

OPINION

THE WEEKEND INTERVIEW with Guy Consolmagno | By Kyle Peterson

An Astronomer's View of the Christmas Sky

T Castel Gandolfo, Italy the Wise Men were led to Bethlehem, says the Gospel of Matthew, by a heavenly sign. "Where is he that is born King of the Jews?" the Magi asked, "for we have seen his star in the east." Two thousand years later, the question often posed to Guy Consolmagno, an American Jesuit brother with a doctorate in planetary science, is what that star perhaps was.

A supernova, the last detonation of a dying sun? No. "When supernovas occur, they leave a remnant," Brother Consolmagno says. The magnificent Crab Nebula consists of the glowing ashes of a supernova that Chinese astronomers noted in 1054. Nothing similar is contemporaneous with Jesus: "Our radio surveys of the sky are complete enough, we would have seen the radio signal."

Might the star have been a comet, blazing past Earth the way Hale-Bopp did in 1997? Probably not, given a lack of historical corroboration. "Nobody else talks about such a comet," Brother Consolmagno says. Worse, spotting one in the ancient world wasn't a good omen: "Comets are always described as arbiters of doom."

The pope's chief stargazer, a Detroit native, discusses what the Wise Men saw, how to deflect an asteroid, and why science and faith are more than compatible.

Maybe the star was a planetary conjunction—say, in 6 B.C., when calculations show that Mercury, Venus, Mars, Jupiter and Saturn gathered together. This theory, Brother Consolmagno says, is everybody's favorite. "The particular one in 6 B.C. that's attractive is—they're all right next to the sun, which explains why nobody actually saw it in the sky," he says. "But the astrologers who can calculate these things would have calculated that they should all be there."

Then again, perhaps the Star of Bethlehem was purely a literary symbol. "Caesar Augustus used a story like this, too," Brother Consolmagno says, "as propaganda for why he should be the emperor and not his rivals. Maybe Matthew is saying: 'Better than Caesar Augustus, we've got astrologers who could say this about Christ.'"

It might seem an odd line of inquiry, especially to a secular world that sees science and religion as separate, if not conflicting, domains. But Brother Consolmagno, director of the Vatican Observatory and thus the pope's chief astronomer, is accustomed to fielding offbeat questions with good humor. One of his books is titled "Would You Baptize an Extraterrestrial?" His short answer: "Only if she asks!"

Brother Consolmagno, 66, grew up in Detroit as a self-described

"Sputnik kid." He studied at the Massachusetts Institute of Technology and the University of Arizona, and then, at 37, joined the Jesuit order. At conferences or when meeting newsmen, he pairs a clerical collar with an MIT class ring. The outfit, along with his thick beard, has a way of confounding expectations.

A desire to integrate science and faith publicly was part of the reason the Vatican established the observatory in 1891, though the church's study of astronomy long precedes that. The Gregorian calendar used today was instituted in 1582 by Pope Gregory XIII to correct the old Julian system, which by that point had drifted out of season by 10 days.

But as the 19th century waned, two things happened. "One was, the unification of Italy meant that the Holy See was desperate to be still recognized as an independent country," Brother Consolmagno says. "Having a national observatory was a sign of nationhood." The same era "was really the first time that people had this idea that church and science might be at war, and the pope wanted a physical way of saying, 'No, we support science.'"

Telescopes were initially placed atop towers in the Vatican. After relations with Italy normalized in 1929, the astronomers fled Rome's light pollution by moving 15 miles southeast to the papal summer home here in the Alban Hills. As visitors coming by train round the bend, they can see the palace perched over a shimmering volcanic lake. Two telescope domes, each about 25 feet across, poke up from the roof. Two more domes, which will open to tour groups in 2019, stand in the gardens, past the cows and chickens that contribute to the pontifical sup. Pope Paul VI watched the moon landing here in 1969.

Since the original equipment is outmoded, the Vatican runs a newer telescope, built in the '80s, on a mountaintop near Tucson, Ariz., where Brother Consolmagno studied for his doctorate and now spends part of each year. All in all, the observatory and its dozen Jesuit staff run on an annual budget of roughly €1.5 million (\$1.7 million), a third from private donors. "For 12 people, that's remarkable—but we come cheap," Brother Consolmagno says, alluding to their religious vow of poverty. "Jesuits all live together, and we get just basically a token salary from the Vatican."

This setup allows the astronomers to pursue science that would struggle to get funding elsewhere. Take Brother Consolmagno's early work on meteorites, the chunks of alien rock and metal that hit Earth after a meteor burns through the atmosphere. The Vatican has one of the world's largest meteorite collections, more than 1,000 samples in baggies and small vials, cataloged by the drawerful. When Brother Consolmagno arrived in the 1990s, he began systematically measuring their densities.

Most meteorites, he says, originate in the asteroid belt between



Mars and Jupiter, which he calls "the junk-pile scrap heap of the planets." Scientists hunt for them in Antarctica, where the black rocks stand out on the ice, untouched for millennia after falling from the sky. Brother Consolmagno, after many days weighing and calculating, amassed hundreds of data points. "The first time I presented my preliminary results at a big meeting," he says, "one of the grand old men of the field came up and said, 'Guy, why are you measuring density? Nobody does that.'"

