At the Intersection of Faith and Science
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THE VATICAN OBSERVATORY

BIG HISTORY PROJECT
EVERY SUMMER, THE POPE LEAVES THE HEAT OF ROME AND HEADS TO HIS VACATION HOME AT CASTEL GANDOLFO, IN THE ALBAN HILLS. THE SIXTEENTH CENTURY MONASTERY SITS ON A HIGH RIDGE, A PERFECT SPOT TO VIEW AND REFLECT UPON THE HEAVENS.

CASTEL GANDOLFO serves as the main headquarters for the Vatican Observatory, one of the oldest astronomical institutes in the world. It operates under the jurisdiction of the pope and the Roman Catholic Church.

Since 1891, when the observatory was founded, the pope’s astronomers have used it to study the night sky. Equipped with one of the world’s oldest telescopes, they have applied their scientific expertise to fundamental questions that engage people of all faiths: How did this Universe come to be, and what is our place in it?

For more than a century, this research center has been a bridge between theology and science. In addition to the telescopes, private rooms, working quarters, and kitchen, the facility at Castel Gandolfo has a museum of meteorites and two large libraries containing more than 22,000 volumes, including historic works by Copernicus, Galileo, Newton, and Kepler. Every summer, the astronomers at the observatory update the pope about their work.

Father George Coyne, who was appointed director of the Vatican Observatory by Pope John Paul I in 1978, remembers well his early experiences at the Vatican Observatory. He recalls the excitement of observing the stars from the telescopes inside Gandolfo’s notable domes, and the
satisfaction that came from doing “good science” while serving the Church. “Science is an attempt to explain natural events by natural causes,” says Coyne. “The Church has a serious interest in understanding the Universe and everything in it.” But in his view, “True science, good science, does not conflict with religious belief.”

ROOTS IN CONTROVERSY
The relationship between the papacy and astronomy has not always been so smooth. Earlier Christian astronomers may have tried to detect which wandering star or supernova led three wise men to a stable in Bethlehem — the birthplace of Jesus Christ. More precisely, papal interest in stargazing can be traced to more than four centuries ago, when Pope Gregory XIII (papal reign 1572 — 1585) set up a committee to examine the implications for science related to the pope’s 1582 reform of the calendar.
Enter Italian astronomer Galileo Galilei (1564 — 1642), whom Albert Einstein called “the father of modern science.” Using observational evidence, Galileo challenged the teachings of the past. In 1609 and 1610, Galileo used a telescope of his own design to see the surface of the Moon, the phases of Venus, and the moons of Jupiter, compiling strong evidence for Copernicus’s Sun-centered theory (Farrandon, 2007). Galileo, who was born and educated in Pisa, first visited Rome in March 1611 to demonstrate the power of the telescope to Church officials.

Galileo suggested that his studies supported the theories of Polish mathematician and scholar Nicolaus Copernicus (1473 — 1543). It was Copernicus who theorized — a century before Galileo — that the Earth moved around the Sun, and not vice versa.

But the Catholic Church, which backed the Earth-centered, geocentric teachings of Aristotle and Ptolemy, was not accepting of these new ideas. The Church was already dealing with the Reformation, a movement that challenged the authority of the pope and the Catholic Church in Rome. In 1542, the Church began the Inquisition, an organization that made decisions on questions of morality and faith. It analyzed books and individuals to determine if what they said agreed with the Bible. Some people were sentenced to death for airing their beliefs.

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Copernican heliocentric model. In 1633, he was convicted of heresy for defending that model and placed under a life sentence of house arrest. He died on January 8, 1642, still in confinement.

DEDICATION TO DISCOVERY
Nevertheless, the Church has, since Galileo’s time, expressed an interest in astronomical research. Three early observatories were founded by the papacy: the Observatory of the Roman College (1774 — 1878); the Observatory of the Capitol (1827 — 1870); and the first incarnation of the Vatican Observatory (1789 — 1821), housed in a building called the Tower of the Winds that still exists within the Vatican.

A breakthrough came in the mid-nineteenth century with research conducted at the Roman College by Father Angelo Secchi. He was the first to classify stars according to their spectra, the color of light that stars emit. Modern spectroscopy is very important in astronomy today because scientists know that different elements have their own emission spectra, and can contribute to the “chemical signature” that a star’s light reveals.

On March 14, 1891, Pope Leo XIII (papal reign 1878–1903), in an attempt to counter the persistent perception of hostility by the Church toward science, set up another small astronomical observatory on a hill behind the dome of Saint Peter’s Basilica.

In 1910, Pope Pius X (papal reign 1903 — 1914) gave the observatory a new, larger space at a villa built in the Vatican Gardens by Leo XIII. From 1914 to 1928, the observatory contributed to the Astrometric Catalogue, an ambitious map of the sky that was undertaken in conjunction with 17 observatories around the world. The Vatican printed 10 volumes, which listed the brightness and positions of 481,215 stars.

By the 1930s, however, light pollution from the city of Rome prevented the study of the fainter stars and galaxies. Pope Pius XI (papal reign 1922 — 1939) relocated the observatory to Castel Gandolfo and put it in the hands of Jesuits; three new telescopes were constructed, an astrophysical laboratory for spectral analysis of the light from distant celestial bodies was installed, and research programs began on Cepheid variables. A Schmidt wide-angle telescope, installed in 1957, allowed for further work on the classification of stars.

