The Leader's Way Podcast

20: Astronomy and Faith with Graziella di Tullio Zinn

Graziella Zinn: In a letter that he wrote to a friend, Galileo wrote that in his scientific discoveries, he learned more with the help of divine grace than with these telescopes. I mean, isn't that amazing? Galileo was very proud of his telescopes.

B: Hi, I'm Brandon Nappi.

H: Hi, I'm Hannah Black.

B: We're your hosts on The Leader's Way. An audio pilgrimage from Berkeley Divinity School, the Episcopal Seminary at Yale University.

H: On this journey, we reflect on what matters most in life as we talk about all things spirituality, innovation, leadership, and transformation.

B: Hey, Hannah.

H: Hey, Brandon. How's it going?

B: It's going well in this wintry April here in New Haven.

H: Yeah, I'm ready for the sun to break through once and for all.

B: Yeah, I am clinging to Easter hope amid what feels like Lenten weather.

H: Mm-hmm. It's Easter on the inside.

B: Thank you. I'm going to remember that.

H: In fact, it was Easter last night at the Berkeley Community Eucharist when we decided to enjoy the tiramisu as much as possible.

B: Yeah. I feel like we stumbled upon some perennial wisdom here. When in doubt-

H: Eat the tiramisu.

B: You eat the tiramisu. Can you imagine the scenario in which that's not the case?

H: No.

B: It was quality tiramisu. As somewhat of a tiramisu connoisseur.

H: I figured you'd have tiramisu opinions, which is why when you were enjoying it, I thought I must partake.

B: Okay. Unpopular opinion here. I don't think Italians do dessert well.

H: Oh, wow.

B: I know.

H: Oh my goodness. I'm taken aback.

B: I say that as an Italian-American, Italian on both sides, Southern Italian, Sicilian, and Roman. But I do think that tiramisu is an exception.

H: It's so good.

B: And gelato? Fair enough. I think about gelato as its own food category separately.

H: It's a snack.

B: It's going to be eaten for breakfast. It's not a dessert. Okay. So fair enough. Gelato, tiramisu … But I'm going to critique the canolli. I'm not a big fan of canolli.

H: I see that. What is your favorite dessert?

B: Oh, I am going to be uncharacteristically patriotic on this one. It's strawberry shortcake.

H: Oh, wow.

B: Like that's, like an American dessert.

H: I thought for a second you were headed in a pie direction, which reminded me that has to be my favorite dessert.

B: Oh, what kind of pie?

H: Any fruit pie. I go through pie baking… What's the word? I keep calling everything an "era." I was teaching a class the other day and described the church as in "our Holy Spirit era." So I was going to say I have pie eras.

B: I'm not the only one with a little Taylor influence going on. Yep. For the record, this is the first podcast with a Taylor Swift reference that I did not initiate. Okay. We're, I think, fully off the rails. Yeah.

H: Did you have some extraterrestrial musings to share?

B: Well, of course, this is a really fun conversation that we had with astronomer, astrophysicist, Graziella Zinn. I've been thinking a lot about this conversation because I've been watching “Three Body Problem” on Netflix, which is a sci-fi thriller. The stars feature very prominently. Extraterrestrial life is a big apocalyptic threat. So, I'm thankful for this conversation with Graziella because we take the big questions to the big people.

H: So true.

B: And questions of the stars and the origins of the universe and God's work through creation and extraterrestrial life do come up in this conversation rather organically. Yeah.

H: Very inspiring. I feel like after listening to this episode, one should go stargaze a little bit. Actually, this is being released right after the eclipse.

B: Right.

H: So we should have opened by saying “happy eclipse to you.”

B: Yes, absolutely. I would encourage everyone to stargaze with a gelato. Because of course, Graziella Zinn is our favorite Italian astrophysicist, and you're going to hear a lot of her beautiful Venice accent in her poetic descriptions of the universe. So she's someone who is one part poet and one part scientist. So I'm really excited for that.

H: Yeah. I don't know what could make stars better except for gelato. And I don't know what could make gelato better except for stars. So that's the challenge for this week is to stargaze while consuming gelato. All right. Mission accepted.

B: Welcome, Dr. Graziella Zinn. Here on the podcast, this is an amazing moment, not only because I know we're going to have a really rich conversation, but because we have known each other for over a decade, maybe almost 20 years.

G: 20 years. Yeah.

B: This is amazing. And I'm trying to remember our first moment of meeting, and I think you tell me if my memory is correct, that we were in a writing and prayer group, and we were preparing a kind of commentary on the lectionary for small Christian communities.

G: Yes. The famous Quest booklet, The name was Quest. Yes.

B: Yes. And I am just so thankful that our paths have, on many occasions, crossed over the years, and we've been able to collaborate on faith and the stars. And you've just been a really, really rich, vibrant light in my life. Even when we're not connected, I

think of you and I think of your work, and it's meant so much to me as I know it's meant so much to others. G: Oh, thank you, Brandon. Anyway, I want to thank you for you and Hannah for inviting me to this very special community. Passioned seekers, and inspiring leaders.

