



VATICAN OBSERVATORY NEWSLETTER

embracing, encouraging and promoting scientific study



The Crab Nebula, M1, is the remnant of a supernova first seen by the Chinese in 1054. This image was taken at the Vatican Advanced Technology Telescope by Br. Jonathan Stott, S.J., using filters that emphasize thermal emission and hydrogen emission lines.

Founded in 1891, the Vatican Observatory demonstrates the Church's desire to embrace, encourage and promote scientific study, on the basis of her conviction that 'faith and reason are like two wings on which the human spirit rises to the contemplation of truth' (Fides et Ratio, Proemium). For more information, email (katie@vaticanobservatory.org) or call (+1 (520) 795-1694).

Father José Funes, S.J.
Director, Vatican Observatory
Brother Guy Consolmagno, S.J.
President, Vatican Observatory Foundation



President's Message

✦ by Br. Guy Consolmagno, S.J. ✦



Photo Credit: ESA/Valentini

I can't begin to describe how thrilled I am to be taking up this new position as President of the Vatican Observatory Foundation... but I am a little bit nervous, as well. After all, Father Al DiUlio had a tough enough act to follow when he took up the reins from Fr. George Coyne; now I have to follow up the two of them, intimidating enough for anyone!

As we all know, Father George did a spectacular job of founding the Foundation, raising the millions of dollars it took to build the Vatican Advanced Technology Telescope and establishing an endowment to keep the telescope operating. Father Al had the far less glamorous, but equally important, task of putting the board on a business-like footing and establishing a sustainable model for funding the Foundation's work.

Thus the foundation of the Foundation has been well set: we have our telescope, and we have our resources. The question facing us now is, what shall we build on this excellent foundation?

I keep recalling the mission that Pope Leo XIII first gave the Vatican Observatory in his Motu Proprio, the document that re-established the Observatory in 1891. The purpose for which we exist, he stated, was "that everyone might see clearly that the Church and her Pastors are not opposed to true and solid science ... but

that they embrace it, encourage it, and promote it." For nearly 125 years, the Observatory has embraced good science. But the essential role that we at the Foundation can fulfill is to show that science to the general public, so that "everyone might see clearly" the work of the Vatican astronomers.

Already we're developing exciting plans to promote education and public outreach in astronomy -- working with Catholic high schools, running workshops for parish educators, engaging the large community of amateur astronomers.

But we at the Observatory can't do it by ourselves. We need the help of you, the true members of the Vatican Observatory Foundation. Of course, we need your financial support; without it, little is possible. But we also will be asking you for your ideas; and your time. But most of all, facing my new role, let me ask you for your prayers... that together, we may continue to give Glory to God, the Maker of the Heavens and the Earth.

Yours in Christ,

UPCOMING EVENTS

Laurensburg, NC:

St. Andrews University - Tuesday, October 21st
John Calvin McNair Lecture on Science and Theology

Chicago:

Adler Planetarium – Tuesday, November 18th
"Would You Baptize an Extraterrestrial?"

Albany, NY:

State University of New York – November 19th
"The Galileo Affair"

Tucson:

Faith and Astronomy Workshop – January 19 - 23
"What is Life?" University of Arizona Centennial Hall - January 26th
Annual Circles of Giving Awards Dinner - February 27th

Erie, PA:

Gannon University – February 4th

Washington, DC:

Annual Seminar at Catholic University of America - March 17th





Noteworthy

Fireball imaging network installed in southern Arizona by Fr. Kikwaya & collaborators captured its first bolide on August 26!

A newly installed three-camera fireball network in southern Arizona affiliated with the Vatican Observatory has successfully captured its first fireball images. Fr. Jean-Baptiste Kikwaya has led the installation of this network, in collaboration with Carl Hergenrother of the University of Arizona and Bill Cooke of NASA's Meteoroid Environment Office, along with the active participation from the University of Arizona's Lunar and Planetary Lab and the Planetary Science Institute.

The ultimate hope is that once they have recorded a fireball big enough to produce meteorites, these images can be used to help them find and recover those meteorites. In that way, they can study the phenomenon of a meteorite's fall from its entry in the atmosphere to meteorite recovery, and thus compare the chemical and physical properties of the meteoroid (including its bulk density, grain density, heat capacity, and thermal conductivity) as inferred from the bolide light curve and spectra, to the physical characteristics of the recovered meteorite itself.

