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Music Composition in Dialogue with the Cosmos: Gustav Holst, Paul Hindemith, and Symphony of the Sun by Austin Ali

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Gustav Holst, Paul Hindemith, and Symphony of the Sun by Austin Ali

A dissertation submitted in partial satisfaction of

the requirements for the degree Doctor of

Philosophy in Music

by

Austin Huvishka Ali

2025

ABSTRACT OF THE DISSERTATION

Music Composition in Dialogue with the Cosmos:

Gustav Holst, Paul Hindemith, and Symphony of the Sun by Austin Ali

by

Austin Huvishka Ali

Doctor of Philosophy in Music

University of California, Los Angeles, 2025

Professor Ian Krouse, Co-Chair

Professor Richard Dane Danielpour, Co-Chair

This dissertation investigates music composition in dialogue with the cosmos, using the total solar eclipse of April 8th, 2024 as both the scientific inspiration and narrative framework for an original orchestral work. Its central creative project, *Symphony of the Sun*—a thirty-two-minute tone-poem triptych—traces the eclipse across three movements. The accompanying scholarly treatise situates this work within a broader lineage by examining Gustav Holst and Paul Hindemith, composers who each turned to the solar system as inspiration. In analyzing their approaches through the lens of science and human-centered narratives, I articulate how my own symphonic writing extends, adapts, and diverges from these models. The final chapter reflects on my aesthetic and compositional strategies through which the April 8th eclipse is rendered in musical form in *Symphony of the Sun*.

The dissertation of Austin Huvishka Ali is approved.

Robert William Een

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University of California, Los Angeles

2025

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In loving memory of my high school band director and mentor **David B. Herring**, whose Symphony No. 1 *Hidden in Darkness* inspired me to explore the cosmos in music.

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To the **UCLA Graduate Division** for the Graduate Research Mentorship, providing a fellowship that afforded me the valuable time to work on my symphony as a full-time student at UCLA.

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And finally, to **all my lifetime of teachers** who invested in my knowledge of math, science, the humanities, and music, to synthesize these fields in this dissertation. Thank you.

VITA

Hailing from Texas and based in Los Angeles, **Austin Ali** is a composer, trumpeter, and arranger who writes music full of energy and curiosity. Inspired by the beauty of nature and the cosmos, his music bridges jazz, contemporary classical, and transcultural influences to create a fresh and deeply personal world of sound.

Austin has collaborated with many distinguished artists including GRAMMY-winning soprano Hilá Plitmann, Carpe Diem String Quartet, Diotima Quartet, Bridge to Everywhere, Salastina, and a growing number of orchestras worldwide including the Austin Symphony, New Conductors Orchestra, Tampa Bay Symphony, Columbus Symphony (Indiana), New England Philharmonic, Orchestra Senzaspine, and Filarmonica Arturo Toscanini.

As a cross-genre collaborator and Hollywood transplant, Austin's original film score premiered at the John F. Kennedy Center in 2025, and his jazz and pop arrangements for Big Wy's Brass Band and Trombone Timo have gained millions of views online. Highlights include performing for the President of Costa Rica and opening for Stevie Wonder with Big Wy's Brass Band at Circuit of the Americas in Austin, Texas.

An avid arts education advocate, Austin serves as Vice President and Composer Mentor at Los Angeles Inception Orchestra. He holds his B.A. and B.M. from the University of Texas and his M.A. and Ph.D. (ABD) from UCLA. His works are available at austinali.com.

CHAPTER I: INTRODUCTION

1.1 Connecting the Personal Experience of the Cosmos to *Symphony of the Sun*

"Science cannot solve the ultimate mystery of nature. And that is because, in the last analysis, we ourselves are part of the mystery that we are trying to solve. Music and art are, to an extent, also attempts to solve or at least express that mystery. But to my mind the more we progress with either the more we are brought into harmony with all nature itself."

—Max Planck, physicist, musician, Nobel laureate, and father of quantum mechanics

The total solar eclipse of April 8th, 2024 aligned more than the Sun, Moon, and Earth. It joined my hometown, family, loved ones, and me—fusing the celestial and human into harmony.

I spent seven years planning for the Great American Eclipse of 2024. I began with the previous American eclipse that occurred in August 2017. While the path of totality (the narrow band of Earth's surface covered by the Moon's shadow) did not cross my hometown of Dallas in 2017, the penumbra (partial shadow of the Moon) did. On August 17th, 2017, with the aid of eclipse glasses, I witnessed the Moon take a bite out of the Sun's disk, signifying the cosmic event and sparking my infinite curiosity. Upon learning that the next total solar eclipse in the United States would pass directly over my home, I created a Facebook event for an eclipse party seven years in the future. It would take place on April 8th, 2024.

After the 2017 encounter with the extraterrestrial, my obsession for astronomy and planetary science skyrocketed. I invested in a telescope with my best friend and enrolled in science courses in addition to my music composition courses at the University of Texas at Austin

(UT). Through the interdisciplinary program offered at UT, Plan II Honors, I wrote my undergraduate thesis *A Musical Portrait of Triton, the Rogue Moon of Neptune*.

I continued into graduate studies in music composition at UCLA, emboldened to further my journey into the cosmos through music. I immediately began work on my first orchestral cycle, *The Face of Venus*. Over my two-year master's program, I completed and premiered all three movements, totaling just over fifteen minutes of orchestral music based on scientific papers published about Venus in September 2020 (Greaves, et al.). The work became my master's thesis.

As I returned to UCLA to pursue my PhD in music composition in 2022, I set my sights on my next celestial tone poem. Each of my degree-culminating works expanded outward in scope and scale: my undergraduate thesis focused on Triton, Neptune's moon, in *Triton, the Rogue* for wind ensemble (7 minutes), and my master's thesis on Venus in *The Face of Venus*, an orchestral suite (15 minutes). Naturally, my doctoral dissertation would complete this cosmic trajectory with a thirty-two-minute, through-composed symphonic fantasy on the star at the center of our solar system—the Sun.

In January 2023, the *Symphony of the Sun* idea began to germinate as I visited the desert for the first time on a road trip from Los Angeles to Las Vegas. The landscape overtook me and inspired me to freely improvise orchestral music directly into my notation software. This excerpt became the two-minute *Adagio* introduction to the symphony, spurred by my awe-inspiring encounter with nature, and encoding the DNA to the remainder of the composition.

I completed the first draft of the symphony's first movement, "Totality," in October 2023. Completing this draft coincided with another eclipse, much like the one in 2017. On October 14th, 2023, I visited Griffith Observatory for the partial solar eclipse and observed the

Sun for the first time in my life through a solar telescope. I could clearly see the sunspots dotting the surface, the fiery solar prominences emanating from the edges, and the imposing figure of the Moon slowly overshadowing the Sun. The event signified the celestial clock ticking ahead as the heavenly bodies renewed their cycles, foreshadowing the next year's perfect alignment on the same plane.

In April 2024, I flew back from LA to Dallas to attend the eclipse gathering I had planned seven years earlier. Musically, I had completed the first few drafts of another movement, "Unveiling Light," which would eventually become the third movement. On the day of the eclipse, dozens of guests arrived at my parents' home, traveling from San Francisco, Seattle, New York City, and across Texas. I felt the personal significance of joining my family and closest friends in this once-in-a-lifetime experience. The musical, astronomical, and personal had aligned.

Like an opera, nature played out with suspense of epic proportions. In what can be described as a miracle, the clouds surrounding the sun vanished approximately two seconds before the moment of totality. In a moment of pure exhilaration, the crowd cheered and screamed with joy and awe. The sky darkened and turned to a deep shade of navy blue as the temperature rapidly dropped and the animals began to fall asleep. The Sun's mighty corona, the stellar atmosphere only visible during an eclipse, radiated outward from the Sun-Moon duet. Due to the Moon's shadow, the onlookers could safely take off their eclipse glasses and observe the Sun in its full coronal glow. The ambient brightness dropped enough so that the stars and planets became visible to the naked eye. In fact, all seven remaining planets, with the Sun and the Moon, were present in the daytime sky, alongside the Earth beneath our feet. As the Sun re-emerged from the shadow of the Moon, the birds began to chirp, as if the day had begun again.

In the aftermath of witnessing totality for the first time, I realized the significance of the event. I had brought together people from across the country and different phases of my life into unity. Achieving this harmony reminded me of the effort in organizing a musical performance—especially a world premiere of a large ensemble composition. Since 2017, I had a vision of how April 8th, 2024 would take place. I knew the exact position of every planet, star, and moon that day by heart. I knew to the second exactly when totality would strike. All I had to do was convince forty people to join me in my creative vision and lead them to the miracle of nature. The eclipse of 2024 completely encapsulated my artistic ethos and affirmed my reasons for making a career as an artist and completing and premiering my symphony.

In my expanding research about the Sun, I realized that the solar dynamics I studied connected back to the eclipse. Just over a month later, between May 8th and 10th 2024, some of the most powerful solar flares in decades erupted in quick succession, launching a coronal mass ejection toward Earth and producing an intense geomagnetic storm. Though clouds in Texas blocked my view of the aurora that night, I observed a rare Jupiter-sized sunspot in broad daylight with my eclipse glasses. My observations reignited my curiosity and led me to study NASA mission data, the solar cycle, and even witness another geomagnetic storm from Southern California later that year.

In an eclipse, the act of obscuring becomes a revelation. Like a harmonic on a violin, when the node on the string is covered, the higher partials are sonically revealed. In fact, Albert Einstein made use of this profound truth during the total solar eclipse of May 29th, 1919. Eight years prior in 1911 Einstein had predicted in his theory of General Relativity that objects with mass deflect light through their gravity. During the eclipse, Einstein was able to directly observe evidence of the gravitational light deflection effect by measuring the path of light from stars passing near our Sun. The results from his observations and solutions to his equations of General Relativity led to his worldwide fame. In essence, the total solar eclipse covered the Sun but revealed a deep truth about the universe.

In similar fashion, the geomagnetic storms were connected to my experience observing the eclipse because the same solar matter that created the aurora was present in the corona of the Sun—only visible during totality. In fact, scientists study the corona of the Sun using devices called coronagraphs with occultation disks blocking the Sun to reveal the corona. This realization allowed me to unify my composition, *Symphony of the Sun*, while also exploring various aspects of the Sun, as revealed by the eclipse. These observations formed the basis for the remaining movement, "Harmony of the Spheres," that I would complete the following year.

Over the first five months of 2025, I significantly revised the first movement, "Totality," and prepared the movement for live performance. On May 13th, 2025, I conducted "Totality" live at UCLA, marking the movement's world premiere. Like the eclipse party one year prior, I had brought together so many of the people that had been part of my journey—my colleagues, mentors, collaborators—all into one performance.

In December 2025, I completed all three movements of the symphony. While the symbolic backstory is not necessary for the listener to engage with *Symphony of the Sun*, the deep personal significance of the story permeates the symphony, shaping a unique work in my repertoire. The remaining chapters of this dissertation will explain how I composed each movement and how my work fits into the canon of orchestra works dealing with the cosmos.

1.2 The Works Covered in this Dissertation

Symphony of the Sun (2025) derives inspiration from *The Planets* (1916), a wildly popular and influential suite for orchestra by British composer Gustav Holst, and the *Die Harmonie der Welt* (1951) symphony, the rarely-heard orchestral work by Paul Hindemith adapted from his opera of the same name. Each work serves as a canonical foundation for *Symphony of the Sun*.