B: So one of the great blessings of this podcast is we get to hear the vocation story of leaders, poets, and philosophers, and theologians, and priests, and musicians. And I would love to hear, in your words, Graziella, you tell us the story of your faith and your professional work with the stars.

G: Well, it was a long, quiet journey, that started when I was in first grade, a little time ago. I was blessed to have an amazing teacher who knew how to inspire young girls to appreciate the beauty of creation in all its expression, from flowers to stars. I remember vividly the very beginning of my astronomical journey. It was late winter, at the time when the planet Venus would appear in the western sky as the evening star just after sunset. The teacher encouraged the whole class not to miss that spectacular sight, and it was unforgettable. A huge sparkling diamond piercing the blue velvet of the sky over the water. It was a true epiphany for my young, exploring mind. For me, that was the revelation that the night sky is the most beautiful sight to contemplate, and I did it in my own simple way. Now is the story. My family lived on the harbor, facing 180 degrees of the Venetian Lagoon, spectacular, without any barrier against the night sky. In the clear nights before going to bed, I started the habit to look out of my bedroom, and the search for the stars over the lagoon, then became a ritual for my evening prayers. Growing up, I would enhance my evening quiet time by taking a walk along the pier under the embrace of the stars, contemplating in prayerful silence that mystical beauty, a feeling closer and closer to God, the eternal beauty. I developed also a deeper sense of gratitude to be part of God's wonderful creation. Then, later on, when I went to the University, it was natural for me to enrich my faith-filled dialogue with the universe by learning and researching its science story, and I became a professional astronomer.

B: It's amazing. We have so lost our connection to the stars in daily life, at least here in New Haven. There's so much light pollution, and it's so easy to forget to look up.

G: Yes, yes.

B: And I wonder, Graziella, what is it that we lose when we forget that we're connected to this incredible universe beyond the Earth?

G: Yes, it's a big loss, but because you said something before we forget to look up. I just want to share quickly. First, one of my students was actually a political science major. He was a senior, so we were there last semester. At the end of the course, he came to me and said, "You know, taking this course, for the first time, I took opportunity to look up at the stars when I was walking through campus. I never did in four years." So he said, "I'm taking the summer off. I'm postponing my job in Florida," And then said, "I want to take time to enjoy creation." So that tells us, I think, that yes, it's a big loss. I

would say a fundamental loss. Since stargazing has been the most primordial and essential human experience, Sun, Moon, Stars with their patterns and their cycles in the sky have guided the development of ancient civilizations, with the creation of calendars for the agricultural season, maps for the direction of their migrations, orientation for the sacred sites of their religious rituals. Ancient astronomical history has been discovered by all the archaeostronomy findings. So we know that this happened, for sure.

Think about Stonehenge. It is the most famous example of astronomical religious site in Stonehenge. Maybe you saw because you were in England. The impressive prehistoric monument on the Salisbury Plain in England, thought to be around 5,000 years old. Its massive standing stones, placed in circular arrangement, appears aligned with certain seasonal positions, of Sun, Moon, Stars. Unfortunately today, thousands of years later, the vast majority of people living in our modern cities are denied the enchantment of a night sky. Unfortunately, starlight has been washed out by the effect of light pollution. You know, and there is a 10% yearly increase. 10%! At the point that now, 80% of the world's population live under sky glow, with no stars visible. You can go in darksky.org, you can find all the instructions, all the information about light pollution, so we can put a link if it's good. And they give all kinds of instructions, and we can reduce at least a little bit. Then we can have public policies, talk with the city government, and do something.

I just wanted to share another reflection before we end this. Does light pollution have anything to do with faith? I think it does, because the mystical beauty of the starry sky connects the human soul with the creator of the beauty, who is the eternal beauty. And when we lose that connection, as you were saying Brandon, and I'm thinking especially of the young people, the human spirit is deprived of a fulfilling relationship with the universe. It has to be fulfilling. I'm not talking about a virtual relationship that we are used today, but a real one, a personal one, that has to go beyond thought, or videos, or books, or pictures. They're very good, but we need a real faith-filled experience that touches our heart. So now, we all have responsibility for this? It means something to ponder. It's not just the responsibility of astronomers.

H\: Oh my goodness. It reminds me so much of Dante, and it reminds me also of a really amazing trip I took with some of my friends once to Zion National Park, which was the first time I was out there camping, and it's the first time I could see the Milky Way with the naked eye. And it's just, I mean, there's something about that that's so profound, like you're saying.

G: You don't find a substitute to that experience. I think we need to understand that. You know, we have five little grandchildren. I mean, what kind of sky are they finding when they are old? You know what I'm saying?

H: Yeah. Yeah. Well, okay. Speaking of your grandchildren, Brandon has told me that you have described the universe as a family. Can you tell me about that?