The southern Arizona network is part of NASA's ASgard network. More information, with images and videos of the fireballs, can be found online at <http://fireballs.ndc.nasa.gov>

AAS will present the 2014 Sagan Medal to Br. Guy in Tucson on Thursday, November 13th followed by his talk "Discarded Worlds"

"The Carl Sagan Medal is awarded by the American Astronomical Society for outstanding communication by an active planetary scientist to the general public: Br. Guy Consolmagno has a decades-long track record of communicating planetary science to the public while maintaining an active science career. In addition, he occupies a unique position within our profession as a credible spokesperson for scientific honesty within the context of religious belief.

As a Jesuit Brother, Guy has become the voice of the juxtaposition of planetary science and astronomy with Christian belief, a rational spokesperson who can convey exceptionally well how religion and science can co-exist for believers."

Minor Planet Center announces Asteroid 23443 Kikwaya

Named for Fr. Jean Baptiste Kikwaya Eluo, S.J., this asteroid was discovered on October 4, 1986. Father Kikwaya is a native of the Democratic Republic of Congo and Staff Astronomer at the Vatican Observatory. Using optical meteor measurements, he estimates the bulk densities of smaller meteoroids through numerical ablation models.

Fr. Corbally participated in the Clavius Symposium at Notre Dame honoring Fr. Bill Stoeger



The Clavius Symposium on faith-science dialog, "God's Action in the World," was held on the campus of Notre Dame University on July 16 and 17, 2014, and honored the memory of Father William Stoeger, S.J. This international symposium treated a variety of topics relating faith and science – philosophical, mathematical and scientific aspects of knowledge, fuzzy language in theology, and the evolutionary dynamics of divine action.

Father Stoeger had been a member of the Clavius Group of Catholic Mathematicians, which organized the symposium. It has been meeting annually for a few weeks in July since 1963 to run seminars and live together as a Christian community. Father Corbally represented the Vatican Observatory at the symposium presenting "Natural Hiddenness and God's Action in the World" and included some reflections on his long time colleague and friend Father Stoeger.

Just Released! On Sale Now at a Bookstore Near You!

Amazon describes it as "Witty and thought provoking, two Vatican astronomers shed provocative light on some of the strange places where religion and science meet."

"Imagine if a Martian showed up, all big ears and big nose like a child's drawing, and he asked to be baptized. How would you react?"

— Pope Francis, May, 2014

Pope Francis posed that question — without insisting on an answer! — to provoke deeper reflection about inclusiveness and diversity in the Church. But it's not the first time that question has been asked.

Brother Guy Consolmagno and Father Paul Mueller hear questions like that all the time. They're scientists at the Vatican Observatory, the official astronomical research institute of the Catholic Church. In *Would You Baptize an Extraterrestrial?* they explore a variety of questions at the crossroads of faith and reason: How do you reconcile the Big Bang with Genesis? Was the Star of Bethlehem just a pious religious story or an actual description of astronomical events? What really went down between Galileo and the Catholic Church — and why do the effects of that confrontation still reverberate to this day? Will the Universe come to an end? And... could you really baptize an extraterrestrial?

With disarming humor, Brother Guy and Father Paul explore these questions and more over the course of six days of dialogue. *Would You Baptize an Extraterrestrial?* will make you laugh, make you think, and make you reflect more deeply on science, faith, and the nature of the universe."





Galaxies Come to the Vatican:

Twenty Five International Students Participate in the 14th Biennial Vatican Observatory Summer School (VOSS) in Astronomy and Astrophysics

Galaxies, collections of billions of stars in beautiful spirals or elegant elliptical clouds, were once called “island universes” because they seemed so distant that they couldn’t possibly impinge on us. But the study of galaxies, near and far, young and old, has touched the Vatican this past summer at Vatican Observatory’s fourteenth summer school in Observational Astronomy and Astrophysics. Twenty five university and post-graduate students came from every continent; including two from Africa, six from South America, and eight from Asia.

The topic of galaxies is timely for many reasons. “Galaxy formation and evolution is at the forefront of modern astronomy research,” noted Fr. José Funes, director of the Vatican Observatory, himself an expert in galaxy observations. “Galaxies are the fundamental building blocks of the universe. And new space and radio telescopes, and sophisticated numerical modeling, are challenging our views of galaxies, young and old.”

