

FOR HEAVEN'S SAKE

That there's an observatory on Mount Graham isn't unusual. That it's run by the Vatican is hard to figure. But, there it is. And its mission, according to the newly canonized Pope John XXIII, is twofold: to explain the church to the scientists, and to explain science to the church.

BY MATT JAFFE

PHOTOGRAPHS BY BILL HATCHER

Father Paul Gabor, S.J., the vice director of the Vatican Observatory Research Group, looks to the heavens outside the Vatican Advanced Technology Telescope (VATT) building. Gabor calls the observatory atop Mount Graham "a very standard scientific institution."

Shortly after dawn, the sky swirled with the pink remnants of Hurricane Odile as Father Paul Gabor, S.J., and I headed east from Tucson along Interstate 10. Our journey, first to Safford and then up to the Mount Graham International Observatory, was a modest drive but also a road trip into the universe.

An astrophysicist and Jesuit priest, Gabor serves as vice director for the Vatican Observatory Research Group, which operates the Vatican Advanced Technology Telescope (VATT) on Mount Graham. This immediately brings up two questions: Why does the Vatican have an observatory? And what is that observatory doing in Arizona?

Gabor, I quickly discovered, is a fine traveling companion, his reserve balanced by a dry, mischievous wit. That said, I admit to being overmatched: Raised in the former Czechoslovakia, Gabor holds multiple advanced degrees, from astrophysics to divinity. He speaks eight languages, six fluently. As for me, I'm neither especially religious nor adept at the physical sciences, having pulled a C in college astronomy — a fact I confessed to Gabor early on.

If the idea of a Vatican observatory suggests *The Da Vinci Code*-style intrigue, with researchers probing the origins of the Star of Bethlehem, Gabor quickly dispelled such notions. "We are really a very standard scientific institution," he said.

The observatory traces its roots to Pope



Gregory XIII's 16th century effort to study the annual cycle and reform the Julian calendar. Simply put, the Julian calendar was slightly inaccurate and didn't accurately reflect the precise time the Earth takes to orbit the sun. Over the centuries, those errors add up. There's now a 13-day discrepancy between the Julian and Gregorian calendars.

Gabor said it's a misconception that today's observatory has "some sort of particular project set out for us by the pope or someone at the Vatican."

He added: "I really love the quote from the newly canonized John XXIII, who supposedly said: 'The observatory has a two-fold mission. One, to explain the church to the scientists. Two, to explain science to the church. So it appears we are doing much better at the former.' There's some truth to that. Within the church itself, many Catholics have no idea that there is a Vatican observatory. And that includes the bishops."

Lts 10,695-foot summit cloaked in clouds, Mount Graham, a sacred Apache peak, loomed to the north as we turned toward Safford. For permitting reasons only slightly more fathomable to me than the operations of Switzerland's Large Hadron Collider (on which Gabor once worked), we were unable to drive up to the observatory together. So Gabor dropped me off at Eastern Arizona College's Discovery Park Campus, which conducts public observatory tours, and I joined a group of the school's engineering students. Waiting for the van, they resembled a casting call for a prequel to *The Big Bang Theory*.

The roughly 30-mile, nearly 8,000-foot climb from Safford to Mount Graham's three observatories is an endless series of stomach-churning switchbacks. I heeded Gabor's advice to take Dramamine, then wrangled a spot in the van's first row. There was plenty of chatter at first, before the hairpin turns exacted their most cruel toll and the passengers fell silent.

We reached the observatories in about 90 minutes, then received strict instructions not to cross yellow ropes marking the boundaries of the Mount Graham Red Squirrel Refugium, a protected area for this federally endangered species. Up the road among the spruce and firs, the Large Binocular Telescope loomed. Operated by an international consortium that includes the University of Arizona and Arizona State University, it is very large indeed — one of the world's most powerful telescopes.

Gabor waited at the VATT, the smallest of Mount Graham's three facilities. Boxy, not baroque, and with gray steel walls, the VATT building hardly looks the role of a Vatican observatory, except for the telescope's silver retractable dome. It certainly doesn't resemble the lair of mad monks scanning the darkness for the coming of an alien Antichrist from outer space, among the many existing conspiracy theories. ("I can assure you that's not true," Gabor said.)

Even so, the VATT creates endless speculation. Although the observatory had no role in the project, when Germany's Max Planck Institute for Extraterrestrial Physics installed an infrared camera and spectroscope at the Large Binocular Telescope, the move inspired all sorts of breathless headlines about the Vatican's nefarious intentions. Mainly because of the

device's allegedly demonic acronym: LUCIFER. Now shortened to LUCI, the new name, by contrast, hasn't engendered conjecture about a secret papal search for Lucille Ball.

More oil well than H.G. Wells in aesthetics, with bundles of cables, ladders and iron girders, the Vatican telescope's industrial look belies its awe-inspiring capacity to observe stars and galaxies 12 million light-years or farther from Earth.

Gabor told our group that the telescope had marked its 21st birthday two days earlier. "It's of age; it could have a drink," he said. "Or, rather, just a change of oil."

He explained the VATT's history and how it came to Mount Graham: For centuries following the calendar reform, the church operated several observatories before Pope Leo XIII formally refounded the Specola Vaticana (Latin for "Vatican Observatory") near St. Peter's Basilica in 1891.

He declared, "The church and her pastors are not opposed to true and solid science, whether human or divine, but they embrace it, encourage it and promote it with the fullest possible dedication."

