

The Isaac Newton Telescope gazes into the northern night sky. The clouds, trapped below, roll by harmlessly

THE FORGOTTEN SKIES

Kevin Lochun travels to La Palma to find out how amateurs can enjoy its exceptional observing conditions for themselves

It is little wonder that, in 1979, astronomers at the Royal Observatory in East Sussex decided to close the dome of the Isaac Newton Telescope for the last time and pack it off to the Canary Island of La Palma. This tiny volcanic crag, a geological infant at just a few million years old, is one of the finest observing locations on Earth. The skies are dark, the nights almost cloudless and the seeing rivals that of the Atacama Desert in Chile or Mauna Kea in Hawaii. Yet the island is just a few hundred kilometres from the coast of Morocco – a relative stone's throw from the UK.

La Palma's fortunes have traditionally been built on boom and bust industries. In centuries past these included sugar, rum and silk; today, it's bananas. Plantations pepper its lower reaches, as common as grass in a meadow. But in 2012 the island was named a Starlight Tourism Destination, a nod to the quality of the night skies and a growing focus on astro tourism.

Part of the reason that the skies are so dark is the 1988 Law of the Sky, a piece of legislation that

GETTING THERE

The island has one airport, Santa Cruz la Palma (SPC). The only direct flights from the UK are operated by Thomson weekly on Fridays. If you want to travel on any other days you'll need to change on the Spanish mainland or one of the other Canary Islands.

stargazers who regularly find themselves under the orange haze of light pollution can only dream of. It imposes limits on flight paths (you'll see no contrails here), atmospheric pollution and even the types of streetlights that can be installed. If you were able to hover above the Canaries at night, La Palma would appear as little more than a shadow on the waves, save for the capital Santa Cruz de La Palma and the larger Los Llanos de Aridane on the opposite coast. Between the pair, hidden in the darkness, are the 15 professional telescopes of the Roque de Los Muchachos Observatory (ORM).

"The island sits at 28°N, an ideal location for an observatory," says Ovidiu Vaduvescu, an astronomer based at the William Herschel Telescope, the island's most scientifically prolific instrument. "We're near enough to the equator to have good views of the southern hemisphere, but far enough that we avoid the humidity and haziness typical of lower latitudes."

Vaduvescu is one of a growing number of ORM astronomers who have set up tourism businesses as



ON THE CD

Watch a timelapse filmed from the ORM

side projects to their day job; I meet him in a hotel in Los Cancajos, a coastal resort town a couple of kilometres from the airport where his agency is organising a meteor conference.

"We also have very little atmospheric pollution in La Palma," he says. "There is no heavy industry here."

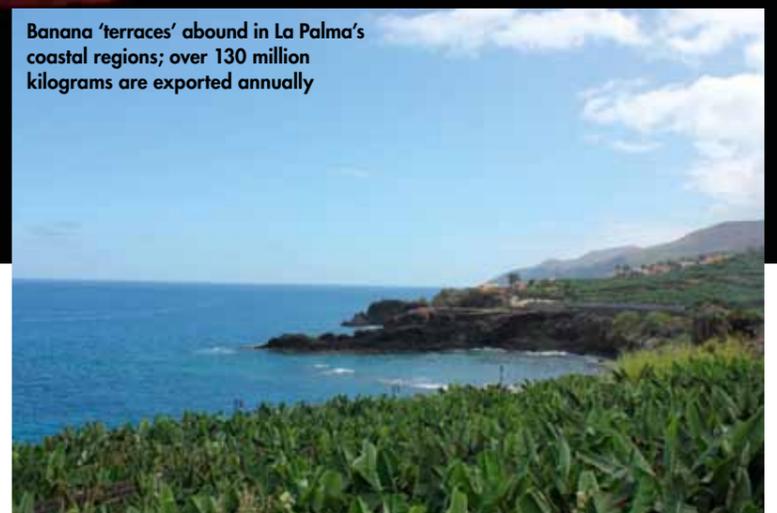
Even from sea level, city dwellers will notice that there are far more stars in the night sky. But to see the best La Palma has to offer, you need to go up.