The Planets is a quintessential space-music composition, celebrated for its grandeur, masterful orchestration, and celestial imagery; however, its broad appeal and influence eclipse its musical and conceptual sophistication. For example, *The Planets'* orbit reaches into popular culture as far as John Williams's score for the iconic film *Star Wars* (1977). Notably, Williams quotes the bombastic ending of "Mars, the Bringer of War," the first movement of *The Planets*, in the first three minutes of *Star Wars*. Since its 1918 premiere, Holst's suite has continued to inspire both audiences and artists, prompting numerous reinterpretations and expansions to Holst's work by composers such as Kaija Saariaho, Colin Matthews, and Matthias Pintscher. *The Planets*' broad reach and expansion to new composers inspired me to produce my own addition to the canon of symphonic space pieces.

Paul Hindemith's *Die Harmonie der Welt* symphony, like *Symphony of the Sun*, comprises of three movements across just over thirty minutes. Translated as "The Harmony of the World," Hindemith's composition draws on German astronomer and mathematician Johannes Kepler's *Harmonices Mundi* (The Harmonies of the Worlds, 1619) and Roman philosopher Boethius's *De Institutione Musica* (c. 500-507).

Kepler’s treatise synthesizes his own astronomic data with the Pythagorean cosmological theory of the Harmony of the Spheres, a model of the universe where the planets occupy geometric orbits in space that resonate at harmonic (but inaudible) intervals. In fact, Hindemith’s 1956 opera of the same name situates Kepler as its main character, focusing on Kepler’s search for the harmony of the universe. The opera and symphony overlap with much musical material; however, this dissertation will primarily focus on the symphony.

Boethius’s *De Institutione Musica* delineates three classifications of music: *musica instrumentalis*, music produced by humans, *musica humana*, the harmony of the human body and spirit, and *musica mundana*, the harmony of the universe. Likewise, the three movements of Hindemith’s symphony are titled “Musica Instrumentalis,” “Musica Humana,” and “Musica Mundana.”

Due to *Die Harmonie der Welt*’s foundation in musico-cosmological theories, the work serves as a philosophical launching point for *Symphony of the Sun*. Hindemith’s deep engagement with the harmony of the universe on a scientific and personal level provides an intellectual precedent for exploring the relationship between music and the cosmos in *Symphony of the Sun*.

1.3 Themes Compared between Works

This dissertation aims to distill and pinpoint the scientific and narrative elements within *The Planets* and *Die Harmonie der Welt* to provide an analytical framework for *Symphony of the Sun*. All three works exhibit connections to hard science and anthropomorphic narratives of the cosmos. The first section of each chapter will analyze science’s influence on each composition.

Subsequently, I will analyze the way the composers portray human narratives of the cosmos using the process of anthropomorphizing—assigning a non-human subject like a planet or star human-like traits. In the *Symphony of the Sun* chapter, I will also relate the themes back to Holst and Hindemith's works.

SCIENCE

Art is not science, but art does draw from science. I am interested in the extent to which science permeates the artistic process, if at all. In music, how does that process vary from composer to composer? Furthermore, how does one translate or associate their work with the themes of science or the universe? To answer these questions, this chapter illustrates a spectrum from hard science—disciplines like astronomy and planetary science—to pure art. The influences that traverse the boundaries of disciplines begin to reveal the answers.

In composers' search for the music of the cosmos, data sonification, the practice of mapping datasets to sound, offers a concrete method of translating the universe. A familiar modern example is the Geiger counter, a scientific instrument which indicates radiation levels as audible clicks. However, sonification draws on a much older intellectual lineage: the Pythagorean and Platonic view of number and sound. This tradition was preserved in the quadrivium, where arithmetic was number in the abstract, geometry number in space, music number in time, and astronomy number in space and time.

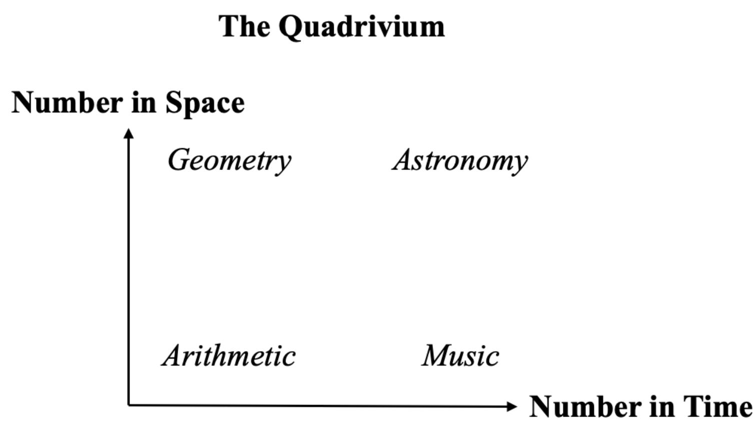


Figure 1.1. The quadrivium.

From this perspective, sound has long been understood as a medium through which number becomes perceptible—a framework that modern sonification makes newly practical. On this spectrum, I plot *The Planets* (Holst), *Die Harmonie der Welt* (Hindemith), and *Symphony of the Sun* (Ali). None of these three pieces translate data in the purest sense like a Geiger counter. Rather, all these works filter their scientific materials through artistic interpretation. Each work exhibits a varying degree of influence from hard science, as explained in this dissertation. We will discuss *Harmonices Mundi* (Kepler) in the Hindemith chapter.

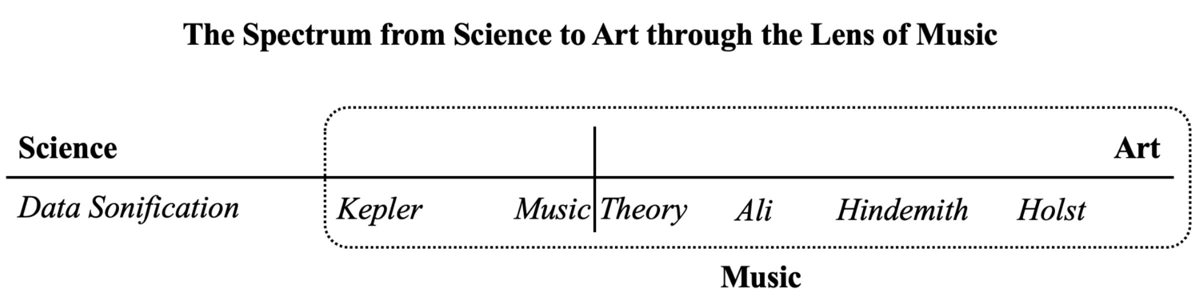


Figure 1.2. The spectrum from science to art through the lens of music.

In this paper, I argue the Kepler is music-influenced science, and the Hindemith, Holst, and Ali are science-influenced music—to varying degrees. In other words, Kepler investigates scientific questions using the language of music—he seeks harmonic consonance in the heavenly bodies. Likewise, the Hindemith, Holst, and *Symphony of the Sun* create musical compositions with various scientific components—influenced by the disciplines of astronomy, planetary science, and cosmology. Furthermore, music theory exists at the intersection of science and music, where tonal and rhythmic relationships are codified through empirical study of musical repertoire. I use music theory to help quantify and analyze the extent to which some scientific aspects permeate the musical process. This model is not at all exhaustive, but it serves as a helpful reference for how this dissertation contextualizes each of the works studied.

ANTHROPOMORPHIC NARRATIVE

To create music about the cosmos, the composers studied in this dissertation assign human characteristics to celestial objects. The human component allows for the star, planet, or moon to exist as a character in the context of a narrative. Such context enables the composer to create music—to artistically interpret—and communicate the narrative to an audience. I refer to this process as an *anthropomorphic narrative*. Anthropomorphization refers to assigning human characteristics to non-human entities. Therefore, anthropomorphic narratives create an opportunity to impose emotional and musical language onto non-human subject matter, such as the cosmos.

Furthermore, anthropomorphism aligns with the broader philosophical concept of the microcosm-macrocosm analogy—the idea that the human form mirrors the structure of the universe. As Carl Sagan famously observed, “the cosmos is also within us. We’re made of star-stuff." By portraying worlds as characters with human qualities, composers can create a layered symbolism: what is expressed through the human form in music may gesture toward a deeper truth about the cosmos itself.

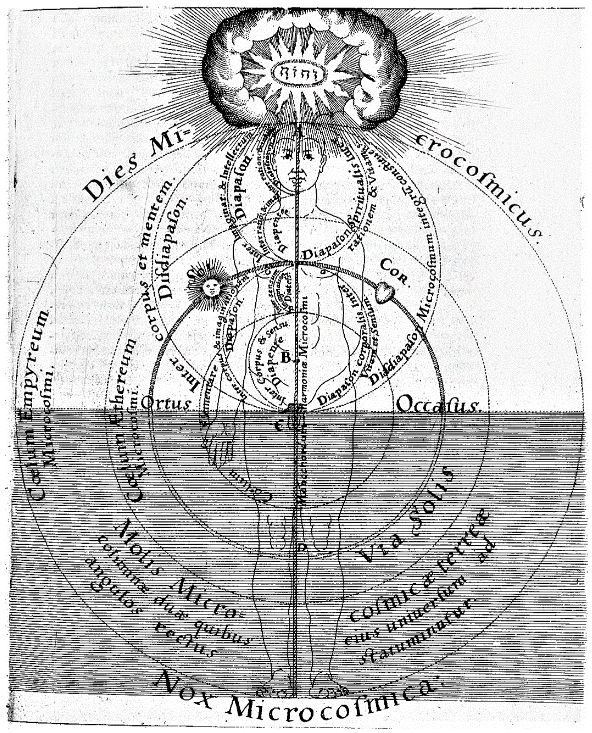


Figure 1.3. *Ultrisque Cosmi* by Robert Fludd, 1619. A depiction of the microcosm-macrocosm analogy.

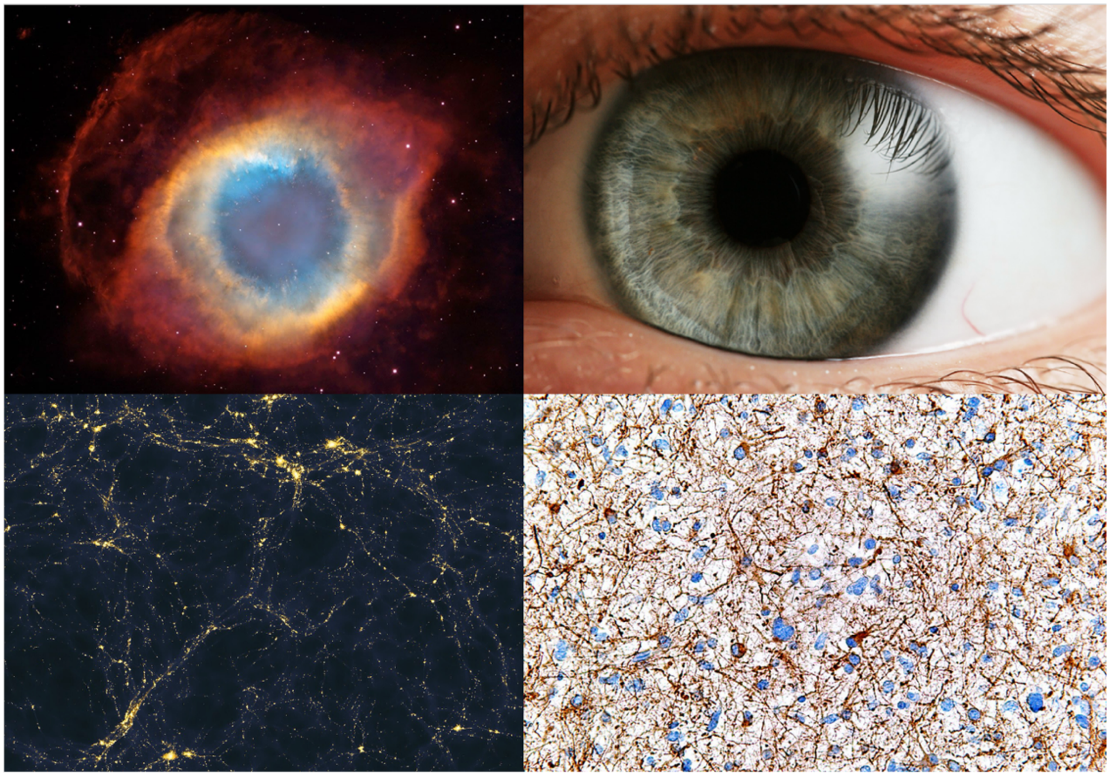


Figure 1.4. Top left: Helix Nebula composite view from the Hubble Space Telescope; top right: human eye; bottom left: computer model of the early universe over 50 million light years across; bottom right: glial cells in the human brain from a biopsy.