G: Well, Brandon has a very good memory, let's face it. Okay. Yes. When I give presentations to the public, I like to show connection between our human life experience and the cosmic life experience. I think it gives more sense of belonging. One example is

the connection between our human social nature, our family structure, and the visible social character diffused throughout the universe. There is. How do we know that? We have learned about the cosmic aggregation that we could describe as families, from extended astronomical sky observation--we don't make these up. They are observation, observation, and we find these. They have shown that stars, which are the basic building blocks of the observable universe, tend to form in groups, as pairs, or multiple systems, or association, or even very large star clusters, like the one we'll show you at the beginning. Up to hundreds of thousands of stars. Also, galaxies, which are the fundamental unit of the larger scale structure of the universe, are mostly found in groups or larger clusters. Here we talk about thousands of galaxies.

So, it is really kind of multifamilies and multi-communities of cosmic fabric. Yes. Brandon remembers well. Moreover, the universe has a cycle of life and death for all its components. Well, you know, you talked about Dante, they thought the stars were eternal, but that was the cosmology of the time, not the fault of Dante. I mean, science moves slowly. Just like human families do through generation, go through generations and generations. Okay.

Maybe I want to explain a little bit in the case of the stars. They are born in clouds of cold gas and dust following gravitational collapses. They go through life changing and evolving as they age. I do that too. But we all do. Eventually they die, just like people do. Also, stars leave a legacy, actually a most important one. We learn the stars are cosmic furnaces, burning hydrogen and helium into heavier elements, creating most of the chemical elements of the periodic table. When we studied chemistry in high school, no one told me they were all made in the stars.

H: Oh, wow.

G: Yeah. The order of that table, if you have a recollection, is amazing. It is perfect.

B: My memory, Graziella, is I would look at that periodic table and just cry because I didn't understand any of it. So I love how excited you're getting because it was the source of suffering for me.

G: It's amazing. Okay. So what's happening then? Oh, at the end of their lives, the elements forged in their interior will be scattered throughout space. And they end up in two ways, both in the evolutionary phase of planetary nebula, like our Sun will do. These are medium-sized stars. Or in the explosion of supernova. These are the massive stars. They want to be shown in the brilliant cluster, very massive. They will die soon, in a few million years. And they will die with an explosion of supernova, a tremendous firework. So we are talking about the cosmic recycling. You think we invent it now? No, no, no, no. It was there for billions of years. Yeah.

So because every time, the newly ejected stardust, see how fascinating-- people say stardust is used to form the next generation of stars and planets. Eventually stardust will be processed and make its way into the chain of nutrients that form and sustain living bodies on a planet, if they are there. In particular, our human bodies on the planet earth. So our Sun, for example, is a third generation star. Only old over 4.5 billion years. Okay. So we are all interconnected. That's why I said we are really a family

in the fabric of cosmic life down to the stars. Is this another good reason to appreciate the stars! So anyway, we have to remember, see, when we say, "So, we are stardust," I remember that Carl Sagan kept saying that. Which is fascinating to say. And in some way is true, but we have to remember we are above all that because we are created in the image of God. We cannot stop by the stardust. So we can repeat this famous logo. Yes, I *am* stardust, but only in a limited sense because we are more precious than that in the eyes of our Creator. So that's where you see the interplay of faith and astronomy keeps coming closer and closer.

H: Okay. I'm so sorry. This isn't even a science question. It's a Disney question.

G: It's okay. I'm still a human being.

B: Hannah has been waiting to ask a Disney question for the history of the podcast.

H: Oh my! I tried to push it down, Brandon. Okay. So there's a new … the newest Disney movie is called Wish, and it's about wishing on a star. And there's a whole song. I just pulled it up so I could read you the lyrics because I want to know what you think. It says, "Well, you don't have to look too hard. It's all around you and not too far. If you're trying to find out just who you are, you're a star. Do you know you're a work of art even in the deepest dark? If you really want to know just who you are, I'm a star." And I was with my mother-in-law watching this, and we were like, "This is the worst theological anthropology I've ever heard."

G: Unfortunately, I agree.

H: Well, okay. But then a week later, we actually, Brandon and I were at a service at Yale Divinity School where there were a lot of reflections about being made of stardust and this kind of thing. So tell me, how does this work?

G: Well, I think as I just mentioned, we don't have to *stop* there. Right. So it's just the beginning. Like for example, in the book that we will talk a little about, I try to connect with Genesis, and not to be concordist. I don't believe in concordism. I don't believe that the Bible has to concord with science at all. They are two different ways of understanding reality. But just to say, the Lord took the dust of the ground. And that dust came from stardust. I mean, no way.

H: Oh, wow.

G: So … “no way.” It was a process, it was elaborated. It was all kinds of re-managing, a kind of other life that they come and grow. So there are death and life, as I just said, it was a recycling. But in the beginning, the very original dust was formed in the stars.

