PHOTO: ADOBESTOCK

An exclusive location: the Big Bear Solar Observatory is surrounded by water. This reduces disturbing turbulence due to rising warm air and creates the best conditions for solar observation.

Max Planck researchers collaborate with partners in more than 120 countries. Here, they write about their personal experiences and impressions. Hans-Peter Doerr from the Max Planck Institute for Solar System Research spent three weeks working at the Big Bear Solar Observatory in California. He explains why the solar telescope stands on the water and tells us about anglers, gun enthusiasts, and alternative ways of transporting data.

Like many astronomers, I was fascinated by the universe even as a child. I grew up in the countryside, where you can still look up at a dark night sky, so the view of the stars captivated me from an early age. Our Sun is the only star close enough that we can see details on its surface from Earth. The Goode Solar Telescope at the Big Bear Solar Observatory, which is operated by the New Jersey Institute of Technology, was for a long time the largest ground-based solar telescope in the world, before it was recently superseded by the Daniel K. Inouye Solar Telescope in Hawaii.

With a mirror diameter of 1.6 meters, the California-based telescope is powerful enough to resolve structures on the sun that are 50 to 60 kilometers in size. The observatory is located in the San Bernardino Mountains at an altitude of 2000 meters, in a spot at the end of a causeway that juts some 200 meters out into Big Bear Lake. The location seems unusual, but it is ideal for solar observation because the water heats up less than the land surface, meaning poor "seeing" – disturbing turbulence due to rising warm air – is significantly reduced. Close to the observatory there is a guesthouse with self-catering facilities, which serves as accommodation for the scientists who are working there. For shopping, we travel to Big Bear City, which is less than 15 minutes away by car. We also go out to eat there from time to time. Incidentally, the name "Big Bear" comes from the many grizzly bears that used to live in the area.

The lake is a popular recreational destination for people living in the greater LA area, and this scenic part of the world was a real magnet for visitors during the Covid-19 pandemic when international travel wasn't possible. At one point, a fence even had to be erected because a few trigger-happy Americans had the idea of using the observatory door for target practice for their air rifles! The clean water and abundant fish attract mainly an-

POST FROM

BIG BEAR LAKE, USA

glers to the lake, but you can also hike through pine forests, swim, go boating, or enjoy the romance of a campfire at the campground. In winter, the area is popular with skiers.

During our multi-week campaigns, however, these kinds of leisure activities are not much use to us. Under the direction of Michiel van Noort, we are developing instrumentation for ground-based solar observation, and we are kept busy with setting up and commissioning new instruments because there is always something that needs to be tested and improved.

For the Goode Solar Telescope, we have developed a polarimeter and a camera system. The special thing about our instruments is that they are optimized for the application of computer-aided image reconstruction methods, which allow the theoretical resolving power of the telescope to be almost fully exploited. For optimal results, we need hundreds to thousands of individual exposures in quick succession.

This results in huge amounts of data and an enormous demand for computing power for the purposes of reconstruction. Our camera system delivers about ten terabytes of raw data per hour at a rate of 360 exposures per second. With several hours of data recording per day, this is far too much to transfer over the existing Internet connection, so we resorted to a method aptly referred to as "Sneakernet" by my American colleagues: we carried stacks of hard drives with the observation data across the site on foot and brought them back to Germany in our hand luggage. Lucky for us, the clearly overweight bags were not weighed at the airport, and no one at the security checkpoint was interested in looking at our luggage.

PHOTO: PRIVATE

Hans-Peter Doerr

43, has always been a technology enthusiast and loves to tinker with new instruments for solar observation. After completing a physics degree at Albert Ludwig University in Freiburg, he went on to obtain his doctorate there. Since 2015, he has been working as a postdoc at the Max Planck Institute for Solar System Research in Göttingen in Sami Solanki's department, focusing on observing the atmosphere of our parent star.