In this paper, each of the three works anthropomorphizes the cosmos, assigning human characteristics to celestial objects and, in some cases, transforming characters into these bodies. *Symphony of the Sun* further introduces the role of a human observer. Additionally, all three works exhibit autobiographical anthropomorphism, with each composer inserting themselves into the cosmic narrative as a celestial body, an observer, or both.

CHAPTER II: THE PLANETS BY GUSTAV HOLST

2.1 Science

“[It] must begin from another world and gradually overwhelm this one.”

—Holst on “Saturn” from *The Planets* in a letter to conductor Adrian Boult

The Planets includes seven movements, “Mars, the Bringer of War,” “Venus, the Bringer of Peace,” “Mercury, the Winged Messenger,” “Jupiter, the Bringer of Jollity,” “Saturn, the Bringer of Old Age,” “Uranus, the Magician,” and “Neptune, the Mystic.” The large symphonic suite exhibits multiple connections to hard science including the musical depiction of space in “Neptune,” the composer’s adherence to a heliocentric model of the solar system in his planetary selections, and the astronomical associations with *The Planets* in performances during and after Holst’s life.

In the wake of its many performances, *The Planets* became very popular and attracted associations with astronomy in the public. In 1927, Holst conducted the suite in his hometown of Cheltenham and was presented a “painting of Saturn, Neptune, Jupiter and Venus as seen over the Cotswold hills in May 1919. The Astronomer Royal had been consulted about the exact position of the planets” (I. Holst 123). Such performances indicate Holst welcomed astronomic associations with his composition, even though he did not initially conceive the piece revolving around science alone.

In the music itself, the link to astronomic symbolism is on display especially in the ending of the suite. In my analysis of the final movement, “Neptune,” Holst is symbolizing Neptune as the most distant and mysterious planet in the solar system. Holst evokes the vastness of space—the very concept he enrolled in mathematics lessons years later to understand on an intellectual level—through his use of harmony and orchestration in "Neptune."

The spacious orchestration of "Neptune" derives partially from its origin as a sketch for organ duet, in contrast to the other movements which were each sketched for two pianos (I. Holst and Matthews). Organ works well as an instrument to convey the expanse of the solar system because, unlike the piano, the organ sustains its tone. The sustains evoke a sense of boundless space—without any features or edges. Holst translates the organ long tones to the winds, brass, and strings (and sometimes keeping the organ or organ pedal) in the orchestration, passing off chords from one group to another, crafting a constant bed of sound. On top of the sustains, Holst further illustrates an image of space in "Neptune" by painting a shimmering texture of violin, cymbal, harp, and celesta arpeggios and tremolos—symbolic of twinkling stars.

Figure 2.1. The Walker organ at the school Holst taught at, St. Paul's Girls' School in London.

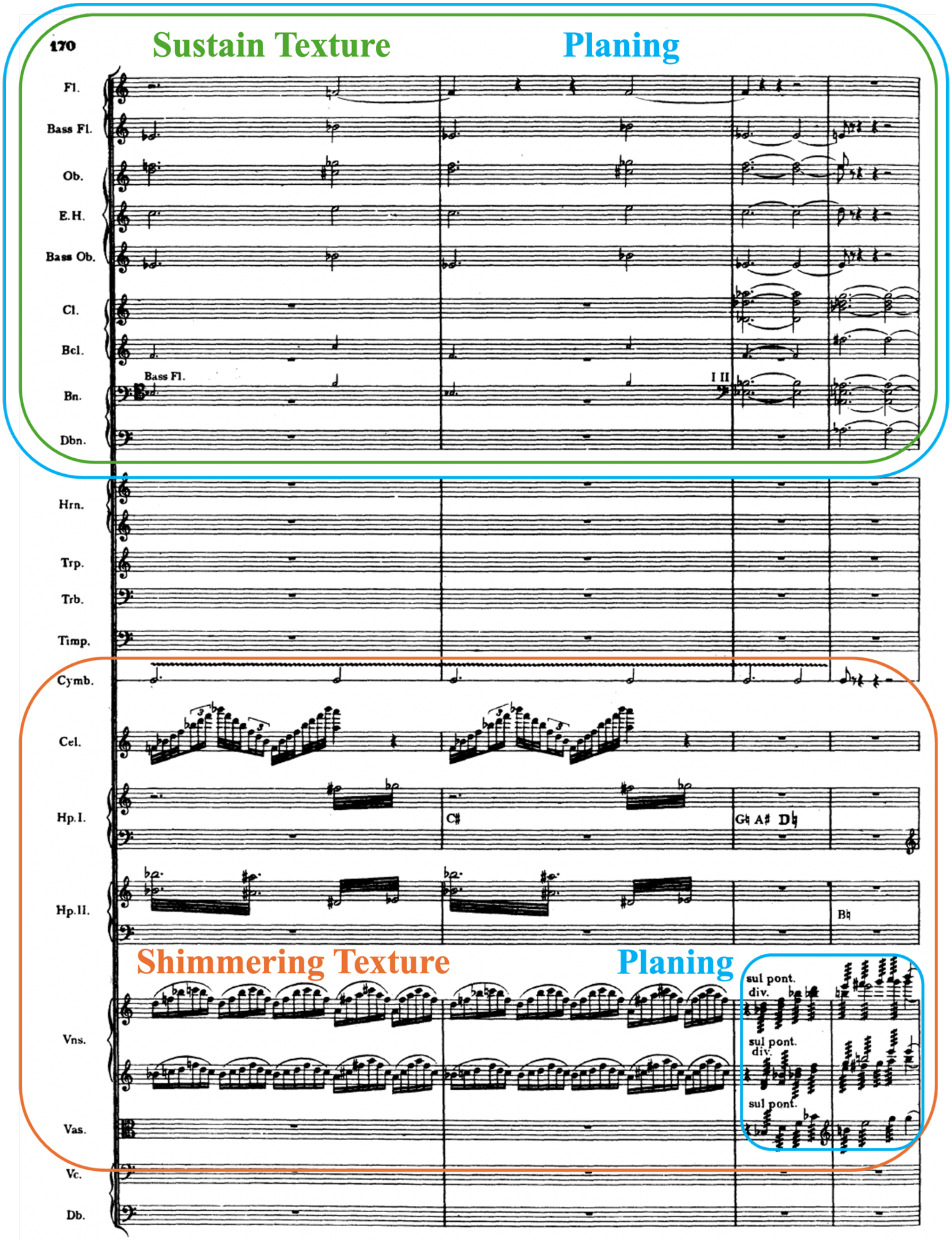


Figure 2.2. Bars 31-34 of "Neptune, the Mystic" from *The Planets*, annotated.

Additionally, the harmonic structure of the sustain section in “Neptune” (rehearsal I to V) utilizes chordal planing. This modern technique, championed by Holst’s contemporary Claude Debussy, features chords that drift in parallel motion, creating an impression of weightlessness. Holst’s planing, also referred to as nonfunctional harmony, reinforces the atmospheric quality by not emphasizing one tonal center over another in “Neptune.”

Furthermore, Holst’s scoring conveys the sense of space in the ending of “Neptune.” For the only time in the composition, Holst writes for a wordless female choir, emerging from the earlier sustained texture. The ethereal chorus maintains a *pianissimo* dynamic, weaving in and out of the orchestra until the final bar, indicated by Holst “to be repeated until the sound is lost in the distance.” By indicating that the choir be situated off-stage, Holst literally employs the dimension of space in the music. Thus, the ending of “Neptune”—and thus, the entire *Planets* suite—represents a musical depiction of space.

Holst’s documented obsession with astronomy reveals a strong scientific symbolism in *The Planets* score. Imogen Holst notes in her father’s biography about him reading Sir James Jeans’s book on astronomy, *The Mysterious Universe*, about fifteen years later than the completion of *The Planets*. She writes, “he had been reading a good deal about astronomy recently… [he] was perpetually chasing the idea of the Space-Time continuum. In hopes of making it easier to reckon in light-years, he had taken lessons in elementary mathematics.” (I. Holst 139-140). Furthermore, in Michael Short’s *Gustav Holst: The Man and his Music* regarding *The Planets*, Short deduces “when [Holst] read James Jean’s [sic] book *The Mysterious Universe*, Holst realized that the ideas which were put forward in scientific terms were exactly the same as those which he had been trying to express in music many years before” (Short 132). Therefore, Holst’s music embodied the same cosmological concepts later articulated in Jeans's work, suggesting an intuitive consonance between his artistic imagination and contemporary science.

Many musical scholars, program notes authors, and popular magazine article writers have superficially assumed that astrology functions as *The Planets*' sole source of extraterrestrial inspiration. Deeper investigation into Holst's biography and the composition suggests a more nuanced and multifaceted relationship with astrology, science, and *the Planets*. For example, in their paper *Holst's Planets, The Final Frontier: Interplanetary Voyage as Intrapersonal Escape*, Motazedian and Murphy note, "Holst was reading Alan Leo's *What is a Horoscope and How is it Cast?* while he was composing *The Planets*, and he was enthusiastic in his exploration of astrology." Webster defines astrology as "the divination of the supposed influences of the stars and planets on human affairs and terrestrial events by their positions and aspects." Thus, astrology serves as a strong contrast to the hard science of astronomy. Yet, as Motazedian and Murphy observe, Holst's engagement with astrological ideas was more symbolic than literal:

> Holst's daughter Imogen, however, asserts that 'horoscopes had nothing to do with the writing of *The Planets,* and once he had taken the underlying idea from astrology, he let the music have its way with him' (I. Holst 1958, 44). Significantly, Holst did not include the Sun and the Moon—which are considered 'planets' in astrology—but he did include Uranus and Neptune, which are not acknowledged by the classical astrology of Holst's time. And even though Mercury is the third movement of the finished work, it was originally listed as 'no. 1' in his sketch notebook—an indication that Holst was thinking of its position as the first planet from the Sun.

In summary, Holst's planetary selections in the suite complicate the astrology-only solar system model in *The Planets*.

Furthermore, Uranus and Neptune share a strong astronomical significance because they were planets discovered using math—not by the naked eye. In fact, Uranus was discovered by composer-turned-astronomer William Herschel in 1781, a century and a half later than Kepler's *Harmonices Mundi*. Neptune followed in 1846. Thus, acknowledging Uranus and Neptune as planets as opposed to the astrological Sun and Moon situates Holst's planets as a heliocentric model—aligned with the science of his time. Due to Holst's inclusion of updated models of the solar system, his suite draws inspiration and structure from hard science.