So it is fascinating in the sense that when the Bible tells us the very deep meaning of human life, that does not really contradict the meaning of science. We have to talk

about meaning. We have to never talk about details. See, never talk about the particularity. That would be very wrong, because the day that we found something a little different, then our faith seems to collapse.

That was the problem of Newton in some way, because he thought, he believed in this gravitational force. He said, well, the universe doesn't collapse because God holds us. Then we find out that these are all kinds of different forces in the universe. So he said, “Oh, we don't need, the answer is we don't need God like Laplace said.” No, that would be the wrong way of going. So going back to your Disney song, it sounds pretty fascinating. Well, it's not completely true. I will say that. And that actually, I found the limitation when I was teaching a lot of my students, which were not a science major, I did teach for non-science major. I wanted to focus in concepts, not in formulas for them.

H: Right.

G: Because you remember concepts, you don't remember formulas. Well, anyway, all right. So anyway, so I realized that they will learn a lot from science fiction. And that was a problem. That was a problem, because they were seeing the reality in a fantastic way. Maybe one day we will find things, but let's move step by step.

H: Right. Right.

B: This is really fun. I'm wondering what it's been like, Graziella, to be a person of faith in your field. As an astronomer, I presume that in your academic community, there may be lots of people who have faith. There may be lots of people who are pretty insistent that faith and science can't have a complementary relationship. And so I wonder how that's been for you as a Christian. And especially I'm thinking about our leaders who are church leaders, they're rectors and pastors of parishes, and they are frequently as leaders in rooms and throughout the community with people who don't have faith. And so I just wonder if you could tell the story about your own faith and professional life and what it's been to be a part of conversations when your faith hasn't always been shared.

G: Right. Well, yeah, I can say this in the beginning. I always try to be myself. I don't escape from my reality of a believer. I try to be gentle and understanding, and very respectful. Like the course I taught recently, one of the person was atheist and at the end, we had a conversation which can be difficult, but kind. And in the end, he wrote me a note, and he said, “I'm really grateful that you always respected my point of view.” I think that's important. I don't have to convince anybody. It's only the grace of God that operates. But I have to be a witness. If I hide myself, behind convenience, I will really fail to be who I am. First, I'm deeply grateful for the gift of faith. That I received at the baptism. I think that was really special. And I thank my parents who offered my life back to God. I know now many times I have friends that say, “Oh, let the child decide when he's older.” And I do feel sorry for the child. I know it's not my responsibility, obviously. Oh, I can't even think of a life without faith because I never experienced that. God was always there when I had the humility to ask for his help. And also when I was too

distraught to have the energy to ask for. Looking back, I see that one way or another, God always reminded me that he was on my side. At times I understood that only later.

How did I transfer this faith experience in my scientific career? I think it became natural, but also intentional. Because sometimes, I had to make an effort, guided by prayer, to remind myself that my Christian values were above any scientific accomplishments or any scientific competition. It came down to a matter of priorities like honor God and love your neighbor. I have learned to consider Jesus' words reported in Matthew 6:33, “Seek first the kingdom of God and everything else will be given to you.” It's a powerful motto. I hope it's not a disrespectful word, *motto*, also for a scientist. The rest belongs to God. It will be given in the right way at the right time. Actually, I have another motto specifically for astronomers and for Latin lovers: *Deus Creatorem, Venite Adoremus.* “Come, let us adore God the creator.” I don't have ownership for this motto. It is carved on the wall at the entrance of the Vatican Observatory at the headquarters, at Castel Gandolfo, just outside of Rome. I really would recommend this motto also for stargazers. Come, let us adore God the creator. You know, I heard Brandon in one of your episodes that you are going to Italy soon.

B: It's true. It's the first time in 25 years.

G: Yeah, so maybe that's an interesting place to visit. It's just outside Rome. It's very easy. I think there is a train that goes quickly.

B: Is there? I've never been before.

H: Now I'm ready to book a trip.

G: I think especially actually, to see this very ancient observatory. You know, actually the Vatican Observatory is the ancient modern observatory started in the 16th century in Rome by the Jesuit College. Yeah, in the way of astronomy, the time of Galileo was pretty flourishing.

H: Well, yeah, this is what I've been thinking as you're talking about your faith and being an astronomer that I sort of went through theological education in an era where we have all these great theologians wanting to square science and religion and say, “Actually, you know, a lot of science has come from religion in certain ways and people like Galileo and Newton sort of were making discoveries from a faith-based framework.” How does that sound to your ears, since you know so much more about this than I do?

G: I think there is a misconception that is provided, absolutely. Yeah, the story of Galileo has been so much distorted, it becomes a myth for some ideological purpose. So I think knowledge is important. That's why when I was talking about in my book about the dialogue, we need to know what we are talking about. We don't want to be taken by the media, the popularity of whatever we hear on TV or whatever we are reading. We need to know the historical facts and we have to put everything in context. The famous Galileo affair is only to be understood in context. So that's more important.