ADVANCES IN RESEARCH
The telescopes at Castel Gandolfo are rarely used anymore for astronomical research, reserved instead for visiting groups and summer-school students. All serious study is performed using other telescopes around the world, mainly in Arizona.

Father Coyne helped establish the Vatican Observatory Research Group (VORG) in Tucson, Arizona. Problems with nighttime viewing conditions around Rome spurred the need for this mountaintop institute, founded in 1981. In 1993, the observatory completed the construction of the Vatican Advanced Technology Telescope (VATT) on Mount Graham, Arizona; its optical mirrors are among the most exact surfaces ever made for a ground-based telescope. And the telescope’s observational abilities are augmented by the skies above — some of the clearest and darkest in North America.
This page: Jesuit priest astronomers using the telescope at the Vatican Observatory in Castel Gandolfo in 1946.

Right: Father Emmanuel Carreira using the telescope at the Vatican Observatory in Castel Gandolfo in 2005.

Bottom right: A 1.8-meter honey-combed mirror crafted for the VATT at the University of Arizona.

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The observatory’s 15 staff members collaborate with astronomical research institutes in countries around the globe, and as members of the International Astronomical Union and the International Center for Relativistic Astrophysics.

“The first priority of the Vatican Observatory is scientific research, and the VATT is our tool,” said VORG director Jose G. Funes at a February 2009 research seminar at the University of Arizona. “We are priests and religious men, but we also are scientists…Astronomy is our main service to the church” (Stiles, 2009).

NEW POINTS OF VIEW
On the evening of September 16, 2009, Pope Benedict XVI inaugurated the new facility of the Vatican Observatory with a prayer and blessing. The facility includes two floors in a renovated building on the grounds of the Pontifical Villas of Gandolfo, and has a library, conference room, offices, guest quarters, laboratory, and chapel (Vatican Observatory Newsletter, Fall 2009, p. 1). The unveiling took place in what was dubbed the “International Year of Astronomy,” which honored Galileo’s first scientific use of the telescope 400 years prior.

The subject of Galileo has remained a tricky one for the Church throughout the years. In 1992, Pope John Paul II (papal reign 1978 — 2005) expressed regret at the way Galileo had been treated, stating, “The error of the theologians of the time, when they maintained the centrality of the Earth, was to think that our understanding of the physical world’s structure was, in some way, imposed by the literal sense of sacred Scripture.” (BBC News, 2008).

Father Coyne, who ran the Vatican Observatory throughout Pope John Paul II’s reign, says, “The Church is a human institution, and a human institution can make, and has made, mistakes.” In the 1600s, Coyne says, the Church believed that Galileo contradicted Scripture. “We can’t judge by the modern day what happened 300 to 400 years ago,” Coyne continues. “We do have to say the Church was wrong in thinking Scripture teaches science...The Church now knows that.”

Such thinking didn’t change overnight. The sense and sensibility of the appropriate relationship between faith and reason, science and Scripture, has evolved over time. Each pope’s approach may yield subtle shifts. In 1998, Pope John Paul II wrote in an official letter:

Faith and reason are like two wings on which the human spirit rises to the contemplation of truth; and God has placed in the human heart a desire to know the truth — in a word, to know himself — so that, by knowing and loving God, men and women may also come to the fullness of truth about themselves. Near the end of the same letter, he said:

I cannot fail to address a word to scientists, whose research offers an ever greater knowledge of the Universe as a whole and of the incredibly rich array of its component parts, animate and inanimate, with their complex atomic and molecular structures. So far has science come, especially in this century, that its achievements never cease to amaze us. In expressing my admiration and in offering encouragement to these brave pioneers of scientific research, to whom humanity owes so much of its current development, I would urge them to continue their efforts without ever abandoning the sapiental horizon within which scientific and technological achievements are wedded to the philosophical and ethical values which are the distinctive and indelible mark of the human person.
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But the papal understanding of the right rapport between reason and faith is still emerging. In January 2008, Pope Benedict XVI (papal reign 2005 — 2013) canceled a visit to a university in Rome where lecturers and students had protested against his views on Galileo. The university’s rector cited Benedict’s 1990 statement, when, as Cardinal Ratzinger, he said the Church’s verdict against Galileo had been “rational and just.”

However, in 2009 Pope Benedict XVI dedicated a plaque that attests to the “Church’s steadfast support for the work of the observatory at the nexus of faith and science.” Father Coyne emphasizes that Galileo paved the way for a harmonious relationship between religious belief and scientific inquiry. “Galileo anticipated by four centuries what the Church would finally say about the interpretation of Scripture,” he says. “Galileo said that Scripture was written to teach us how to go to heaven, not how the heavens go.”

And Galileo never turned away from the faith that had sentenced him. “[He] was a devout Catholic and was not trying to start a conflict between science and religion,” writes Rachel Hilliam in *Galileo Galilei: Father of Modern Science*. “He believed that the Bible was there to instruct people in how to get to heaven and was not meant to be a scientific book explaining how the Universe worked” (p. 78). His recantation, or confession, on June 22, 1633, “did not include two points because Galileo was opposed to them: that he was not a good Catholic and that he had deceived others by publishing his book” (p. 79).

Coyne believes faith and science complement each other. He says, “Faith is: ‘God loves me.’ I accept God’s love. I try to return that love to God each day.” At the same time, he notes, “We are human beings. Science is instrumental to improving our knowledge of the Universe. But we will never have the final answer.”


Vatican Observatory Newsletter, Fall 2009.
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