However, *The Planets* does not include the Earth—a planet from the heliocentric perspective of astronomy. Moreover, four years before Holst's death, Pluto was discovered in 1930, yet Holst never appended a Pluto movement to the suite. Years later, in 2000, British composer Colin Matthews wrote "Pluto, the Renewer" as a commission by the Halle Orchestra. Colin Matthews studied with Holst's daughter Imogen (the author of Gustav's biography and a celebrated composer). In the program notes to "Pluto," Matthews asserts, "even though Pluto was discovered four years before Holst's death in 1934, I am certain that [Holst] never once thought to write an additional movement." Overall, despite omitting Earth (and Pluto), Holst's exclusion of the astrological Sun and Moon and inclusion of Uranus and Neptune suggests a non-trivial influence from astronomy in *The Planets*' overall construction.

Table 2.1. Holst's model of the solar system in *The Planets* compared to the geocentric model in classical astrology and the heliocentric model in astronomy.

	1	2	3	4	5	6	7	8	9
Holst	Mars	Venus	Mercury	Jupiter	Saturn	Uranus	Neptune		
Classical Astrology	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn		
Astronomy	Mercury	Venus	Mars	Earth	Jupiter	Saturn	Uranus	Neptune	Pluto (1930-2006)

Once associated with astronomy by the public, *The Planets* became a launching point for future artists to contribute to the space-music canon. Likewise, Holst's omission of Pluto and Earth created opportunities for new works to fill those conceptual gaps. For instance, the Wikipedia page for "The Cultural Influence of Holst's *The Planets*" contains dozens of entries including adaptations, additions, and new pieces inspired by the suite. Before Colin Matthews's "Pluto," Leonard Bernstein and the New York Philharmonic improvised a movement called "Pluto, the Unpredictable" as the finale to *The Planets* in Bernstein's final Young People's Concerts series broadcast in 1972. The cultural association with astronomy helps explain why John Williams adopted "Mars" in *Star Wars*—the extramusical association of *The Planets* translated into the film's power to convey a setting in outer space. Additionally, in 2006, the Berlin Philharmonic expanded the space-inspired repertoire by commissioning four works by prominent composers Kaija Saariaho, Mattias Pintscher, Mark-Anthony Turnage, and Brett Dean. Named "Ad Astra," the project under the direction of Sir Simon Rattle produced works inspired by asteroids and dwarf planets such as "Asteroid 4179: Toutatis" and "Ceres" released as an album alongside *The Planets*. Such associations with planetary bodies outside of the astrological canon of planets opened the door to even further astronomy-inspired works.

In Summary, *The Planets* is deeply intertwined with science through Holst's musical portrayal of the cosmos in "Neptune," its heliocentric conception of the solar system, and the enduring astronomical associations that have shaped *The Planets*' reception during and beyond Holst's lifetime.

2.2 Anthropomorphic Narrative

Holst incorporates anthropomorphic narratives of his cosmic subjects in *The Planets* by symbolizing a journey to peace in death in “Saturn, the Bringer of Old Age,” embedding his own personality into “Uranus, the Magician” through musical cryptography, and assigning human characteristics to each planet to provide a dramatic narrative.

The Planets are character pieces. With their subtitles such as “Mars, the Bringer of War,” “Saturn, the Bringer of Old Age,” and “Neptune, the Mystic,” Holst explicitly creates a character for each piece. In “Saturn, the Bringer of Old Age,” Holst transforms Saturn into a figure reflecting on life and transitioning to death through the piece’s harmony, form, and voice-leading. The opening of “Saturn” maintains an ostinato of oscillating parallel tritones—using musical stasis and dissonance to convey old age. After the ostinato resolves into a new descending bass line, the trombones emerge with a foreboding dotted-rhythm melody—a musical trope of a funeral march. In the subsequent chorale section, Holst’s Saturn character reflects on youth: the voice-leading in the chorale gradually ascends, and the trumpets reach their highest C in a climactic orchestral tutti, symbolizing the prime of life. The following bars re-attempt to attain the C unsuccessfully, where the trumpet melody is frustrated and passed to the *animato* violins in a variation of the opening old-age ostinato (see Figure 2.2). Thus, Holst achieves a musical depiction of old age reflecting on youth.

In the aftermath of the climax to “Saturn,” Holst transforms the mood from a foreboding image of death to a peaceful one. The harmony shifts from parallel tritones to parallel fifths, plucked by dainty harp harmonics, twice as fast as before. Holst again orchestrates a gradual melodic ascent, but this time as monophony passed between strings and brass, not as a chorale.

The harp-woodwind ostinato remains as the harmonic backdrop, doubling in speed two more times from quarter to eighth to sixteenth-note pace. All the rhythmic, harmonic, and melodic tension resolves when “Saturn” arrives at the final nine bars. The ostinato returns to quarter-note pace, reminiscent of the tranquil rhythmic finale of “Venus, the Bringer of Peace.” The ending melodic tone recalls the frustrated B from before; however, the tonal goal of C is finally achieved in the harmony—a C major 7th chord. Holst metaphorically conveys a peace and acceptance in old age, satisfied in reflection on life. In the final moments of “Saturn,” Holst leaves us with the reverberation of the chimes, evoking an image of a church bell at a funeral.

The character depiction in “Saturn” stems from his previous work, a 1915 setting of Thomas Lovell Beddoes’s poem *Dirge and Hymeneal* for treble chorus and piano. The Beddoes text (see Figure 2.4) is explicitly about juxtaposing death and youth. The preamble indicates the poem is “supposed to be sung as the funeral and wedding processions cross each other at the church-door.” As seen in the original manuscript of Holst’s setting (Figure 2.3), the opening bars of *Dirge and Hymeneal* contain the musical DNA of “Saturn,” namely the static ostinato built on tritone harmony, and the dotted-rhythm funeral melody. Through Holst’s recycling of the core musical ideas and fusing them with the Beddoes text, “Saturn” therefore strongly connects to the personification of an elderly person peacefully reflecting on youth. Moreover, as Holst expressed in a letter to conductor Adrian Boult on “Saturn,”

> In the opening some instruments are quite ‘dead.’ Others have < >. Make the latter as emotional as possible… The 4 flute tune (Tempo I) was soft enough but try and get the timp, harps, and basses also down to nothing. This part must begin from another world and gradually overwhelm this one. (Short 130)

In other words, Holst is equating the otherworldly nature of Saturn the planet with death itself in the music. Therefore, the Beddoes text and Holst letter demonstrate that the spiritual worlds of death and the heavens become synonymous in “Saturn.”

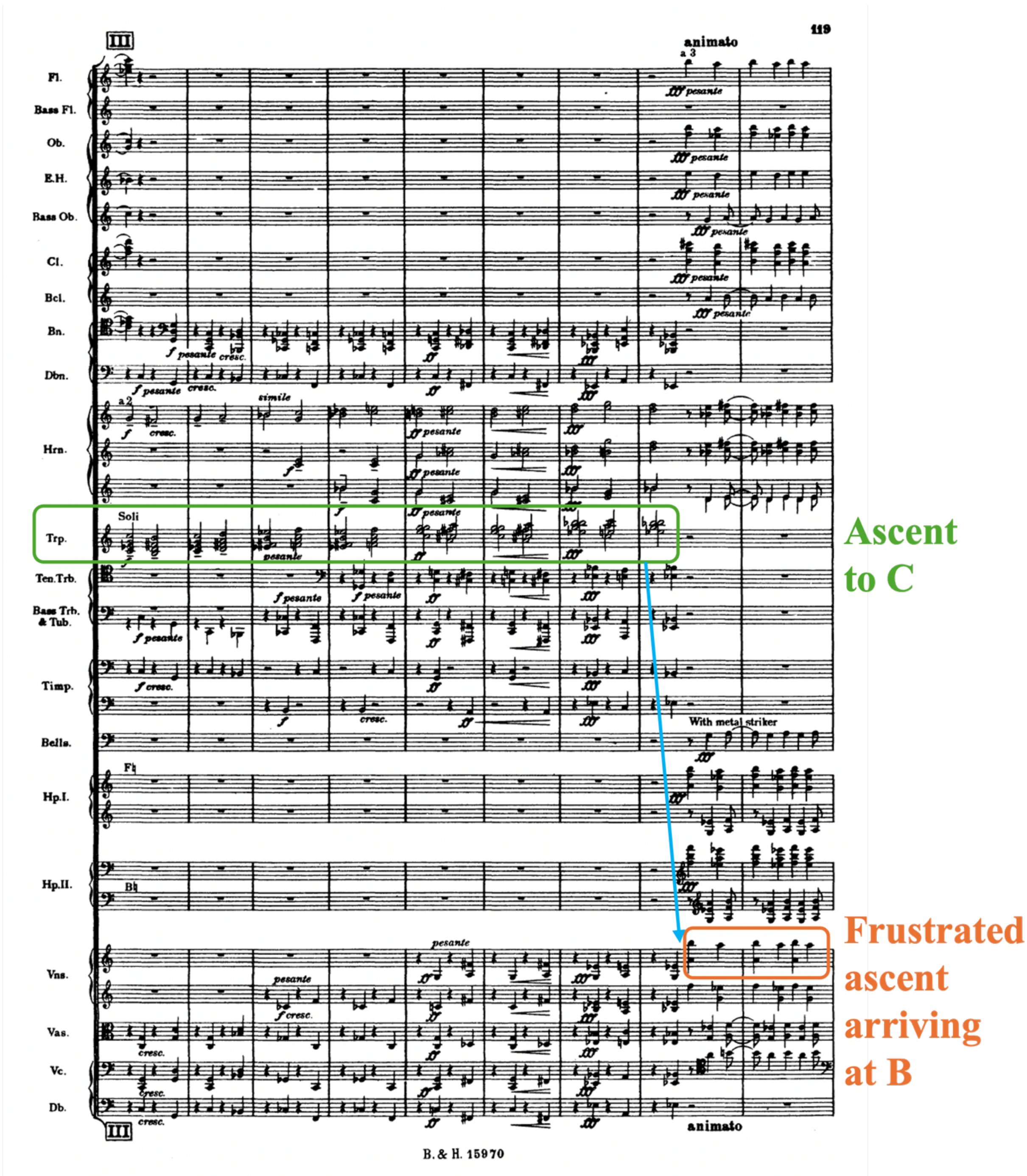


Figure 2.2. Bars 70-78 of “Saturn, the Bringer of Old Age,” in *The Planets*, annotated.

Figure 2.3. Original manuscript of bars 1-17 of *Dirge and Hymeneal* by Gustav Holst.

Dirge.
WOE ! woe ! this is death's hour
Of spring ; behold his flower !
Fair babe of life, to whom
Death, and the dreamy tomb,
Was nothing yesterday,
And now is all !
The maiden, from her play
Beside her lover gay,
The church-yard voices call,
Tolling so slow,
Woe ! woe !

Hymeneal.
JOY ! joy ! it is love's day ;
Strew the young conqueror's way
With summer's glories young,
O'er which the birds have sung,
Bright weeds from fairy rings ;
Here, there, away !
Joy, joy the tree-bird sings,
Joy, joy, a hundred springs'
Melodies ever say:—
Maiden and boy,
Joy ! joy !

Dirge.
SHE cut the roses down,
And wreathed her bridal crown.
Death, playful, culled her blossom,
And tore her from life's bosom.
Fair maiden, or fair ghost,
Which is thy name ?
Come to the spectral host ;
They pity thee the most,
And, to the cold world s shame,
Soft cry they, low,
Woe ! woe !