Sentinels in the sky

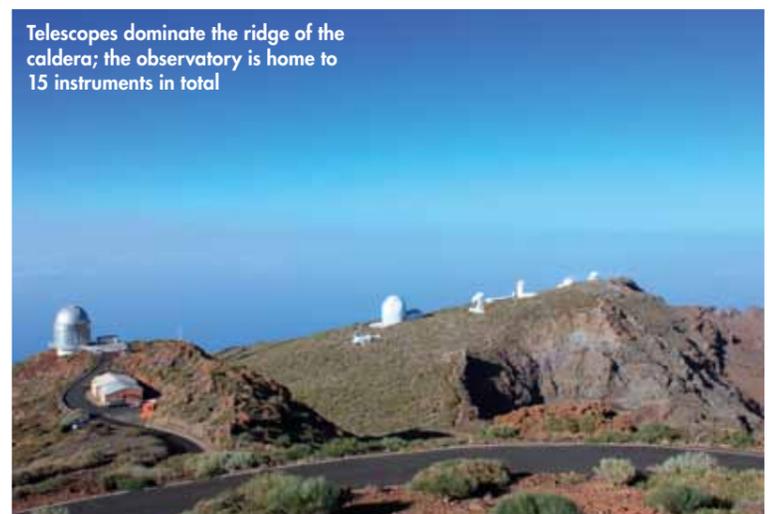
The locals say that La Palma is the steepest inhabited island in the world. It is less than 20km from the east coast to the west, but over this distance the island rises to 2,426m – equivalent to Snowdon on top of Ben Nevis. The peak is part of the Caldera de Taburiente, a 10km-wide crater that stretches across the north of the island. Just 30m below, on the crater's northern wall, is the ORM.

The site testers of the 1970s had to trek up to the observatory with mules; today it is a 45-minute drive up a specially built road with hairpin turns every few metres. You round each corner only to find another ahead of you, so when you finally reach the observatory it comes as something of a surprise – its brilliant shells of white and ▶

Banana 'terraces' abound in La Palma's coastal regions; over 130 million kilograms are exported annually



Telescopes dominate the ridge of the caldera; the observatory is home to 15 instruments in total



► silver pop into existence like the first few stars in a freshly dark sky.

It was from this dusty scarp that astronomers found the first brown dwarf and discovered that comets could have sodium tails. King of the hill is the 10.4m Gran Telescopio Canarias (GTC), the largest optical instrument in the world, at least until the European Extremely Large Telescope in Chile is finished. Fourteen more domes and dishes – gamma ray, solar and robotic scopes among them – fan out along the ridge, a line of gleaming sentinels peering into the cosmos.

Equally striking is the sea of clouds that often sits below the observatory. It is held in place by an invisible net, a temperature inversion layer that persists at 1,300m-1,600m for much of the year. Over most landmasses air near to the ground is warmer than the air above it; convection causes the warm and cool air to mingle, spreading dust and pollutants freely. When a temperature inversion occurs, the layer of air near the ground becomes cooler than the one above it, creating a barrier. Pollutants, dust and even clouds in the cool, lower layer cannot pass through into the warm one.

Consequently, the skies above the inversion are frequently clear and stable. Conditions are improved further on La Palma because the air flowing over the island arrives after travelling over several hundred kilometres of ocean, and as such holds very little turbulence. “The seeing is typically 0.6-0.7 arcseconds,” says Vaduvescu. “On the best nights it is as good as 0.2 arcseconds.” In other words, the atmosphere is so still that the image of a star is spread by only a miniscule amount.

