



Eyes into space: the two MAGIC telescopes on the Roque de los Muchachos register particle showers in the Earth's atmosphere and use them to make indirect observations of gamma light from the depths of the universe.

78 Max Planck researchers cooperate with partners in more than 120 countries. Here they write about their personal experiences and impressions. Lea Heckmann from the Max Planck Institute for Physics is spending two months working on the MAGIC telescopes on La Palma in the Canary Islands. She talks about unforgettable sunsets and explains what La Palma has in common with Ireland.

Welcome to the city of telescopes! This is what went through my mind when I first saw all the observatories on the Roque de los Muchachos. Up here, at more than 2,200 meters above sea level, I will be spending the next eight weeks working on the two MAGIC telescopes. MAGIC is an acronym and stands for “Major Atmospheric Gamma Imaging Cherenkov”. As their complicated name suggests, these are no ordinary optical instru-

ments, but rather so-called “Cherenkov telescopes”.

The MAGIC telescopes detect Cherenkov light, a kind of blue flash lasting only a few billionths of a second when high-energy gamma rays interact with the Earth's atmosphere. Two mirrors, each with a diameter of 17 meters, enable the telescopes to collect this light and record it on camera. The data allow conclusions to be drawn regarding the initial gamma rays.

My research focuses on so-called “blazars”. A blazar is an active galaxy with a supermassive black hole at its center that consumes surrounding matter. Blazars are some of the most energetic objects in the universe, because particles evading the devouring black hole are accelerated towards the Earth in an extremely high-energy stream known as a relativistic jet, which in turn triggers the emission of gamma radiation. You could essentially compare blazars

with particle accelerators like CERN in Geneva, but with inconceivably larger dimensions and energies.

I am specifically observing the two blazars closest to the Earth – although ‘closeness’ is naturally a very relative term in the vastness of space. The radiation we capture with our telescopes today was actually emitted at the time the first complex life forms were evolving in the Earth's lakes and oceans – in other words, several hundred million years ago!

Since we are studying the night sky, our work usually begins late in the afternoon and finishes in the early hours of the morning. First we have to configure the electronics, calibrate the telescopes, and get everything ready for the measurements. The observations begin after sunset; that means we sit in the control room, watch several monitors to ensure that all the systems are working properly, and direct the telescope towards various light sources.

## LA PALMA

This might sound rather monotonous, but in reality it hardly ever gets boring since you constantly have to deal with the problems arising. However, the most exciting things happen at the beginning and end of each shift, when we go out and either secure the telescopes or release them so that these 60-ton giants can be moved. They can make one full rotation around their axis in less than a minute – a really impressive sight.

More than 20 institutions are involved in MAGIC, and we usually are around five people on site at the same time. There are currently researchers from Spain, Italy, Japan and the U.S. keeping me company. That means you could also see the whole thing as a kind of social experiment: what happens when you lock up five physicists on a mountain? Although it goes without saying that we aren't really locked up! We always have three days at work followed by one day off. I often use my free time to go down to the city, relax on the beach, or explore the island.

La Palma only measures around 700 square kilometers, less than double the area of Vienna, the city where I studied. Nonetheless, its geographical diversity is fascinating. Like all of the Canary Islands, La Palma is volcanic in origin, as you can clearly see from the black sandy beach, the dark volcanic rock, and the crater-pocked landscape in the south. The north, on the other hand, is dominated by dense jungle, remote villages and steep rocky cliffs that remind me of Ireland.

The sunsets above the clouds are unforgettable, and I can enjoy them almost every day. However, the most wonderful moments definitely happen at night, when I step out of the control room into the fresh air and gaze up at the sky. I look at the stars, let my thoughts wander, and am constantly reminded of how small we are here on Earth. That's one reason why I find the name MAGIC so appropriate for these telescopes. Or does anyone seriously want to dispute the magic of the universe?



PHOTO: PRIVATE

Lea Heckmann

27, studied Technical Physics at the Vienna University of Technology (TU Wien) and the KTH Royal Institute of Technology in Stockholm. Since January 2019, she has been working towards her doctoral degree in astroparticle physics at the Max Planck Institute for Physics in Munich. The scientist's research focuses on blazars, active galaxies with supermassive black holes lurking at their centers that are among the most energetic objects in the cosmos. Lea Heckmann has also been acting as the spokesperson for the Max Planck PhDnet since the beginning of 2021.