Figure 2.4. Transcription of *Dirge and Hymeneal* by Thomas Lovell Beddoes.

In the following movement, “Uranus, the Magician,” Holst creates a striking personification of himself through musical cryptography.

Figure 2.5. Bars 1-5 of “Uranus, the Magician” in *The Planets*, trumpets and trombones.

The motif G–S–A–H, derived from the letters of his own name, “GuStAv H.,” translates in the German note-naming system to G–E^{b}–A–B. Called a *soggeto cavato* (“carved-out subject” in Italian) and first recorded by Franco-Flemish Renaissance composer Josquin des Prez, this technique involves deriving musical material from letters of text. In some cases, composers specifically encode names as cryptograms, effectively creating musical autographs, as seen in the work of Holst, Bach, and Shostakovich. Notably, Holst assigns this cryptogram to the trombones—his own instrument—doubled an octave above by the trumpets in a fortissimo statement at the opening of the movement. The orchestration reinforces the motif’s prominence and imbues it with a sense of power and self-declaration, suggesting that Holst’s musical signature is not merely hidden, but proclaimed. Given that “Uranus” centers on personification, Holst’s self-insertion acquires particular significance: the “Magician” may be interpreted as a representation of the composer himself—the figure who conjures worlds, or the planets themselves, into existence. Therefore, Holst imbues a musical cosmology into his work through the autobiographical “Magician” metaphor.

By taking the view that Holst is the conjurer of worlds, each of the planets in the suite are characters of his own creation. This explains why Holst did not agree that *The Planets* was bound purely by any external mythology. As Imogen Holst clarifies, her father, “was a bit annoyed when certain newspapers dragged in bits about Zeus in *The Planets*,” insisting that “the legends about Greek and Roman gods have nothing to do with it” (I. Holst 1981, 55). As expressed in his essay, “The Philistine, the Mystic, and the Artist,” Holst’s character creation in his music can be explained by his view that “Artistic Form has a transcendental quality” (Holst). As he writes in the essay,

> Form in music to a student usually means analysing the details of the Sonatas of such men as Mozart and Beethoven. It is like the engineer studying the Parthenon; and is quite interesting and not dangerous as long as you do not imagine that it has any direct bearing on Art. You are learning facts about Art; but Art is a vision, complete in itself, and an intimate one. Art is an emotion. Above all, Art is not the sum total of its details. (Holst)

In the above quote, Holst distinguishes between facts and emotion, leaving space for the artist to observe transcendental qualities and express them in their work. Likewise, each of the movements in *The Planets* express an emotional personality, such as “Jollity” or “Peace,” embodied by each planet in a metaphorical sense. Thus, the narrative of *The Planets* is a transcendental one—an artist’s attempt to bring the cosmos and the human into union.

CHAPTER III: DIE HARMONIE DER WELT SYMPHONY BY PAUL HINDEMITH

3.1 Science

"What did tonal materials mean to the ancients? Intervals spoke to them of the first days of the creation of the world: mysterious as Number, of the same stuff as the basic concepts of time and space, the very dimensions of the audible as of the visible world, building stones of the universe, which, in their minds, was constructed in the same proportions as the overtone series, so that measure, music, and the cosmos inseparably merged."
—Paul Hindemith, *The Craft of Musical Composition* (Hindemith 12-13)

Hindemith's *Die Harmonie der Welt* draws upon an intellectual lineage linking music and cosmology. In their respective works, both Johannes Kepler and Boethius investigate the idea of Harmony of the Spheres, a philosophy tracing back to the Pythagoreans that planets made sounds as they moved. Hindemith associates these ideas musically in his main theme for the composition. The symphony unites Roman philosopher Boethius's interpretations of ancient Greek musical thought with Kepler's Renaissance treatise on the motion of the planets. Thus, to understand Hindemith, this chapter will examine the philosophies of Johannes Kepler and Boethius.

In our contemporary understanding of physics, sound propagation requires a medium, such as the air in the Earth's atmosphere. Therefore, the planets do not emit sound in the vacuum of space. However, generations later than the Pythagoreans, Johannes Kepler rediscovered the Harmony of the Spheres not by listening with some kind of auditory telescope—but rather by analyzing the orbital data of the six known planets. Contrary to his Pythagorean studies, Kepler found that the planets did not circumscribe perfect spheres in their orbits. In a leap in astronomy, Kepler discovered the elliptical nature of planetary motion.[1] In Kepler's search for the music of the cosmos, his results formed the foundation of our modern understanding of orbital dynamics.

Uninhibited by a lack of perfect Pythagorean harmony, Kepler detailed his findings using scientific and musical language in *Harmonices Mundi*, a seminal text in the history of planetary science. Over the course of the work, Kepler explains various scales, modes, and chords that can be mapped to his calculations of the planets' motions. In effect, Kepler is explaining a music theory of the cosmos through data sonification. He notes his results as such:

> Accordingly the movements of the heavens are nothing except a certain everlasting polyphony (intelligible, not audible) with dissonant tunings, like certain syncopations or cadences (wherewith men imitate these natural dissonances), which tends towards fixed and prescribed clauses—the single clauses having six terms (like voices)— and which marks out and distinguishes the immensity of time with those notes. Hence it is no longer a surprise that man, the ape of his Creator, should finally have discovered the art of singing polyphonically [*per concentum*], which was unknown to the ancients, namely in order that he might play the everlastingness of all created time in some short part of an hour by means of an artistic concord of many voices and that he might to some extent taste the satisfaction of God the Workman with His own works, in that very sweet sense of delight elicited from this music which imitates God.

[1] Kepler came to his conclusions by using astronomical measurements and data from Tycho Brahe and assuming a Copernican heliocentric model of the solar system.

Figure 3.1. Data Sonification of the planets in *Harmonices Mundi* by Johannes Kepler, page 49, "In the Extreme Planetary Movements the Musical Modes or Tones Have Somehow Been Expressed."

The most important part of the above quote is the "short part of an hour by means of an artistic concord." Put differently, Kepler is saying that while the planets overwhelmingly orbit in dissonant harmonic relationships with each other, eventually the planets' oscillating frequencies will harmonize in a fleeting consonance. Therefore, in his view, there is some combination of musical notes which expresses this brief harmony, able to be determined by the human intellect.

Likewise, in the chapter "The Universal Consonances of All Six Planets, Like Common Four-Part Counterpoint, Can Exist," Kepler invites the composers of his generation to artistically interpret his findings about harmony in the universe. He writes,

> (Shall I have committed a crime if I ask the single composers of this generation for some artistic motet instead of this epigraph? The Royal Psalter and the other Holy Books can supply a text suited for this. But alas for you! No more than six are in concord in the heavens. For the moon sings here monody separately, like a dog sitting on the Earth. Compose the melody; I, in order that the book may progress, promise

that I will watch carefully over the six parts. To him who more properly expresses the celestial music described in this work, Clio will give a garland, and Urania will betroth Venus his bride.)

Answering the challenge from Kepler, in *Die Harmonie Der Welt*, Hindemith directly refers to Kepler's treatise. Hindemith creates a melody based on Kepler and Boethius's ideas that serves as the main theme of the symphony.

***Die Harmonie der Welt* Main Theme**

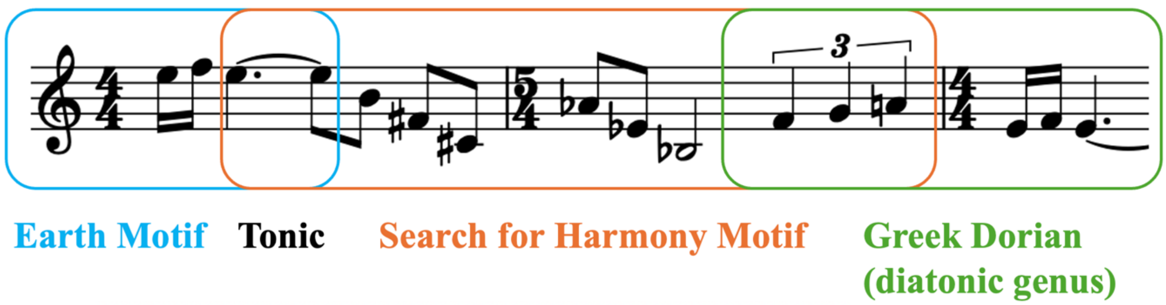


Figure 3.2. Analysis of *Die Harmonie der Welt* symphony Main Theme. Taken from bars 2-3, trumpets and bar 4, horns.

The first two notes of the main theme, first heard in the trumpets in bar two, stem verbatim from Kepler's data sonification. As, Siglind Bruhn puts it,

> The mordent E-F-E employs the tones that, in Kepler's famous calculations, correspond to the two pitches of the earth's orbit, MI and FA. As Kepler interprets this in a marginal gloss toward the end of chapter 6 in Book V of *Harmonices mundi*, "The Earth sings MI FA MI, so that even from the syllables you may guess that in this home of ours, *MI*sery and *FA*mine hold sway." (Bruhn 85)

I will refer to the E-F-E mordent as the Earth motif. Hindemith cryptographically represents the Earth in musical form, "E" for Erde in German.

The second part of the theme comes from search for the Harmony of the Spheres. Boethius writes on *musica mundana*, or cosmic music, the following quote on the three types of music:

> The first kind [of music], the cosmic, is discernible especially in those things which are observed in heaven itself… For how can it happen that so swift a heavenly machine moves on a mute and silent course? … For that reason, a fixed sequence of modulation cannot be separated from this celestial revolution. (Boethius 9)

The "fixed sequence of modulation" takes form in the Hindemith as the cycle of perfect fourths in the main theme. The 4:3 ratio is an important proportion to the Pythagoreans because of its arithmetic simplicity. Therefore, Hindemith's use of the 4:3 ratio in the melody, harmony, and rhythm encapsulates the search for the Harmony of the Spheres.

The third part of the theme creates a direct musical link to Boethius's *De Institutione Musica*, particularly the diatonic genus of the ancient Greek Dorian scale. As defined by Boethius, the scale is two diatonic tetrachords separated by a whole tone, starting on E, or E-F-G-A-B-C-D-E.[2] Boethius writes, "it would seem proper to add concerning the above tetrachords … as a kind of exemplar of the celestial order and specification" (Boethius 46). Additionally, the scale shares the first two notes with the Earth Motif, E-F, connecting the end of the main theme back with the beginning, creating a cycle like a planetary orbit.

[2] Dorian: *hypate meson–nete diezeugmenon* (e′–e″). Today known as the Phrygian mode.

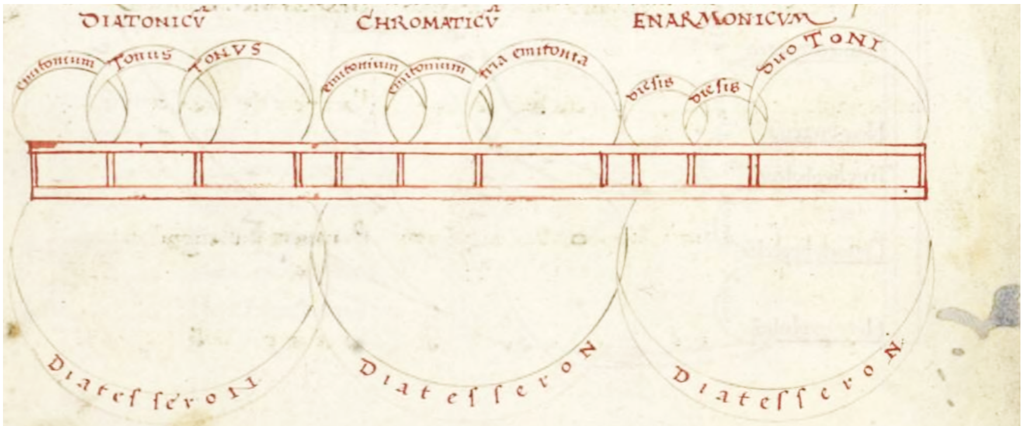


Figure 3.3. *De Institutione Musica*: diatonic tetrachord on the left, shown by semitone, tone, tone in Latin.

