieve the high temporal resolution with an ultra-short time source that generates a very short light pulse in the extreme ultraviolet range. This special radiation requires its own lens with which a suitable microscope is built that can observe the processes. This microscope and the associated beamline, which is three to four metres long, are now to be built at TU Graz in the coming years.

LIGHT

Light has always interested the 34-year-old. "Light, on the one hand, is very central to our lives. We get a lot of energy from the sun and communicate worldwide via optical fibres," he says. "And on the other hand, it is aesthetically beautiful. When you create a short pulse with an ultra-wideband laser and the light along a hollow fibre goes from completely invisible to glowing slightly red to brilliant white, it's beautiful. And when something is skew, it makes wonderful geometric shapes. It's very interesting." And perhaps most relevant for the physicist: "We are still learning how to actually deal with something as mundane as light. There are so many ways to shape light. We are still regularly discovering surprising possibilities and applications and can always learn something new. And that's great as a researcher, of course." ■

Meta-optics shows physical processes in the attosecond range