

STRIKING A CHORD

by Judy Hill



When music and science converge

“

If I were not a physicist, I would probably be a musician,” said Albert Einstein, who nicknamed his violin Lina and was famously ardent about Mozart and Bach. “I often think in music,” he added. “I live my daydreams in music. I see my life in terms of music.”

The Nobelist was hardly alone among his fellow scientists. Music and science, it seems, have gone hand in hand through the ages: physicist Richard Feynman was an avid bongo player; Russian chemist Alexander Borodin composed Romantic-period music; and Queen’s guitarist, Brian May, is a respected astrophysicist. Here at Caltech, a sizable number of scientists also wield a bow, pluck a string, or tickle the ivories. Two in particular have forged powerful links between their research and their musicianship.





or planetary scientist Konstantin Batygin (MS '10, PhD '12), the parallels between music and science are clear. "If you look at a scientific idea, it's just a riff," he says. "It's a melody, but it's not attached to anything. The way that a scientific idea grows into a hypothesis, into a theory, requires all of this additional work where you take an idea, you build it, and you see how it fits in. It's the same with music."

Batygin has been in the spotlight in recent years for his work with Caltech colleague Mike Brown that hypothesized the existence of an as-yet-undiscovered ninth planet ("Planet Nine") in the solar system. That work is deeply exciting to Batygin, but recently he has been just as excited about classical music.

Batygin's forte, he will quickly point out, is not classical music. With his band Seventh Season, he plays hard rock, a genre he has passionately espoused since around the age of 11. Nevertheless, earlier this spring he traveled to Florida to play guitar on a piece of music written by Miami Symphony Orchestra conductor Eduardo Marturet and inspired by Planet Nine.

Batygin met Marturet when both were selected for the Genius: 100 Visions project, which collected the insights and visions of top minds around the world in celebration of the 100th anniversary of Einstein's general theory of relativity in 2015. A mutual acquaintance mentioned the ninth-planet hypothesis to Marturet, and the conductor seized on the idea of writing a Planet Nine symphony as an extension to Gustav Holst's Planets suite.

Batygin was not completely surprised that Marturet felt compelled to write a new symphony after learning about a hypothetical ninth planet. "I think there is, among classical musicians, a thing about the planets and the Planets suite," he says. "The other intriguing thing about Planet Nine is that it has this remarkable property where people can resonate with it. It's something that astounded me when we first wrote the original paper. It didn't just get media attention; it seemed to me that people were truly captivated. I think it's at the right intersection of mysterious and tangible. It combines those two curiosities of the human condition in such a nice way, the notion that there's something there in the solar system, in our home solar system, that has yet to be discovered. I think because of that, there's a real magnetism to the Planet

Nine hypothesis. That's why you can go out and make art out of it."

To get ready for Miami, Batygin practiced like never before, since, he says. "It turns out being pretty good at rock 'n' roll isn't the same as playing in the symphony."

Music has always been part of Batygin's life. His father, Yuri, also a scientist, had a band, so Batygin grew up watching him play guitar, though, as he notes, "it wasn't really proper to play rock music in the Soviet Union." When the family moved from Moscow to Tokyo, he attended a Japanese elementary school and, as he recalls, basically pretended to play the keyboard amid a "bunch of third graders who were actual virtuosos, just perfect, on every instrument."

He started to learn guitar as a preteen, because, he explains, "that's the time when your brain starts to have weird hormones, and you need to express yourself through A minor, primarily." That was also when he discovered Metallica and became fascinated with heavy metal, both for its technical challenges and the way it pushed the art form to the next level. For a while, he says, he had no other interests than to start the next Metallica.

On the off chance that plan A did not work out, and with a natural affinity for physics, he enrolled at UC Santa Cruz. "I ended up absolutely falling in love with what I do now," he says. He attributes that to his undergraduate adviser, Greg Loughlin, who also, as it happened, played in a band. "I ended up doing cool research and published a paper with Greg in my final year of undergrad," Batygin says. Graduate school at Caltech (he received his PhD in planetary science, working with Dave Stevenson and Mike Brown) followed, and he never looked back. He also kept playing.