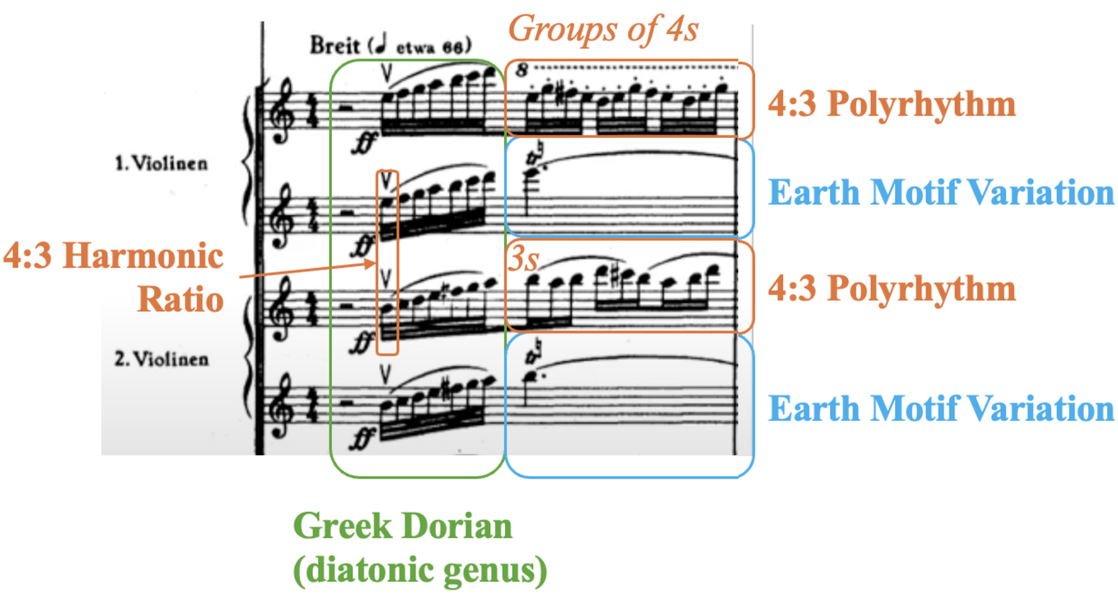


Figure 3.4. Analysis of *Die Harmonie der Welt* symphony opening. Taken from bar 1, violins, annotated.

In the first bar of *Die Harmonie der Welt*, Hindemith establishes all three elements of the main theme in the orchestration. The Earth Motif takes form in a variation as a trill from E to F in the first violins. The 4:3 ratio appears both harmonically as the interval between the B and the E and rhythmically between the groupings of four versus three. The ancient Greek Dorian scale presents itself from E5 to E6 in the first violins.

Furthermore, the entirety of the *Die Harmonie der Welt* symphony reflects the main theme in its micro and macro-level structure. On the micro level, for example, the persistent trill motif in the third movement woodwinds from bar 249 to the end of the symphony is a diminution of the MI-FA motif. After the initial presentation in the first movement, the fourth motif appears in fragmented and inverted forms in the following movements. In the second movement, the tutti section at A includes ascending fourths in the strings in bar 16, transitioning into the chamber-like rehearsal B, with descending fourths in the flute in bar 19. In the final section of the second movement, marked “Quietly, a wistful dance sounds from afar,” the solo violin again recalls the fourth motif in ascending motion in bar 64.

On the macro level, the entire symphony focuses on E as a tonal center—as if the piece is in the key of “Erde” or “Earth,” matching the first note of the Earth motif. The first movement ends on a plagal cadence, signifying the motion of a descending perfect fourth from A back to E. The penultimate section of the first movement cadences on F, resolving into a final section in E from bar 436 “in the earlier march tempo” to the end of the first movement. Furthermore, the second movement departs from E, centering around C# and A. Yet, the A major chord in the final bar of the second movement reprises the earlier plagal motion, because the A again cadences to E in the first bar of the third movement. The new C# key area foreshadows the end of the symphony: the third movement climaxes at a very dissonant C# chord with E and F (E#) simultaneously serving as the third of the chord in bar 273. The melody in the horns resolves on E#, but the trumpets maintain the pedal tone of E in the countermelody. This melodic and harmonic clash marks the height of tension in the entire symphony, eventually resolving to a triumphant E major in 278. Therefore, in analyzing these micro and macro moments, the main theme serves as the intellectual seed from which the entire piece grows.

The integration of the main theme into the symphony's overall structure lies at the heart of Hindemith's compositional philosophy. In his theory textbook, *The Craft of Musical Composition*, he writes,

> But just as today an astronomer cannot understand his reckonings in light-years, or the equalization of time and space, without knowing the workings of the electrons within the cosmos of the atom, so to the believing musician the sense of his musical material, the earthly image of the harmonious music of the universe, can never be clear unless he continually returns to the deepest kernel of the single tone, and seeks to understand its electronic flux—the overtones in their proportional relations. (Hindemith 54)

Hindemith's scientific-musical perspective where the atomic unit is the motif and the universe is the whole piece is epitomized in *Die Harmonie der Welt*. Namely, Hindemith in an audio interview said the work "starts with Kepler's private life and ends in the universe with stars and all kinds of things. It has a very large rise from small to large" (Hindemith). Therefore, Hindemith explicitly connects to the broader science-based concept of marrying the atomic and astronomical through the composition of the *Die Harmonie der Welt* symphony.

3.2 Anthropomorphic Narrative

In the first movement of the *Die Harmonie der Welt* symphony, the cello, bass, and horns cry out the Earth Motif from bar 10 to 16, utilizing their low brooding registers to accentuate the "misery" and "famine" connotation from Kepler. In this section, Hindemith is anthropomorphizing the celestial melody of the Earth—blending the cosmic and the human through music.

To further accentuate the human features of the Earth, Hindemith employs earthly genres of music in the first movement, "Musica Instrumentalis." For example, in bar 34 (figure 3.5), marked "Weighty" in the score, the piece launches into a march. Hindemith orchestrates a reedy low clarinet melody doubled in cellos and violas on top of percussion and brass thumping a martial rhythm. Reprised and developed over the first movement, the incessant, percussive music stands out within the symphony's otherwise abstract gestures in movements II and III. By invoking a familiar, terrestrial genre, Hindemith sonically embodies Boethius's *musica instrumentalis*. The grounded quality of this march allows Hindemith to anchor his cosmic architecture in the tangible world of human sound and experience.

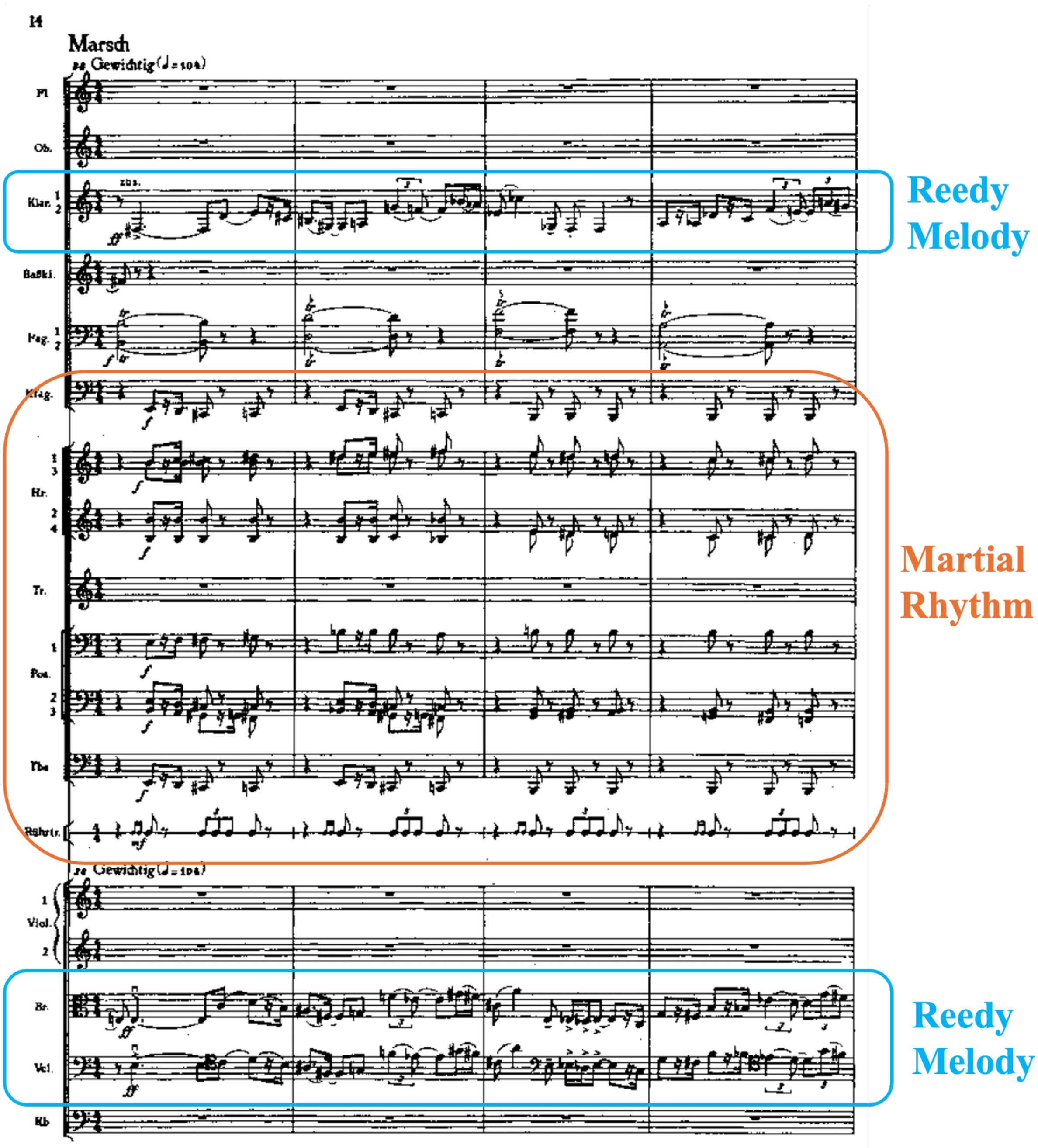


Figure 3.5. The first march section from bars 34-37 in “Musica Instrumentalis” in *Die Harmonie der Welt* symphony, annotated.

Figure 3.6. Comparison of the finale of *Die Harmonie der Welt* opera and symphony (bars 270-273).

The finale of the symphony links directly to the finale of the *Die Harmonie der Welt* opera where Hindemith transforms his human characters into celestial objects. To briefly summarize the plot, Kepler, a German astronomer and mathematician, embarks on a quest to find cosmic order amidst his shaken faith in the world during the Thirty Years War. The opera contrasts Kepler with Emperor Rudolf II and Florian, obsessed with astrology and mysticism, Wallenstein and Count von Tilly, representing political chaos and war, and Kepler's wife Susanna, who grows weary of Kepler's scientific pursuits.