Looking out from the local group of galaxies we can now see back to see galaxies formed within the first billion years after the Big Bang. By studying distant galaxies, whose light began its journey to our telescopes more than ten billion years ago, we can look back in time to the conditions that existed when the first stars were formed.

Dr. John Stocke, of the Center for Astrophysics and Space Astronomy at the University of Colorado, led the faculty; he was joined by Christopher Carilli, of the Very Large Array in Socorro, New Mexico; Michele Trenti, of the University of Cambridge, UK; and Jacqueline van Gorkom, of Columbia University, New York.



Among the guest speakers were Miguel San Martin, the designer of the landing system for NASA’s Curiosity Rover currently active on Mars, and Dr. Filippo Mannucci, the director of the Astrophysical Observatory of Arcetri outside Florence. In addition to lecturing on the metallicity of galaxies, Dr. Mannucci also hosted the students on a tour of the observatory in Arcetri, including a visit to Galileo’s villa.

The Galileo visit, including a trip to the Galileo museum in Florence, pointed up a theme running through this school. The mixture of old and new, near and far, can be applied not only to the history of the universe revealed in the galaxies the students have been studying, but also the history of astronomy revealed in their visits around Italy.

“The Galileo house was amazing,” remarked Jaco Mentz, a student from South Africa. “Just to think that he lived here at the end of his life, in such different times.”

“I had the same feeling when we visited the church where St. Francis was, in Assisi,” commented Juan Garavito, from Colombia. “And the history you can see in the city of Rome is amazing.”

Titania Virginflosia, from Indonesia, described how she felt to be welcomed so far from home. “I was worried when I came here, because not only do we have to be expert in astronomy, but also in English, and my English was not strong. I was worried about giving the presentation on my research in English. But Fr. Funes reassured us that coming from Argentina himself, he understood that we would need time. The faculty are very understanding. And by the second week I was used to the English.” Her talk, on the interaction of binary stars with massive black holes at the center of our galaxy, was the first time she had presented her work in English.





Faith and Astronomy Workshop

The Vatican Observatory Foundation is sponsoring a wonderful opportunity for priests and others working in parish education to do a little hands-on astronomy and learn more about the work of the Vatican Observatory.

But we need your help!

As we mentioned in the Spring Newsletter, we will be holding a

workshop in Faith and Astronomy in Tucson the week of January 19-23, 2015. Participants will get to hear talks from leading astronomers, do hands-on experiments, visit research sites in the Tucson area, and share with each other the challenges and joys of teaching parishioners about the many ways the Church has supported science and especially astronomy. More details

can be found on our website.

So how can you help?

The workshop costs \$750 per attendee. That just covers the cost of room and board plus the other expenses associated with the workshop; the attendees will have to get themselves to Tucson. Many of the folks who might want to attend may have trouble raising the funds. If you can help out by donating to a scholarship fund for this workshop, they'll be forever grateful!

You can donate on-line through our website or by mail to our office in Tucson. For online donations please use the One-Time Gift option and indicate in the comment box that you wish to contribute to workshop scholarships.

This is the first time we've ever held such an event. We hope it can be something really special, something to help fulfill the mission we were first given by Pope Leo XIII back in 1891: to show the world that the Church supports true science.

With your help, it can happen!

Faith and Astronomy Workshop
January 19 - 23, 2015

For parish priests – and those who work with them in youth and adult education

Four days of prayer, reflection, and hands-on-astronomy with the scientists of the Vatican Observatory in Tucson, Arizona

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tucson, arizona | picture rocks | sonoran desert

Indeed, the most important lessons from the school may be in the personal interactions among the students. As Jaco put it, "What has most amazed me has been to be able to meet so many people from different cultures, to make friends and possibly colleagues of all these different people."

The faculty agree. "The Vatican Summer School has been an amazing opportunity to make an impact on tomorrow's leaders in astronomy by mentoring the next generation of thinkers," Dr. Trenti said. "I knew there would be a global and diverse



atmosphere at the school, with participants representing different world cultures and backgrounds. But what has surprised me was not just to teach these students, but to live in such close contact with them, and pick up on how passionate they are about astronomy."