"Music isn't just a way to relax, it's a way to keep the imagination part of your brain going in ways that are very correlated with science," says Batygin. "Of course, they're distinct, but the process through which you come up with an idea and then let it take hold and develop in your mind is exactly the same. I take the same approach to writing scientific papers as I do to writing music."

Seventh Season plays locally at Pasadena's Old Towne Pub. "The spirit of rock 'n' roll is very much alive in the Old Towne. The symphony is never going to perform in the Old Towne, but I had this remarkable opportunity to bridge the divide. Who would ever have thought that being a professor at Caltech would lead me to playing in the symphony?"

Les Deutsch

(BS '76, MS '77, PhD '80)

Deputy Director, Interplanetary Network, JPL



Instruments played/owned: Organ, trumpet, saxophone, clarinet, piccolo, flute, drums, violin, banjo, piano, French horn, euphonium

Caltech connections: I've played just about every instrument in the Caltech-Occidental Wind Orchestra. I've played most of the instruments also in the Jazz Band. Starting in 1974, I've been the Caltech organist playing at every commencement.

I've also done a lot of composing for Caltech over the years. For our 100th anniversary, I composed a Centennial Suite, which is a four-movement suite for band that was performed at Bandorama. In 2017, I did a 20-minute piece for Concert Band in honor of the 40th anniversary of Voyager.

Outside of Caltech: I also play in a professional Dixieland band called the Night Blooming Jazzmen. I wish I'd thought of that name.

Musical background: I started organ lessons when I was 11. My father was a chief scientist at North American Aviation at the time and they were looking for something to apply their electronics toward in the commercial market. He proposed they work on a digital electronic organ, something that didn't exist then. In around 1970, the product was released by Allen Organ Company.

Solos vs. teamwork: As an organist, typically you play alone and you don't get that experience of playing with a group, so playing in the bands is important to me. The same is true in doing research. There are things that you do by yourself, and there are things that you do as part of a team. The two fields are very analogous.

Konstantin Batygin and Lucy Jones share notes in Beckman Auditorium.



A

s one of the world's most influential seismologists, Lucy Jones is a familiar face to residents of the Southland. But while her post-quake TV appearances have been seen around the world, she is less well known as a dedicated player of the viola da gamba, a stringed instrument similar to the cello.

“As we go through the really accelerated times of rising temperatures ... I tried to make it sound really frantic.”

Recently, Jones, who was a seismologist with the United States Geological Survey (USGS) for 33 years and is now a visiting associate at Caltech, combined her scientific knowledge with her musical affinity, creating a piece of music based on climate-science data. She then performed the work with three fellow gamba players at L.A.'s Natural History Museum on February 1, 2019.

Jones credits her musicianship to her Welsh family. Growing up, she says, “my grandparents would come over for dinner, and instead of saying grace, we’d sing it. In parts. A cappella. It was just part of our family life.” Jones took up the cello in fourth grade and discovered chamber music in high school, beginning a lifelong love of small-group ensembles.

As an undergraduate at Brown, studying physics and Chinese, she stumbled across a Renaissance-music group and took along her recorder to audition. Once the adviser discovered she was a cello player, he offered to pay for her to take classes on the viola da gamba. “My joke was that once I discovered the 17th century I never wanted to return to the 20th. It’s music I love, and the gamba gave me a chance to do small-group work.”

While at the USGS, she played on and off with Caltech’s chamber music program: less when her children were small, more once they were grown. She began attending Viola da Gamba Society of America meetings and joined the Los Angeles Baroque, a community baroque orchestra that performs several times a year.

In 2013, Jones started working on her own composition, inspired by a YouTube video in which a cellist demonstrated how much Earth’s temperature had been rising by scaling it into pitch. “It was cool,” she says, “but it was just

chromatic; it wasn’t music, just random notes.” She was interested in creating something more musical. Her first efforts ended up in the trash can, but the idea lingered, and when she retired from the USGS in 2016 she picked it up again, dividing her time between composing and writing her most recent book, *The Big Ones: How Natural Disasters Have Shaped Us*.

Jones had studied a 17th-century musical genre called In Nomine, in which one instrument plays a simple theme, or base song (from the Latin phrase *cantus firmus*), and other instruments play more complex lines in counterpoint. She used that form for her composition on climate change, taking the temperature data and turning it into the base song.