Figure 3.7. *Staging of* Die Harmonie der Welt. *Credit: Bavarian State Opera Archive.*

Hindemith achieves the transformation of his human characters in the opera by utilizing the same singers to reprise their roles as planets after death. For example, Kepler (the character), on his deathbed, proclaims he has failed to find the world the Harmony of the Spheres, and concludes, "[t]o die is only to bring it about, to merge with the celestial order" (Hindemith 379-

380). In effect, death is not an end but a transition into cosmic unity, where the human soul becomes part of the universal harmony Kepler sought in life. After he dies, Kepler is reincarnated as “Erde,” the Earth alongside the other characters-turned-planets in the opera. In the symphony, the passacaglia which occurs during Kepler’s transformation is the same music as the opera. As Siglind Bruhn writes in *Explorations of Universal Order and Beauty in Paul Hindemith’s Symphony Die Harmonie der Welt*,

> The symphony’s third movement, the musical representation of *musica mundana* or cosmic harmony, will make its way most directly into the eventual opera: it underlies the second half of act V. Hindemith later merely added vocal lines to the orchestral texture and interpolated a few recitativic inserts. (Bruhn 89)

Thus, the music links Hindemith’s personification of the planets through the opera to the symphony, providing more context to the otherwise-wordless symphony. Figure 3.6 superimposes the opera on top of the symphony score, bar-for-bar, in the climax of the finale, mapping the musical association between the two.

Furthermore, Hindemith himself explained how human narratives permeate through *Die Harmonie der Welt* in an audio interview reproduced on the Hindemith Foundation website. He described,

> I was already working on this even bigger idea of world harmony. And through my work with Kepler, it seemed very suitable for me as the subject [*Die Harmonie der Welt*]… It takes place in the Thirty Years' War… the very big world with the great politics of Wallenstein and of the emperor, and this opposition, where a man is put in the middle, who believes in a harmony of the world, but in his own life and in the course of time does not find anything of it… everyone somehow comes into this situation that he believes in

> something better and is disturbed by something worse in his belief, that is the general human problem… [The opera] starts with Kepler's private life and ends in the universe with stars and all kinds of things. It has a very large rise from small to large. (Hindemith)

The above quote demonstrates Hindemith synthesizing the worlds of the human and the cosmic in his compositional process for *Die Harmonie der Welt*.

However, in my analysis, Hindemith was not only describing a work about Kepler's life —Hindemith was writing a piece about himself. During World War II, Hindemith fled Nazi Germany to the United States in 1940, joining the composition faculty at Yale University. Likewise, Kepler lived in Linz, Austria during the Thirty Years War (1618-1648) and fled in 1626 due to religious persecution. Both Hindemith and Kepler published texts (such as *The Craft of Musical Composition* and *Harmonices Mundi*), attempting to explain harmonic laws endemic to the universe. In the earlier Hindemith quote, "everyone somehow comes into this situation that he believes in something better and is disturbed by something worse in his belief," the "something better" is harmony, and "something worse" is war. Thus, Hindemith naturally found Kepler as a kindred spirit. Accordingly, Hindemith filled Kepler's character with the composer's own aspirations to find harmony in a world filled with war and injustice. Thus, both Hindemith and Kepler turned to the stars. Therefore, *Die Harmonie der Welt* takes on an autobiographical component in Hindemith's cosmic narrative.

CHAPTER IV: SYMPHONY OF THE SUN BY AUSTIN ALI

4.1 Science

"Earth's Moon is about 1/ 400th the diameter of the Sun, but it is also 1/ 400th as far from us, making the Sun and the Moon the same size on the sky—a coincidence not shared by any other planet-moon combination in the solar system, allowing for uniquely photogenic total solar eclipses."

―Neil deGrasse Tyson, *Astrophysics for People in a Hurry*

Symphony of the Sun demonstrates multiple connections to hard science including the depiction of the total solar eclipse and its accompanying solar phenomena, the chords derived from orbital data sonifications, and the use of ratios and intervals as symbols of the Harmony of the Spheres. Many of these musical devices relate to those discussed in the Holst and Hindemith chapters; likewise, their influence permeates the composition of *Symphony of the Sun*.

The progression of the eclipse over time forms the overall structure of the symphony. A total solar eclipse occurs when the disk of the Moon completely covers the Sun in the daytime sky. During the event, the Moon overtakes the Sun (2 in Figure 4.1), reveals the solar corona (3), then the Moon recedes symmetrically back into the sky (4). However, the symphony does not progress linearly through time—all three movements explore totality from three different angles. As demonstrated in Figure 4.1, the first movement takes place from (1) to (3) in the diagram, the second movement depicts (2) to (4), and the third movement depicts (3) to (5). Therefore, the chronology of each movement overlaps during totality, allowing multiple perspectives of the same event across the symphony.

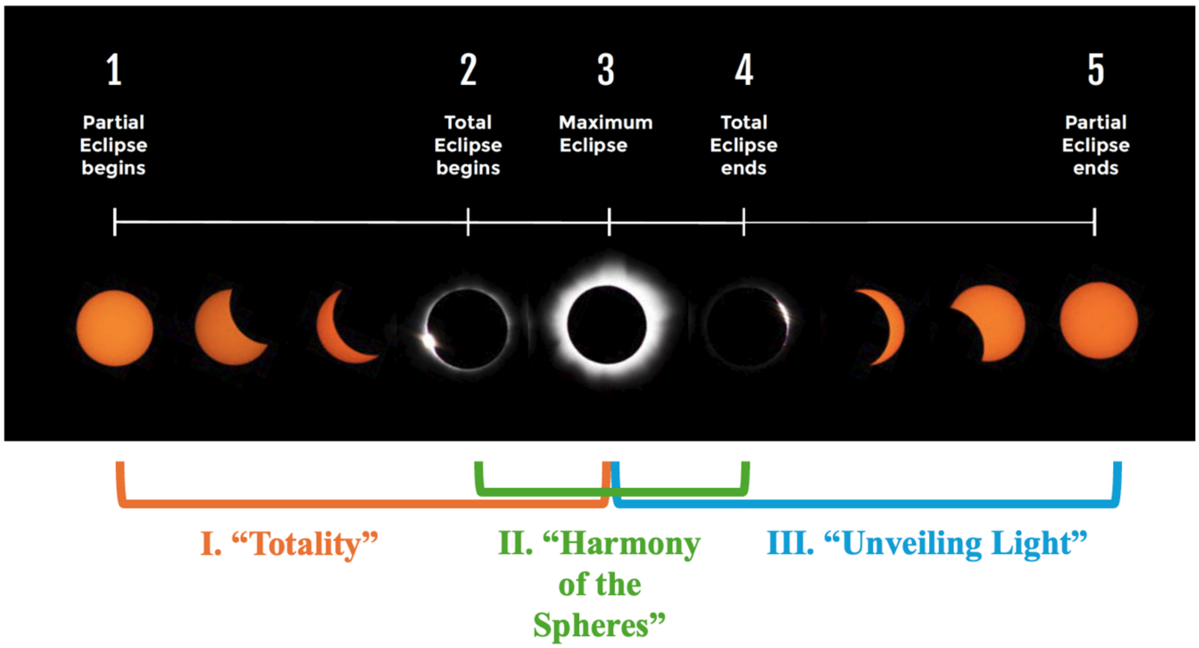


Figure 4.1. Total solar eclipse mapped to *Symphony of the Sun*.

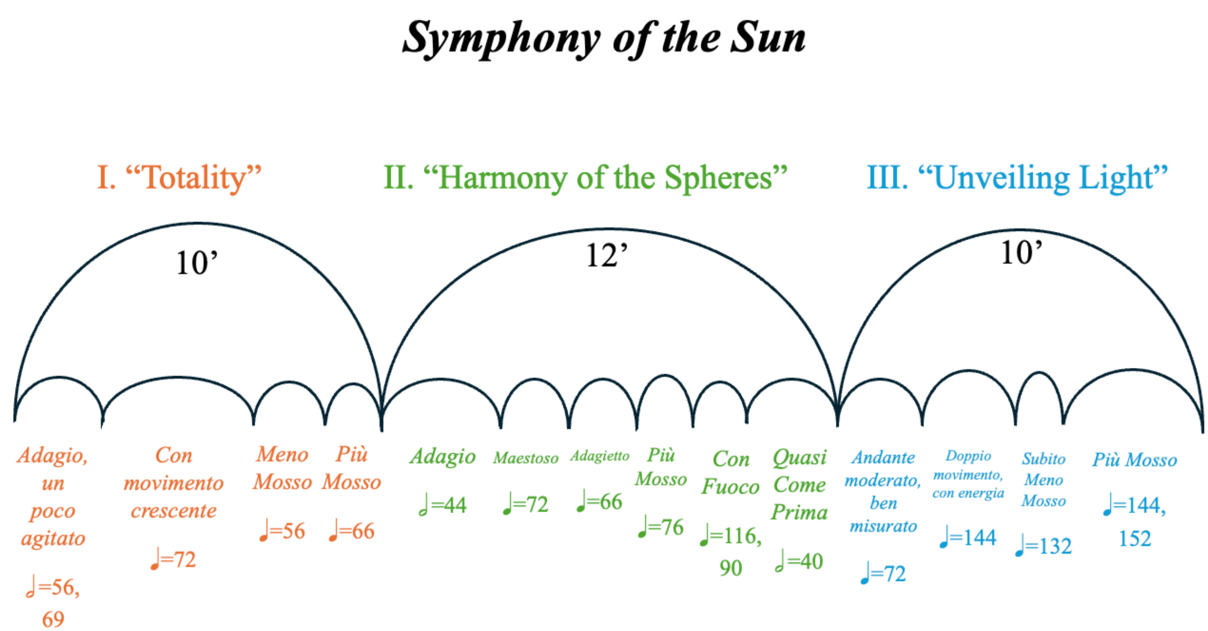


Figure 4.2. Arc diagram of *Symphony of the Sun*.

The symphony begins (1) and ends (5) with a portrait of the Sun itself. The first two-minute *Adagio* emerges from a unison G-to-A melodic second in the violins, violas, and cellos. The unison here symbolizes the atomic number of hydrogen, and the second symbolizes helium—the primordial elements which combine in nuclear fusion to give the Sun its life and its light.

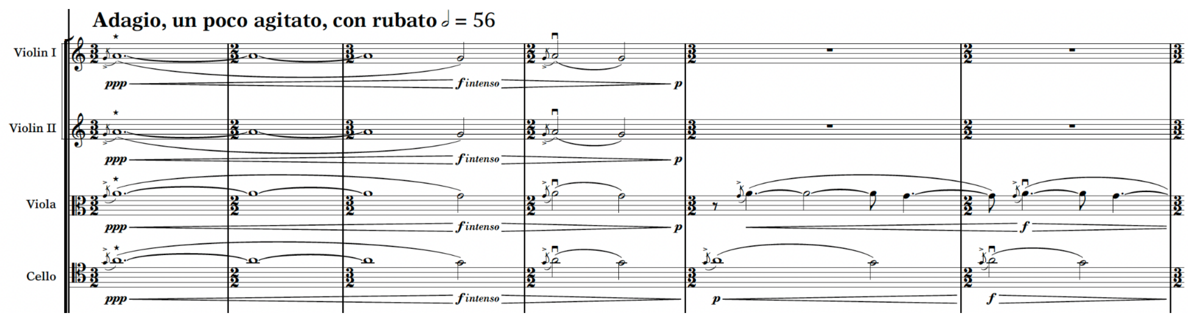


Figure 4.3. Bars 1-6 of *Symphony of the Sun*, violins, violas, and cellos.