H: Does Galileo show up in your book *Astronomy and Faith and Dialogue with the Universe*?

G: Two long chapters on Galileo.

H: Oh, okay, okay. The real Galileo.

B: It's time to get the story right and Graziella sets us all straight.

G: I know, I know, I know, I know. Anyway, this famous one, I think you asked me how do I see this, did you ask me the relationship between faith and science?

H: Yeah.

G: Well, I have to tell you that in my work as a scientist, and in my faith journey as a believer, I never felt I had to choose between the discoveries of astronomy and the beliefs of my Christian faith. What I knew that I just had to acknowledge where their authority ended, recognizing that they are different kinds of knowledge, with a different purpose. That's why I did not see any conflict between the two. But also I did not expect that they had to prove each other, either. That would be the mistake. They're usually just complementary. This perspective, not just my own, is shared by many scientists. Sometimes they are quiet about or they do speak up, fortunately. It is, a powerful example of a believer who was also a pioneer of science is offered by Father George Lemaître. Not many people know him, do you, Hannah? You, Brandon? After all the time I took to explain it at Holy Family.

B: There's so much I don't know. And there's more by the moment that I'm ignorant of.

G: You remember Big Bang, Big Bang? The Ring of Bang?

B: Oh, he's the Big Bang dude? Yes.

H: I'm with you now.

G: Okay. So Father George Lemaitre was a Belgian physicist and Catholic priest. People don't know it was a Catholic priest who first developed the Big Bang model for the beginning of the universe, you see? He said that, he said very clearly: "once you realize that the Bible does not claim to be a textbook of science, all the controversy between religion and science vanishes." So we need to know what we are looking for. This is crystal clear. So that's important. Unfortunately, there is a mistaken common perception about a supposed conflict between faith and science that is fostered by modern secularism. It thrives in misconceptions, like the one that we talk about Galileo. And they think religion is an obstacle for the development of science. When there is an incredible long list of pioneers, and I think I mentioned in the book, of pioneers of science, they were absolutely believers, really committed believers. So unfortunately, this materialistic vision considers only science the way to arrive at the truth. They are

missing completely the purpose of creation, you see, and the real meaning of the human life. Everything becomes disposable.

That's sad. That's really sad. Because you see, science can only answer the what, the when, and the how of a physical reality. Never answer the whys. They belong to a different level of knowledge. They belong to philosophy, and theology, religion. They need the introspection. They don't need the empirical proofs. You cannot prove those things empirically.

H: Now that's so helpful. And it's so simple when you say it like that, even communicating with students or whoever to say, well, the Bible is not trying to answer *what* it's trying to answer *why*. Right. Science is limited to the five senses, really.

G: Yeah, I mean, the scientific method that Galileo really pointed out so clearly. In my studies in Padua, I really was immersed in that. It's fascinating. He really knew what it means to do science, but also knew what it means to be a faithful believer.

H: This is blowing my mind because I grew up in a very conservative environment where the Big Bang was presented as something that some people believe, but actually it's an enemy of religion and God. And the way you're presenting it is like, no, no, no.

G: We don't know if it happens in that way. I mean, let's face it. It's not an event, it's a model. And as all the scientific models, it has a limit. But it's the model that explains what we observe. So there is no other way. If maybe, you know, now we have this Webb telescope that is incredible, and whatever we will put in orbit again in the future, maybe we will discover something different that will contradict a little bit in this model. Then we have to amplify and refurbish the model. You know what I'm saying?

H: Yeah.

G: So science is not the reality. Science studies the reality, gives interpretation of the realities. I'm a scientist and I trust science, but I know these limits.

H: Yeah.

G: Some say the Big Bang, if you see it as a model, which is proved by many, many facts, it seems that it's valid. We don't have an alternative. And it does explain a lot.

B: This is very refreshing. I'm very excited about all of this. Good, good. So I love the kind of partnership between faith and science that you're describing that lives inside of you, it sounds like, in this really, really vibrant way. And I wonder if you would help me because I had this experience over the summertime when I needed an astrophysicist to intervene. I had this one experience and it raised two important questions. My whole family came out into the backyard and we're all gathered together and we had this beautiful fire and we were just enjoying being outside together for hours and hours. The fire died down. We looked up and saw this marvelous sky of stars. And we saw what all of us concluded was a UFO sighting for about one minute. And it was

six or seven lights that were all blinking at the same time. A few minutes later we looked this up and this is one of Elon Musk's Starlink satellites. If you've never seen them, there's like six of them all at once strung together. And so my first question is, what are we doing about all of the junk that we have launched out into space? There are almost 10,000 satellites out there.

I was thinking about what you said, Graziella, that if in fact the universe is one of the ways that we have relationship with our creator, what does it mean that we're sending junk out into the universe and it's literally in the way of us experiencing what the creator has created? And I'm just wondering if you could think about first about space junk and then we'll get to aliens later. That's my second question.