“It’s a little long,” says Jones of the final composition, “because it’s 138 years’ worth of data, since 1880, one measure per year.” Back when she first composed the piece, she had scaled it over three octaves, a wide dynamic range. “You’re in the lower octave for the first 60 years, and then you’re in the next octave for the next 50 years, and then it hits the top of the third octave in 1998. Then it bounces around for a while below that. Nineteen ninety-eight was just one of those freak hot years.”

When she came back to the piece and had the opportunity to update it with new data, she realized it had gone up another fifth. “In 2016, it’s off the end of the fingerboard,” she notes. “Luckily it’s a harmonic, so you can play it just by resting your finger on it. It makes it really dramatic how much it’s changed at the end.”

As a scientist who studies data about our planet, Jones says that when she looks at the figures on climate change she is “terrified” by what she sees and “appalled” at the lack of response. “We aren’t scared enough,” she insists. One of her goals, then, was to convey feelings about the data in musical form. “As we go through the really accelerated times of rising temperatures, I started using multiple motifs and intentionally having them step on each other. I tried to make it sound really frantic.”

She also rewrote the music so it dies away toward the finale. “I sort of strip out the chords and end up on a single note at the end for the uncertain future.”

Inspired by her foray into composition and buoyed by the response (the Viola da Gamba Society of America has already published the sheet music), Jones is currently working with a movie composer/filmmaker to build a compelling narrative for a performance that will blend science and music to explore the implications of climate change and what we can do to change that trajectory. 

Julia Greer

Professor of Materials Science, Mechanics and Medical Engineering

Instrument: Piano

Caltech group: A trio with cellist Monica Kohler and violinist Tony Kukavica (Class of '21).

Why music is still part of her life: I’ve been playing since I was 5 or 6. I grew up in Moscow. Every little Russian girl has to take piano lessons. I just never quit. As amateurs, we have the best of both worlds.

Because we’ve built the tool set to get to the technical level that allows us to actually produce the kind of sound that we want to hear, it’s enjoyable. When you don’t quit, you preserve that skill. You preserve the mechanics of your fingers, your digits.

Why she didn’t become a professional musician: I just always had something else going on. And I was in a math high school as well. In Moscow, you have to make the decision whether or not you’re going to be a professional when you’re 14. It’s very young, and I wasn’t ready for that.

Musical highlight of her life: When I lived in the Bay Area, I was the principal pianist for the Redwood Symphony. I got to play Brahms’s second piano concerto with them and that was probably the highlight of my whole career. It was amazing to play. That’s a monumental piece. And it’s so beautiful.

How music helps her be a better scientist: It allows your mind to relax. We’re all of us type A, overachieving academics. We’re constantly thinking about work and about our students and about proposals. When you play the piano, it allows your mind to let go. It’s just me and the universe and the music.



Paul Asimow

(MS '93; PhD '97)

Eleanor and John R. McMillan Professor of Geology and Geochemistry

Instruments: Piano, flute, tuba, conducting

Caltech groups: Wind orchestra

His Caltech musical debut: I auditioned for the concert band on flute, and because I knew how to conduct [then band director] Bill Bing gave me the wonderful privilege of being permanent guest conductor and doing one piece of my own choosing every semester.

On working with Glenn Price as band director: He’s taken a good group and made it outstanding, with more ambitious programming, larger-scale works, and higher expectations. Now I definitely have to show up for rehearsal every week prepared and on my best game, because he can tell if you’re not!

Why it’s worth his time: I’m eternally grateful to be here at Caltech because the musical groups are open to people other than students. As a tuba player, if I weren’t here, I certainly would have given it up years ago because I wouldn’t have had an opportunity to perform.

How playing the tuba and conducting are not so different:

The tuba is the bass line. It’s not necessarily what people are listening to when they’re listening to a group. But to me, playing the bass line well and conducting a group have a lot in common. You have to be aware of the ensemble so you’re playing at the right volume, and you’re also leading the group and giving them cues in rhythm and in pitch.



Read more about Caltech’s musicians and hear their music at magazine.caltech.edu/post/striking-a-chord