Since the first summer school was held in 1986, more than 350 students have taken part in this program. More than 85% continue today as professional astronomers, including some of the most notable figures in contemporary astronomy.



VATT Comes of Age: Turning 21 on September 18th

By Fr. Paul Gabor, S.J.

Many excellent science projects have been conducted with VATT over the years. As telescope sizes grow inexorably, can VATT remain competitive? A telescope, regardless of its size, is only as good as the science performed with it. So the question is, can cutting edge research be done today with two-meter class telescopes? I am positive that it can. Here are some examples.

Young Solar Analogs (YSAs) are stars which, in a few billion years, will “grow up” to be like our Sun but now are “just” a few million years old. We have always known that going through their “formative years”, stars tend to be “temperamental” with powerful radiation and gigantic eruptions of much larger frequency and size than in the star’s sedate “middle age”.

With the growing interest in the origin of life (and astrobiology in general), we would like to know more about the conditions around Young Solar Analogs. Father Chris Corbally, with his expertise in spectroscopy, has started a very new field of research, observing the activity of such stars with VATT’s new spectrograph.



Composite photograph of the solar flare of August 31, 2012 (Credit: NASA)

The flares occur with no regularity, and only last less than an hour: you need a lot of telescope time to capture them. Large telescopes cannot

dedicate enough time to a Young Solar Analog campaign, and what is more, many of these stars are too bright for an 8-meter telescope anyway. That is why VATT and other telescopes of its size are the only ones that can contribute to this very new and interesting area of research.

Similar considerations apply to many other types of transient phenomena, such as supernovae and gamma ray bursts. The robotization of VATT and the creation of a network of robotic telescopes (Arizona Robotic Telescope Network, ARTN), we will be able to capture more information about these fascinating and rare occurrences. Each telescope in the network will be equipped with a different instrument,

gathering a wider range of data than a single large telescope could.

Such a network could perform cutting-edge research on small bodies within our own Solar System. We know the trajectories of about 500,000 asteroids. Apart from a handful of the largest ones, they are all too small to resolve in a telescope. Space probes have shown us that these objects may be truly surprising in their diversity.

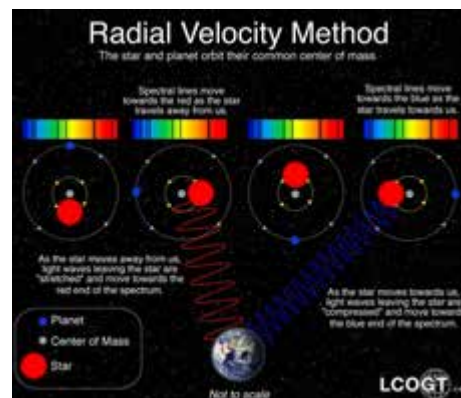


A photograph of the asteroid Itokawa taken by the Japanese probe Hayabusa in 2005. It is about 2,000 ft long (Credit: JAXA)

At any given time there are probably several asteroids of 30 feet or less flying by the Earth. With ARTN, we hope to gather data about these objects that has never been available before, learning

more about their composition. This may be interesting not only scientifically, teaching us important things about the formation of the Solar System, but it might be helpful in the proposed asteroid mining of rare metals. This is yet another field in which an array of smaller telescopes is more effective than a large telescope.

The search for exoplanets (planets orbiting other stars than our Sun) has been very fruitful over the last two decades. NASA’s highly-successful Kepler mission uses the method of transits, observing a star for long periods, looking for periodic changes in its brightness.



These discoveries are confirmed and expanded with the radial-velocity method, using very accurate spectrographs to measure the variations of the speed with which the star “wobbles”

in a back-and-forth motion in reaction to the exoplanet’s motion.



But measuring radial velocities requires highly sensitive spectrometers.

VATT is now connected to a newly-built spectrograph called PEPSI, arguably the newest and best-performing spectrograph in the world. In a new collaboration between the Vatican Observatory and the Astrophysics Institute in Potsdam, Germany, which built PEPSI, we are testing a fiber connection of VATT and PEPSI, planning to study the feasibility of radial-velocity measurements.