G: I think that we go to the point we discussed before, we don't care. We don't care anymore about stargazing. Unfortunately. First we pollute with the light. Now we pollute with all this junk that we place in space. And we think about just convenience, technology, communication--which is good in some way. I think we don't have a balance of things if you don't know, like John Paul II said, that we have two wings to fly through life. One is the reason and one is the faith. So if only we think about our own human reasons, we can create all kinds of other reasons, that we think they're valid, but they are excessive and they are abusive. So I really don't know. We have to create more conscience, more morality in what we do. I think that's a very important motto that I will say, "Seek ye first the kingdom of God" is really true. So, are we seeking the kingdom of God when we throw all this in space? People don't ask anymore the question. I think we go to the bottom line that's always the same. We don't grow up anymore with the sense that we are accountable to God.

B: Yeah, I was shocked to discover there is no policy, there are no rules, there are no laws governing what we send out into space in terms of of debris and refuse.

G: I think it's very hard to be implemented. I'm not sure what they are. I know there are policies if we find ever a connection with some intelligent extra-terrestrial life. No one can do anything. There are some kind of rules. You can't go to harvest anything. Then it's complicated, but that's so far, far away. I don't know if it ever happens.

B: Well, you mentioned it and certainly I brought it up too. My kids will be upset if I spent an hour with an astrophysicist and didn't talk about other forms of life. I mean, you must get asked this at every cocktail party you go to.

G: I do have a chapter in the book, "Are we alone?" Actually, well, we don't know. That is the honest answer to your kids, we don't know if we are alone. We could be not alone. We could be alone. Because science is based on proofs; we don't have any proof yet. But we have these new big space telescopes, the Webb especially, the last one. We already discovered, with other instruments in space, planets that in principle could be hosting life. We are talking about bacterial life, I mean. Intelligent life, there is no sign whatsoever, with all the years and years of experiments, of technological signals, so far. We still say so far. So what they are trying now to do, they have to monitor if there is

atmosphere. See, we know life only as it happens on this planet. It could be a different kind of life experience that we don't know in the universe.

That's why they are trying now with this project to have a platform on the moon, move to Mars, but it's a very, very long way to go. We know the solar system doesn't host any life. If it does, it's very minimal bacteria somewhere in some ocean below the crust of Europa or other things. It seems pretty barren in the solar system. The next star, which is called the Proxima Centauri, which is four light years away, which means it takes a long time just for the light to get there. I don't remember. I think the final calculation takes thousands of years for human beings, if ever, to get there with an instrument and spacecraft. It's a variable star, it's really unstable. It does have planets. So I really don't know how we can get anywhere. Those people, if they are there, they cannot get here. So space communication is tough. It's good to keep exploring. I'm not against it all. We should continue because you never know. We have a lot to do on our planet Earth, actually. What do you think?

H: That's true.

G: Plenty to do. Let's not consume all the energy in space.

H: Well, we keep dancing around your book, so I wonder if you could tell us a little bit about what prompted you to write *Astronomy and Faith in Dialogue with the Universe*.

G: Yes. Okay. The idea of a book on the complementarity of astronomy and faith for unveiling the mystery of the universe came to me several years ago, precisely in 2009. At that time, the astronomical community was celebrating the International Year of Astronomy, I don't know if you remember, proclaimed by the United Nations General Assembly. The purpose was to honor the astronomical discoveries made by Galileo, our famous Galileo, with his first telescope. It was 400 years before, so that was the anniversary. That was a momentous event that marked the beginning of modern astronomy in Padua. It changed dramatically our human perception of the universe. When he found out that the Milky Way was not just this beautiful stripe of milky-ish things, but clouds with just hundreds of stars, he was shocked. In the midst of all that excitement produced by the presentations, and activities, (I was part of the committee, at the Department of Astronomy to organize things, and we wanted to celebrate the scientific revolution initiated by Galileo), I did not hear voices praising the deep faith that nourished Galileo's life. As if it was irrelevant or even worse that it never existed. But I knew that was not the case, because I studied, I worked for years immersed in the legacy left by Galileo in Padua, and also, I read some of his original scripts. For example, in a letter that he wrote to a friend, Galileo wrote that in his scientific discoveries he learned more with the help of divine grace than with his telescopes. I mean, isn't that amazing? You know, Galileo was very proud of his telescopes. So, was that awareness for me, that Galileo was being presented in a distorted way, and I'm affectionate to Galileo, and I feel close to him. The Department of Physics, where I studied, I worked, is “Galileo Galilei.” So, Galileo was there every single day for me. So, that prompted me the desire to write a book, bringing together the faith testimonies of

pioneers like Galileo, with their unique scientific accomplishments. They really go together. Then I realized that in just over 10 years, while the discoveries from the space telescope were becoming more and more popular, and appreciated, the personal connection, the one that we talked before, with the starry sky was becoming more irrelevant, both for the growing of light pollution, and for the emphasis given by the popular media, to the power of the human mind--ignoring that every good thing is a gift from God. So, that's really a loss.