Light pollution forced the observatory to relocate, and in the 1930s, it moved to Castel Gandolfo, the papal summer residence, which sits above a lake within a volcanic crater 25 miles outside Rome. That site, too, was eventually compromised, so the Vatican sought a new telescope location, with Sardinia as one possibility.

The esteemed astronomer and priest George Coyne, S.J., provided the Arizona connection. At the time, Coyne was the Vatican Observatory's director and also served as acting director at the University of Arizona's Steward Observatory. "They put two and two together, and the observatory came to Arizona," Gabor said.

That was the simplest equation I would hear all day.

The Vatican telescope's eye is its primary 1.83-meter mirror. There are far bigger mirrors, including the two 8.4-meter giants in the Large Binocular Telescope. But the VATT mirror holds a unique place in the history of astronomy.

As the Vatican looked for a telescope site, Dr. Roger Angel, director of the Steward Observatory's Mirror Laboratory, revolutionized the fabrication of mirrors. He pioneered a technique known as spin-casting, and the VATT mirror was the first of this kind to be deployed.

"It was a tremendously thrilling time," said Father Christopher Corbally, S.J., Gabor's predecessor as vice director, who has worked at the observatory since 1983. "There was such an element of excitement at developing a new technology that is now the current generation of telescopes."

Guided by Corbally, I toured the lab, located in an unlikely spot beneath the east stands and end zone at Arizona Stadium in Tucson. It's an enormous, hangar-like space. We watched as a worker polished an 8.4-meter mirror, which, along with six others of equal size, will comprise what amounts to a single piece of 80-foot-diameter glass for the Giant Magellan Telescope in the Chilean Andes.

Larger, yet lighter, than earlier designs, Angel's mirrors feature a honeycomb structure. Air can also be circulated within

the mirror, thus bringing glass and outside temperatures quickly into equilibrium to reduce distortion.

Pieces of high-grade glass (the 8.4-meter mirrors require 20 tons) are placed atop an array of hexagonal columns half an inch apart, then spun within a rotating oven and melted at 2,156 degrees Fahrenheit. The molten glass fills spaces between the columns and flows over the top to form a continuous, curving glass surface, with the honeycomb structure below. The mirror cools for three months before grinding and polishing can begin, a process that originally took seven years and even now requires two and a half years. It's accurate to a millionth of an inch.

Hard to imagine it all started with some Pyrex custard cups. But Angel first tested the concept by fusing a pair of cups in a kiln. And before the mirror lab's 1985 move to the stadium, Angel worked in a onetime synagogue building on campus.

Or, as Corbally put it, "an Angel created a mirror for the Vatican in a temple."

After the drive down the mountain, during which red-squirrel stew and football seemed to be equally popular topics, I met Gabor in Safford. He was scheduled to speak at the Discovery Park Campus, so we stopped for dinner at El Charro Restaurant. As the steam from the fajitas cleared, Gabor gamely tried to explain notions of refraction to me, tracing diagrams on the table amid the chips and salsa.

The theme of Gabor's speech was "Martyrs of Science," and he addressed allegations of the church's historic persecution of scientists: "The story of supposed conflict between science and religion is not what it has appeared to be." It was a far-reaching presentation, perhaps too far-reaching for kids in the audience, who, safe to say, heard about cosmic pluralism and 15th century German theologian and astronomer Nicholas of Cusa, if not Galileo, for the first time.

Eager to hit the road (I had agreed to drive back), I could tell Gabor was running long — by the Julian and Gregorian calendars alike. Then, with 50 slides remaining, Gabor quickly wrapped up and gamely donned a knitted cap given to him as a gift. Soon we were outside, gazing up at stars through broken clouds. "They'll be able to observe tonight," he said.

We spoke about many things as I drove. He described the intellectual climate while growing up in communist Czechoslovakia, where he wanted to join the priesthood only to realize that the only two legal seminaries were controlled by the secret police. He longed to "pursue a life of intellectual inquiry without ideological biases," and he found a refuge of sorts by studying particle physics. But years later, Gabor said he knew he needed to enter the priesthood.

"As soon as I entered the building of the novitiate, all of the nagging ceased," he said. "It allowed me to feel this is really the place where I should have been all along."

Reconciling his religious and his scientific sides proved less challenging than one might expect, Gabor said.

University of Arizona astronomy graduate student Ben Rackham stands beneath the Vatican Advanced Technology Telescope. The instrument's 1.83-meter mirror is supported by a 20-ton platform.

"How shall I put this? I think that most astronomers actually have a very similar need to share the amazement and, generally speaking, the joy of understanding the universe," he said. "We're fortunate to have the privilege of being witnesses. In spite of the fact that many astronomers wouldn't label it in religious terms, I'm perfectly convinced that this is a profoundly religious attitude."

In Tucson, we passed the football stadium where, somewhere above the mirror lab, the Arizona Wildcats were mounting their miracle fourth-quarter comeback against California. I handed Gabor the keys, and we said our goodbyes, both too tired to linger. He drove off, and I briefly searched for stars, bright even through city lights.

I imagined how different Corbally's and Gabor's perspectives might be upon looking at the same view. But, as Corbally had said, "So often in our work, there are such incredibly large numbers, powers of 10, and amazing figures of time and distance. But every now and then, there's also a chance to think, 'Gosh, this is all really wonderful, isn't it?'" **AH**

To learn more about the Vatican Observatory, visit www.vaticanobservatory.org.

