

RELIGIOUS OBSERVANCE

THE VATICAN OBSERVATORY

A lot has changed at the Vatican in the 400 years since Galileo was declared a heretic – for astronomy and for the Church. **Eagle Gamma** investigates



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In the mountains of southern Arizona lurks the VATT, a telescope owned and operated by the Vatican





Arizona's Pinaleno Mountains are home to two large telescopes

The Pinaleno Mountains, in the deserts of southeast Arizona, are a far cry from the Vatican in Rome. It's the Wild West, the frontier. And it is here that the Vatican has built its newest astronomical instrument.

The Catholic Church has had a long and complex relationship with astronomy. Some four centuries after Galileo came into conflict with the Church for his heliocentric view of the Universe, the Vatican's own astronomer-priests now study galaxies and cosmology.

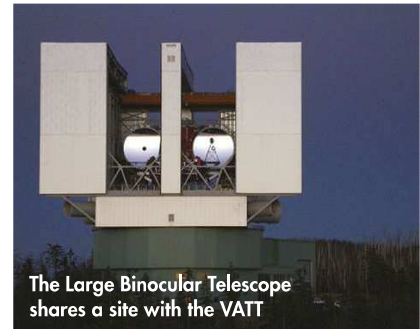
In Tucson, Arizona – one of the astronomical world's major hubs – the Church has set up a research group. But it is here in the nearby Pinaleno Mountains that it has built the Vatican Advanced Technology Telescope (VATT)

to scan the skies. The telescope is currently housed in the Pinalo Mount Graham International Observatory, over 3,000m above sea level. But what does the Vatican use its newest, fastest instrument to investigate?

The Vatican research group covers subjects from meteorites to stars and metagalactic structures. Working in concert with the Very Large Array, they have examined rare micropulsars. These brown dwarfs emit powerful radiation in bursts that reach Earth, and the array measures how they change over time. The Church also conducts research into more unusual topics, including stars that have been stripped from one galaxy and amalgamated into another, and heterogenous



An external view of the VATT observatory



The Large Binocular Telescope shares a site with the VATT

cosmology, which takes away the assumption that on large scales the Universe is the same in every direction.

Our place in the Universe

"We have a special home," says Father Paul Gabor, vice-director of the Vatican Observatory Research Group. "The solar neighbourhood is not quite typical," he says. "It seems that the Sun is in a bubble."

The density of the interstellar medium around us appears to be below average.

THE POPE AND THE ASTRONOMER

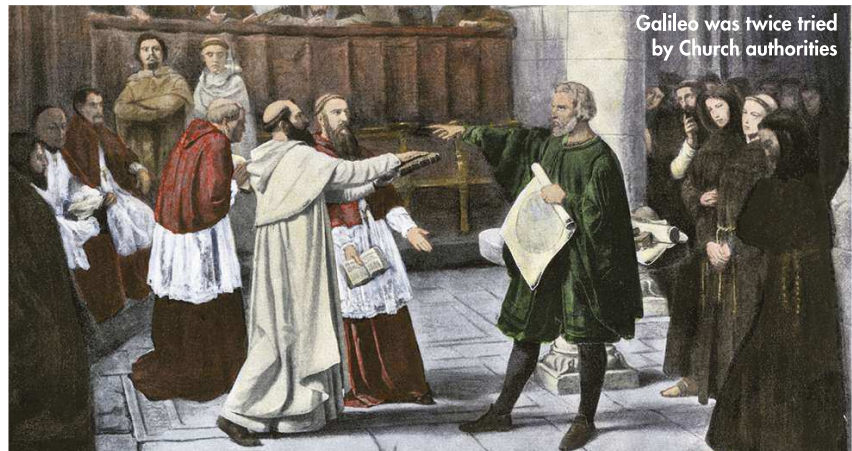
The interaction between the Vatican and astronomy began before Galileo. The Church became interested in astronomy due to inaccuracies in its calendar, apparent when scheduling Easter. This resulted in the Gregorian calendar in 1582 (named after Pope Gregory XIII), which we still use today.