I needed to focus both on discoveries on modern astronomy, and on the central tenets of the Christian faith, together with the faith testimony of famous scientists. Can I read the prologue quickly, just the first part?

“Dear friend, I wrote this book for you. When you search, the night sky with wonder. When you search for God in the wonder. When you search for the wonder of truth, we will search together.” So, I really opened my heart in the prologue. Then, I committed myself in the book to provide the readers with the basic scientific and religious objective information. I was thinking especially about beginners, so it's an easy book to read, you don't need any scientific preparation. I wanted people to become comfortable, while we entertain a fruitful dialogue between astronomy and the Christian faith. And we have to remember, I am very convinced, that dialogue can only be productive, if we know what we are talking about. So, are you going to read the book, Hannah?

H: Yeah, absolutely.

G: I see. I think Brandon has a copy and I'm very happy to send you one.

H: Oh, that's so lovely. So lovely. Okay, I have a crazy question for you before we have more sincere questions for you. Astrology. Is it good? Is it neutral? Is it evil? What's the deal?

G: Well, I don't judge anything evil per se, because it depends on what's in the heart of the person. So, I think most of the time, it is ignorance. Believe it or not, the Yale students, I mean, sad to say, I had the class, I would say maybe one-third to half were looking at the horoscope. So, we had a homework one time. I gave it, yes, I gave it to them: You know when you're born, you take a diary. Don't look at the horoscope this week, ever. Every day, write down what's happening to you. And then, after a week, go to check, go back and read the horoscope. Well, they all came back and said, "Well, it didn't really work, really? It didn't really work." Yeah, I know Astrology. First, it was invented thousands years ago by the Babylonians. And they didn't know much about, really, the scientific method. So, we shouldn't accuse them in any way. Like, when we talk for us, when we talk about the three Kings, for the Epiphany, we call them astrologers, they were the scientists of the time. I mean, they were not people that didn't understand reality. They were looking for, and they were using whatever instrument they had available at that time. But they were open. You see, you need to be open. Also, when your knowledge is limited, be always open. Don't get locked in in that.

Anyway, going back about astrology, it doesn't have any scientific basis for many reasons. First of all, we just learned how the stars are so far away and the planets. How

could they have any influence on us? We know the physical laws. How could they affect us? At that time, they believed the cosmic bodies were divine. That's completely different. That's why Genesis, the story of creation, made a tremendous difference because those bodies were created by the eternal divine God. Those were not anymore divine beings. So, that's very important. So, I think the real message of Genesis is that. Just forget about the details, they belong to the understanding of the culture. But the message is very profound. It's God, the creator. Everything else depends on God. So, they don't have any power on us, or on anything.

Of course, there is also a very practical thing. Because of the rotation of the axis of the earth, the sun doesn't rise anymore in the constellation that we say the month of the zodiac. So, when you say you're a Capricorn, you are not even more a Capricorn. I mean, the whole thing is a little messy. I will recommend the young people, especially, just forget about astrology. Is it time, money, energy, or anxiety. Is the wrong direction, really? But it's a choice everybody has to make. Again, give information. Tell him the truth. Give him the scientific basis. Do you want to be scientific? Well, that's a choice you make.

B: I have a burning question.

G: Am I burning yet? No, I'm okay.

B: And my burning question comes from this observation that we sometimes caricature the relationship between faith and science. I think actually scientists and science itself often are the folks who stand in the midst of mystery, most admittedly. And I'm thinking in particular about gravity. And so, I'm wondering, maybe you can remind us a little bit about how gravity works, because we know that it works, but we don't really understand it. It's a mystery. And so, I'm wondering, and maybe I'm not even understanding this correctly, but I'd love you to explain to me how gravity works if we even know that. And if we don't, then it seems to me that scientists are actually quite good at standing in the face of mystery and not knowing.

G: You said something very important. There are more mysteries in science than answers. And what amazes me all the time, our scientists are very willing to accept the mystery. Think about the dark matter or the dark energy. But when you start to talk about the mystery of God, they say, "It's your invention." Really? Yeah.

B: Oh, thank you for hearing my question. Much better than I could ask it. Yeah, yeah, go on.

G: No, no. So, I say, we are talking about in general; I mean, gravitation is very much dealt at the cosmic level. At the local level, we still talk about the Newtonian force. And it's something that is intrinsic to matter. So, that's a look. But at the cosmic level, when we talk about these extreme distances, we enter into the realm of general relativity. So, that is really mathematical tool and vision. Again, as I said before, not necessarily it does happen as we think, but as we think it does explain the phenomenon. So, we all see it in the point like the Big Bang. So, there is this tapestry of

space and time, the space that Einstein fathoms. Actually, the beginning came from Galileo. Einstein was the avid reader of Galileo as also was Newton. Because Galileo was the first one to understand the relativity of motion. Nothing is absolute. It's relative to the observer. Really, Galileo was a pioneer in many, many ways. So, he didn't see anymore the gravitation as really a force, but as a phenomenon that will come in this fabric of space and time. So, where there is a mass, there is this warping of space and time. The idea to see space and time connected is very hard for us. Very hard. I was only telling my students, we don't have to understand the rationale. We have to trust that it works mathematically.