You can tour parts of the observatory if you book in advance (see page 84), but you can't pop up here at night for a stargazing session: visitors haven't been allowed onto the site after dark for some years, ever



▼ La Palma is the westernmost of the Canaries; in antiquity it was the edge of the known world

The Moon, complete with earthshine, was the first arrival on our observing night on the Pico de la Cruz

since a bus driver ferrying tourists managed to aim his headlights into the open dome of the William Herschel Telescope. However, there is a public viewpoint, the Pico de la Cruz, a few kilometres away. It's at an altitude of 2,300m, so the sky there is just as good as it is above the Roque itself.

Delightfully dark

A crescent Moon hangs above the Pico de la Cruz, where I've joined Vaduvescu and two other ORM astronomers on an observing evening for delegates from the meteor conference. Dusk is setting in, and our nearest neighbour is watching on as the Sun sinks towards the horizon. Our star pauses for a brief moment to silhouette the domes of the ORM; then it's gone. Saturn appears first in close conjunction with the Moon, followed by Arcturus and Vega, then the Plough and Teapot asterisms. Soon the sky is iridescent, the rich seam of the Milky Way arching overhead.

“There are so many stars I could get lost,” says GTC astronomer Agustín Núñez, one of our guides

THE OBSERVATORY

Inaugurated in 1985 with the reopening of the Isaac Newton Telescope, the ORM takes its name from the mound that marks La Palma's highest point – the Roque de los Muchachos, the ‘rock of the boys’. The observatory is a bit bigger these days, with 15 instruments making up the ranks. These are five of the most famous.



GRAN TELESCOPIO CANARIAS (GTC)

The silver dome of the GTC is the ‘mascof’ of the ORM. With a 10.4m primary mirror, it is also the largest optical scope in the world. The mirror is made of 36 hexagonal plates, each of which is 8cm thick but weighs 500kg. The scope also makes observations in infrared light.

WILLIAM HERSCHEL TELESCOPE (WHT)

The 4.2m WHT is the most productive scope on the island – its data has appeared in over 1,200 papers, and its observations have helped to confirm that the expansion of the Universe is accelerating. It was the largest optical telescope in Europe until 2009, when it was surpassed by the GTC.



ISAAC NEWTON TELESCOPE (INT)

The INT was built in Britain for the Royal Observatory in 1967, but was moved to La Palma in 1979 to take advantage of the much clearer skies. Its 2.5m main mirror is small by modern standards, so today the telescope is mostly used for wide-field imaging.



MAGIC-I AND MAGIC-II

The two open-air, 17m MAGIC scopes scour the cosmos for signs of gamma rays, in the form of Cherenkov radiation. MAGIC-I, pictured, began work in 2003; MAGIC-II followed in 2009. Their biggest discovery so far is that the pulsar in the Crab Nebula is 100 times more energetic than was thought possible.



▲ Viewed from space, Gran Canaria and Tenerife shine brightly in the dark; La Palma, top, is a stark contrast

for the evening and a self-confessed fan of power outages. “Have you ever had a power cut in your city?” he asks. “I want to tell everyone to get out into the street and start celebrating the night sky!”

I can see why. Of space, Douglas Adams famously wrote in the *Hitchhiker's Guide to the Galaxy*, “You just won't believe how vastly, hugely, mindbogglingly big it is.” He was right, of course. But when you are faced with skies like these – so good that when the Milky Way is out of the way, you gain one or two extra magnitudes of visibility – it reminds you how much there is to see nonetheless.

Núñez, who also acts as a guide for an astro tourism business, is holding court over a 12-inch Dobsonian, through which we take a better look at some of the deep-sky objects that stick close to the horizon in Britain, including the Butterfly Cluster in Scorpius and the Swan Nebula in Sagittarius. One of the most southerly objects you can see is Canopus, the second brightest star in the night sky. The people who lived on La Palma prior to the Spanish conquest called this star the ‘life giver’ because it only appears from August to April, the months it is most likely to rain.