The centrality of Earth became an essential element of Catholic doctrine, and heliocentric models were considered heretical. When Galileo looked through a telescope and observed a complex system of planets and moons orbiting the Sun, he stumbled into a tumultuous history of conflict.

But the Vatican comes in only to decide on controversy, not to make everyday decisions, says Gabor, who denies the very controversy of the Galileo affair, alluding to the informal way that laws operate in Rome: "When a book was on the List of Prohibited Books, it meant that it was to be read only by those who had the correct preparation. In that sense, the Bible itself was a blacklisted book."

Controversy or not, the Church has changed its attitude to astronomy dramatically. Ever since astronomical revelation first conflicted with cosmological doctrine,

humanity has had a different relationship with the Church. Now, even the Vatican, whose supporters at first refused to look through an eyepiece, turns to observational evidence.



Galileo was twice tried by Church authorities



▲ Left to right: The Crab Nebula, the Horsehead Nebula and the Black Eye Galaxy, as imaged by the Vatican Advanced Technology Telescope



The VATT's 1.6m Gregorian scope (top) uses a concave mirror ground locally (bottom)

VATT looks at stars that will evolve to look like the Sun does today, searching for clues that might answer an age-old question: how normal is our neighbourhood? The answer has huge implications.

Christian Veillet, director of the Large Binocular Telescope Observatory, has an office in the same building as the Vatican's in Tucson and a telescope at the same site on Mount Graham. He believes that our findings affect our sense of self. "If we can gather more information on how unique our Solar System is, I think it will have an impact on our own perception of what we

are in the world." A key question revolves around the search for other planets which may harbour life. "Can we find life evolved in a way where there is this consciousness?" he asks.

Advanced technology

To help answer these questions the VATT uses some unusual technology. Primarily built to conduct surveys, it scans the skies for small objects while taking in larger-scale structure. Its 1.8m Gregorian telescope differs from a Cassegrain in using a concave rather than convex secondary mirror.

The primary mirror on the 'Pope scope' – as local astronomers like to call it – was created at the University of Arizona Mirror Laboratory, using new casting and polishing techniques. These skills would go on to shape the primary mirrors of the Giant Magellan Telescope and the Large Synoptic Survey Telescope, as well as the Large Binocular Telescope, which sits within sight of the VATT.

VATT's primary mirror has an unusually short focus of $f/1$. This places the image at a distance equivalent to the mirror's diameter, meaning the telescope setup is quite small and can rotate rapidly. Combined with an extremely fast camera that has a readout time of only two milliseconds, the result is a formidable scientific instrument.

Despite winter snow, the site has good seeing all year, providing many nights of observations. With its glistening dome, the observatory looks modern and clean. There is nothing to separate the VATT from any other scientific telescope trying to answer the questions of the Universe.

For many Catholic astronomers, the observation and analysis of the Universe constitutes an attempt to understand the mind of God. In this sense, some consider the Bible one book of God, and nature the other book. Many Catholics now conceive

of the entire scientific enterprise as fully consistent with their religion. Veillet, a secular astronomer, can also see why astronomy bears on religion. "Knowing our place in the world is important, at any level. It's true for our relationships, including our faith in God." **S**



ABOUT THE WRITER

Eagle Gamma is a writer specialising in astronomy and astrophysics. In the course of his work he has visited most of the world's leading observatories.

GOD AND THE VATT



Jesuit astronomer Paul Gabor describes himself as "basically an instrumentalist, but also with an interest in exoplanets". He leads the Vatican Observatory

Research Group, which he says serves as a bridge. "Our mission is twofold," he says. "To explain the Church to the world of science and to explain science to the Church. We do better at the former."

Gabor converses on a wide range of topics touching on astronomy and religion. He criticises modern philosophy of science, in which "you move from darkness to the light", an idea he calls "complete nonsense". Instead, he sees a cyclical history that he hopes will erase conflict between science and religion.

Merely the presence of phenomena such as electromagnetic radiation, which permit astronomy, strengthens Gabor's Catholic faith. However, he says his faith precedes his research activities. "If astronomy tells us something about God, it is this: God wants to be known. That on its own is a very powerful statement."