So, again, talking about this famous mystery that we look at, so many theorems in mathematical quote-unquote “dogmas,” we have to accept. And we have to even prove. You can prove them. They work. And then you use them. I mean, that's really a key thing. So, understanding really the nature of gravitation, I will say it is very impossible just to understand the essence of gravitation. We can understand how it works. As I told you, this warping of space and time … that's what we need to accept: the limitation of our human mind. I don't remember who was, maybe it was Benedict XVI who said, "The great achievement of the human mind is to understand that it has limitations." I mean, if we think we can comprehend everything, I think we fool ourselves.

H: Yeah. Yeah.

G: Well, we have to work hard. It doesn't mean to sit back on the couch and let things happen by themselves. We still have to work hard. I think humility is quite a virtue for everybody. And you know, talking about the mystery of the dark matter that was brought it up and the dark energy, they seem that they're operating in some way. That's why we think dark matter exists, because there are so many phenomena that are happening. We don't have any other way to explain this very extra enormous quantity of matter. Only 5% in the universe is what we call normal matter. So everything else is dark matter and dark energy. And also this, because now we know with the Big Bang model, one of the proofs for the Big Bang, indeed the universe is in expansion. Space is in expansion. How can you understand it? I remember one of my students said, where is it expanding? Where? Not in your backyard. Nowhere, it is expanding in itself. It's just expanding. And the more it's expanding, the more space is created. And now with this business of the dark energy, the more it is expanding, the more dark energy is present because it's intrinsic to the space. Okay, so he said, do we need to understand all this? Not really. If you are not working on this model, I mean, if you are, you better make some sense. But if you're just a listener, why? I said “There are so many mysterious things in the universe that tell us of an incredible creator.”

Okay, then there are the people that want just to disregard the creator. They are famous scientists actually, very popular. And they said, “Well, we don't need God. The law of gravity is what makes the universe exist.” Okay. Then I asked, “Who started the law of gravity? Where is it coming?” “Oh, we don't need to find where it's coming.” “Okay, so it's our new divinity then.” So if it doesn't come from anywhere, it's a prime being. So it is a prima causa, a causa prima. So that's what it is. So you see, you got your kind of contradiction. Bottom line, you need to go to the depth of the truth to move

forwards. Otherwise, you're caught in all this labyrinth of your mind. And probably more prayer time, I suppose, would be helpful.

H: Well, this is exactly what I was hoping to ask. I'm sure Brandon has an ultimate question for you. So let me give you a penultimate question. Before we hit record, you showed us this gorgeous image of where, and you said, “Find the earth in this image.” (link "View of the Earth from Saturn"). And talked about how that affects your prayer life. So I wonder if you could share with our listeners how being an astronomer affects your prayer life.

G: As I mentioned on the origin of my vocation as an astronomer, I find the more peaceful time to prayer, is being alone under the stars. I say alone, not to be selfish. Sometimes it's good to be in a group, certainly with my family, with my children, absolutely. But sometimes I just need to be by myself. I just feel the embrace, because after all, God decided I could live in this wonderful universe, to be part of this amazing creation. I mean, it's filling me with hope, really true hope, because it's grounded in God. I really would like other people experience it. That's why I'm trying to encourage people to take time and feel that embrace of the mystery. “Who am I? Who am I? What is all my solitude? What's the purpose?” So these questions, they are very hard that you cannot ask yourself watching TV, I mean, really, you have to immerse yourself and it's paying back immensely. So I do hope in this very confusing time, not a restful time, a sad time, wars and everything. If more people decided to find the time to place themselves under the stars and the presence of God, because that's a fundamental, they will create a bridge of solidarity among them. Wherever you go, you find the same stars. Is another burning question, is there anything left in me to be burned? I don't know.

B: You anticipated my question about hope and you said it just so beautifully. I'm so thankful. You, Graziella, are a star in the constellation of our podcast episodes.

G: Oh my goodness. A lot of pressure on me.

H: With the pressure and the burning, it all sounds like star jokes now. Right.

G: So am I a medium-size star? I hope a very tiny, because then I live a long time.

You know, if I am a very dwarf star, I can live even longer than the sun. But if I'm a big star, please don't. I live a short time, only a few millions years. That’s too short!

B: Thank you for listening to The Leader's Way. We hope you were encouraged and inspired. To learn more about this episode, visit our website at berkeleydivinity.yale.edu\podcast.

H: Rate and review us and follow the podcast to make sure you never miss an episode. Follow Berkeley@Yale on Instagram for quotes from the podcast and more.

B: Until next time,

H: the Lord be with you.