But the data proved interesting. "Meteorites are more dense than a typical rock, and much more dense than the asteroids they came from," Brother Consolmagno says. "And that means that the asteroids that you look at in space are not just a big meteorite, but they're actually a pile of rubble with a lot of empty space—lots of cracks, lots of voids and, as I joke, something big enough for the Millennium Falcon to hide in."

A floating debris pile may sound easier to blow up, should the need to save humanity arise, but it isn't: "When you have loose material, it can absorb impacts without shattering." So what to do if an asteroid hurtles our way? "Plan B is to perturb it out of its orbit," he says. "That's easy to do if it's a pile of rubble, because you have a little machine that throws dirt in one direction and makes the asteroid go in the other direction—like some sort of mass launcher, a wood chipper."

A faithful Catholic since childhood, Brother Consolmagno pursued astronomy without cognitive dissonance. That science might conflict with his faith "never occurred to me," he says. "It was the nuns who taught me science when I was in grade school." Upon entering religious life, he was surprised at the reactions: "So many of my science friends, once they knew I was a Jesuit, started telling me about the churches they went to. I had no idea they were churchgoers."

How, then, did it become a trope to speak of a war between science and religion? There are many threads here to pull, from pop culture to anti-immigration rhetoric in the U.S. near the turn of the 20th

century. "They wanted to keep people like my great-grandfather out of America," Brother Consolmagno says—"people with funny last names who were Catholics."

Let's begin earlier, though, with another question he frequently gets: What about Galileo?

The church was wrong, Brother Consolmagno says, to put Galileo on trial in 1633 for promoting Copernican heliocentrism. Yet he says the affair was more complicated than some Enlightenment morality play. For one thing, the science was inconclusive. Competing with Copernicus was a nearly equivalent geocentric model. Proposed by the Danish astronomer Tycho Brahe, it featured the same orbits without Earthly motion. The sun revolved around us, and the other planets circled the sun.

"There's only one difference between that and Copernicus," Brother Consolmagno says. "The only thing you have to look at is the distant stars. If Copernicus is right, then when the Earth moves around the sun, you should see a slight shifting in the positions of the stars." Because the stars are so far away, the effect was too faint to pick up: "Nobody could see that at the time of Galileo, or for hundreds of years after." Brahe—and the church—was mistaken, but not obviously so.

Brother Consolmagno speculates that politics somehow also came into play. "There's no argument in Galileo's trial about any of the science. Anyone can pick up a copy and read the transcript," he says, offering alternative theories: "Was it a personal politics, that he had insulted the pope? Was it the global politics, that this was happening right in the middle of the Thirty Years War?"

Adding to the perception of a science-faith conflict, deists began reading a Creator into gaps in scientific understanding—which meant that new knowledge kept squeezing God out. Newton suggested the solar system needed divine intervention to stay aligned: "He understood that planets are attracted to the sun. How come the planets don't pull on each other and mess all of this up?" Brother Consolmagno says. "His math

wasn't good enough to calculate how big an effect that would be. The answer is, not very big."

Brother Consolmagno sees a similar trap in arguments for "intelligent design," such as the claim that the universe is "fine tuned" for life. Ditto on citing the Big Bang as proof of a "prime mover." In fact it was a Belgian priest and physicist, Georges Lemaitre, who extrapolated backward in the 1920s to suggest the universe began in a "primeval atom." Brother Consolmagno says Lemaitre eventually "spoke personally to Pope Pius XII" and urged him not to trumpet this news as evidence of a Creator.

A third contributing factor, in his view, was the rise of a peculiar sort of literalism. "The idea that you read the Bible like it was the Chilton's manual for how to repair your Volkswagen—that's literalism. It's a very modern idea," he says. "You don't find that in the church fathers. You don't find that in the rabbis of the time of Jesus. That's not the way they interpreted it. All literature in ancient times started out as poetry."

A minute later he extends the thought: "Science is also poetry. When I describe the path of a falling rock using Newton's law of gravity, I'm saying the path that the rock makes when it falls is like the solution to this equation. It's simile. The rock is not the equation, and the equation is not the rock." The implication is that these two poetic ways of understanding the world perhaps flow toward a unified truth.

If so, it points to a deeper problem with dragging cosmology into religious arguments. "It always makes the science come first and God come at the end of your chain of reasoning," Brother Consolmagno says. "To a scientist who's a believer, it goes the other way around. I've already experienced God. I've already had religious experiences. I've already had things that have made me look at the universe and say: 'What's going on?' Whether they're tragedies like the death of a loved one or miracles like the birth of a loved one, there are things that make you say, 'I'm experiencing something that's more than physical things can explain. Where did this come from?' Or maybe it's just something as simple as: 'I exist. Why do I exist? Why does anything exist? Why does existence itself exist?'"

Facing such questions, he offers a hypothesis: "Let's assume that there's a God that's outside nature, who is responsible for the existence of the universe," he says. "When I start with that axiom, does the universe make sense? Does the universe make more sense than if I assume it's all done by random chance? Am I able to see things I couldn't see before? Am I able to understand things I couldn't understand before? Is it an axiom that works?"

"And to me, yes—that's the answer." Mr. Peterson is a member of the Journal's editorial board.