2015 Official Calendar of the Vatican Observatory

The 2015 edition of this annual publication is ready for distribution. Calendars may be purchased for \$25 each or \$20 each for bulk orders of 4 or more. The VOF is happy to mail calendars to gift recipients for you if the names and addresses are included in the payment. This can make a great and convenient Christmas gift.



To place an order:

-Visit the Vatican Observatory Foundation website:

www.vofoundation.org and click on the Donate button.

-Use the enclosed envelope and pay by check or credit card. All appropriate areas must be completed.

-You may also mail a check made out to Vatican Observatory Foundation including your return address to:

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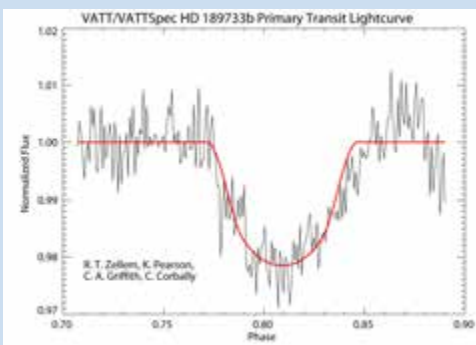
Exoplanet Transit Observed by VATT

Fr. Chris Corbally, S.J.

Around midnight between June 21st and 22nd the exoplanet HD189733b transited in front of its host star HD189733, so blocking a very little of the star's light. Rob Zellem, a Vatican Observatory Summer School (VOSS) alumnus and doctoral student at the University of Arizona's Department of Planetary Sciences, Kyle Pearson, also a student at the Department of Planetary Sciences and Fr. Chris Corbally observed the event with VATTSpec, the spectrograph on VATT. They got a spectrum of HD189733 every minute over a three-hour period. Everything worked flawlessly, and it was the first time that such a transit had been observed in the visible wavelength region with a telescope like VATT, a tribute to the combined efficiency of the telescope, spectrograph, and observing site on Mount Graham.



Kyle Pearson, left, and Rob Zellem in the control room with a display on the laptop of the spectrum which indicated success in detecting the transit. Hence the happy faces!



In the picture is shown the lightcurve of just one of the wavelength channels from the spectral data. When the absorptions, or depths of the lightcurve, from multiple wavelength channels are included, they can give an upper limit on the exoplanet's optically thick radius. In effect, the goal is to get more precise measurements on the radii of transiting exoplanets, which will in turn allow for more precise models of their atmospheric structure and content.

Previously Fr. Richard Boyle and his colleagues had made similar observations with GUF1 of an exoplanet transit as reported in an earlier publication. However, the advantage of this spectroscopic data is to better constrain the radius of the exoplanet.



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INSIDE

2014 VOSS



2015 Calendars for Sale



Exoplanets and Fireballs

Astronomical Tour of Chile

April 14 to 23, 2015

Vatican Observatory Foundation
University of Arizona College of Science
University of Arizona Steward Observatory
European Southern Observatory

- \$6,500.00 per person, double occupancy
- \$750.00 single supplement
- Land and Internal Air Only
- Air to/from Chile is Not included.
- Deposit: \$1,000.00 per person at registration
- Final payment is due January 15, 2015

Due to overnight stays at the observatories the number of participants is extremely limited!

Join Br. Guy Consolmagno, Dr. Joaquin Ruiz, Dr. Chris Impey and Dr. Fernando Comerón for an exclusive expedition to the world-class observatories that crown the mountaintops of northern Chile. Explore with us this area of spectacular beauty with Pacific beaches, deserts, volcanoes and the remnants of ancient civilizations. Our European Southern Observatory hosts have graciously extended special permission for our group to stay overnight at the observatories at La Silla and Paranal. We'll go behind the scenes to meet astronomers who are peering deeper into the universe than ever before. View the pristine desert skies and visit Las Campanas, future site of the Giant Magellan Telescope and ALMA, the largest ground-based astronomy project in existence.

This very special tour is designed for friends of The University of Arizona and the Vatican Observatory Foundation. Since some of the travel will be in remote areas, flexibility is required concerning time schedules, food, dirt roads, weather, and dust. Please keep in mind that we will reach high elevations at times so personal health concerns should also be considered.

For more information, a brochure with full details and itinerary, registration and medical release forms please contact Katie Steinke at katie@vaticanobservatory.org or (805) 901-6591.