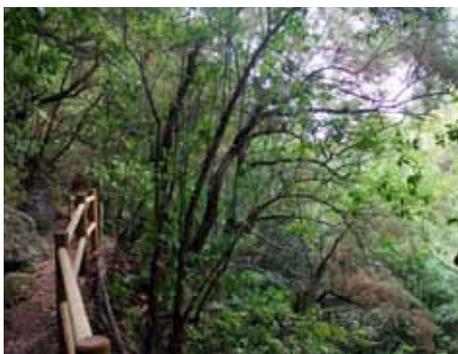
You don't need to be an expert to get the most out of an observing evening like this – the meteor delegates have varying levels of observing experience, but Núñez shortly has them (and me) spotting the Andromeda Galaxy with the naked eye. A few more galaxies, globulars and hours later, it is time to wrap things up. The cosmos acknowledges its audience by firing a meteor along the eastern horizon, a silent farewell salute. On some occasions, it also offers up the zodiacal light, gegenschein and airglow. “It's a ►

WHILE YOU ARE THERE

See how the people who inhabited La Palma before the Spanish conquest lived – and the myriad rock carvings they left behind – at the sprawling **Caves of Belmaco** in Mazo. There is also a museum. <http://bit.ly/belmaco>



The best way to explore La Palma's banana plantations, laurel forests and volcanic origins for yourself is on foot. The island has 1,000km of **signposted walking paths**, many of which criss-cross the caldera. <http://bit.ly/lptreks>



The island's capital, the port of **Santa Cruz de La Palma**, is famous for its dwarf statues and traditional balconies, right. See them near the seafront before diving into the old town's cobbled streets, plazas and museums. <http://bit.ly/LPcapital>



Tenerife is a mere 30-minute flight from La Palma, so you could also pop over to the **Teide Observatory**, home to some of the finest solar scopes in Europe. Like the ORM, visits need to be organised well in advance. <http://bit.ly/IACteide>



► shame we can't stay out to catch Jupiter," Núñez says, forlornly. "The views are steady as a picture."

See it for yourself

The pristine skies that lured pro astronomers here are easily accessible in spite of the fact that the ORM itself is out of bounds at night. There are several local astro tourism businesses on the island, and most cater for both individuals and entire astronomical societies.

Núñez's AstroLaPalma (www.astrolapalma.com) runs regular observing evenings, and themed sessions focused on the Moon and events such as the Perseid meteor shower, priced from €8-€35 per person. AstroTour (www.astrotour.es) offer evening stargazing sessions for €25 per person, as well as an astrophotography workshop (contact for prices).

Vaduvescu's Astro Travels (www.astro-travels.com) offers a seven-day tour of the island that includes trips to beaches and volcanoes as well as the ORM and the privately built Tacande Observatory in El Paso, a village about 25km from the airport. Again, it's best to contact them for prices. You can also book guided solar and evening observing sessions at Tacande directly (www.astropalma.com), for €20 per person.

It is just as easy to go it alone. Over the past few years the island government has set up a network of astronomical viewpoints, known locally as miradores, which are free for amateur astronomers to use. You need to bring your own kit: what the miradores offer are dark skies, parking and somewhere flat to set up

La Palma is still volcanically active; the latest eruption came from this cinder cone, Teneguía, in 1971



a scope, and believe us the latter is at a premium. There are 16 miradores at present – a few are shown on page 82, but a full map is available at <http://bit.ly/miradores>. Most have a sign that points to Polaris, with a basic planisphere below it to help you hop from the pole star to the Plough and Cassiopeia.

If you don't want to bring your own scope, you could hire one from a local agency – AstroLaPalma and AstroTour rent out kit by the night. Though with skies as good as Atacama and Mauna Kea, you have to wonder – will one night ever be enough? **S**

VISITING THE ORM

You can't just rock up to the Roque. Visits to the observatory are available throughout the year, but only by appointment and only in daylight hours. They typically last for between 45 and 90 minutes and include tours inside one or two telescopes. <http://bit.ly/IAC ORM>



ABOUT THE WRITER

Kev Lochun is *Sky at Night Magazine's* production editor. Before realising he could make money from being able to spell, he completed a BSc in biology at Cardiff University.