From the monophony emerges a canon at the eighth-note level; however, because the passage is conducted in half notes, the canon registers more as a heterophonic texture than as true polyphony. This section draws inspiration from Hungarian-Austrian 20th century composer György Ligeti and the Franco-Flemish Renaissance contrapuntal tradition of Johannes Ockeghem and Josquin des Prez. Ligeti's experimental works of the 1960s, particularly *Atmosphères* (1961) brought Ockeghem and Josquin's overlapping canonic textures into the orchestral medium, calling the technique "micropolyphony." Through its textural density, micropolyphony produces sound masses that fuse together like nuclear reactions, a compositional metaphor ideally suited to a symphonic poem portraying the Sun. Through this method, the first two minutes of *Symphony of the Sun* establish the majesty of the full Sun as a foil to the darkness approaching.

The following section, marked "Con movimento crescente," introduces the increasing rhythmic energy to reflect the exciting build-up to totality. During a solar eclipse, the Moon's shadow travels across the Earth's surface at a speed of approximately 2400 kilometers per hour (or 1500 miles per hour, twice the speed of sound). As totality approaches, bands of grey shadows stream quickly across the ground—a phenomenon only visible during an eclipse. The music mirrors the rising intensity of racing shadows by increasing the rhythmic density from quintuplets, to sextuplets, to septuplets, to 32nd notes in bars 120-123.

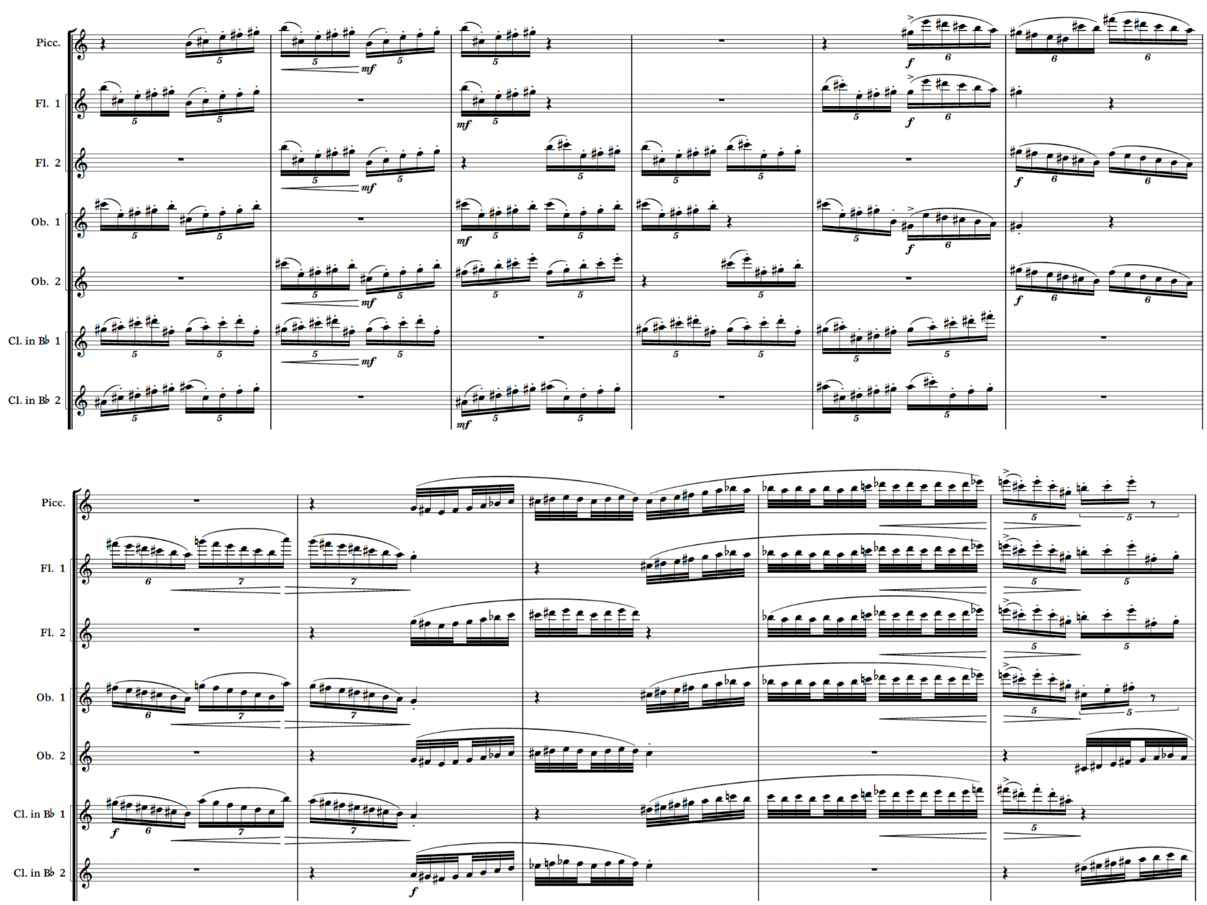


Figure 4.4. Upper woodwinds in bars 116-121 and 122-126 in "Totality."

Figure 4.5. Bars 137-143 of "Totality" with totality encoding, annotated.

The moment of totality is signaled by encoding the time of day into the piece through rhythmic cryptography. On April 8th, 2024, totality struck at 1:41 PM local time at my home in Dallas where I witnessed the eclipse. At rehearsal F, the strings, woodwinds, bass trombone, tuba, and piano strike fourteen chords, indicating the first two digits of the time 1:41. The fourteen chords (thirteen in the piccolo and flutes) also sonically invoke the tolling of clock bells, corresponding to between 13:00 and 14:00 hours in military time. Additionally, the section elides over bar 141, pointing to 1:41 PM. Furthermore, this moment in the music is not trivial—it also marks a significant climax in the piece. The orchestration involves the entire ensemble, with the horns, trumpets, and trombones stacked in octaves and unisons sounding the pedal tone of C. The dense harmony in the strings, woodwinds, bass trombone, tuba, and piano creates a strong dissonance with the pedal. The percussion echoes a horn solo from earlier in the piece, stripped of its colorful melodic quality, as if darkness itself descended on the melody. The powerful orchestration imbues the cryptogram of totality with meaning and significance, elevating the climax with drama and reflecting the immensity of the moment as it occurred in-person.

The dissonant harmony of the "Totality" first climax stems from a data sonification I performed using the planets' orbital velocities. Programmatically, I invoke the planets at this time because during totality, the sky becomes dark enough to see the stars and planets during the daytime sky. By pure celestial coincidence, the April 8th, 2024 eclipse featured all seven planets in the sky, accompanying the Sun and the Moon and the Earth. Therefore, I sonified the planets by scaling their average orbital velocities to musical frequencies, based on a root pitch I assigned of B♭2 (A#2). I then utilized the seven frequencies that corresponded to the seven planets to make a solar system chord.

Table 4.1. Average orbital velocity of each planet scaled to frequencies.

Planet	Average Orbital Velocity	Scaled up to A#2 Root (A=440Hz)	Equal-Tempered Pitch Reference	Octave	Cents Flat/Sharp vs. Reference	Symphony of the Sun Chord	Cents Flat/Sharp vs Reference
Mercury	47.9 km/s (29.8 mi/s)	1033.7609	C	6	-21	C	-21
Venus	35.0 km/s (21.7 mi/s)	755.3577	F#	5	36	F	136
Earth	29.8 km/s (18.5 mi/s)	643.1331	E	5	-43		
Mars	24.1 km/s (15.0 mi/s)	520.1177	C	5	-10	C	-10
Jupiter	13.1 km/s (8.1 mi/s)	282.7196	C#	4	34	C#	34
Saturn	9.7 km/s (6.0 mi/s)	209.3420	G#	3	14	G#	14
Uranus	6.8 km/s (4.2 mi/s)	146.7552	D	3	-1	D	-1
Neptune	5.4 km/s (3.4 mi/s)	116.5409	A#	2	0	A#	0

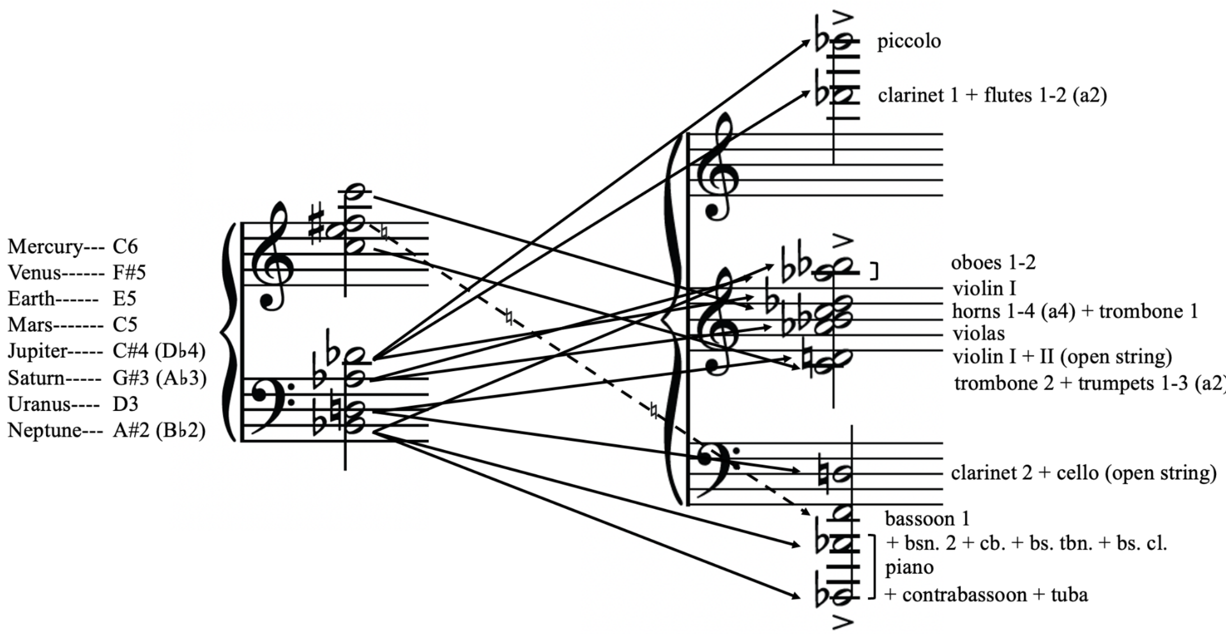


Figure 4.6. Left: solar system chord based on scaling the average orbital velocities of the eight planets.

Right: solar system chord in bars 139-142 in “Totality” using all the planets except the Earth.

However, my sonification was merely an inspiration for the music—not an immutable object. I made modifications to fit the limitations of the orchestra and the context of the symphony. For example, once I obtained the frequencies, I matched them to equal-tempered pitches close to their true microtonal frequencies to score them for a live orchestra. Furthermore, I changed the voicing of the solar system chord. I emphasized the dissonance between the C, C# ($D^{\flat}$), and D in the chord by injecting more seconds and ninths into the voicing. I used 10 brass players (all horns, trumpets, and trombones) all on the note C, strongly clashing with the D-natural and $D^{\flat}$ in the violins and upper woodwinds. To increase the resonance of the bottom part of the chord voicing, I lowered the F# to an F-natural. I also liberally doubled pitches across octaves, magnifying the chord with the power of the full orchestra. Therefore, my solar system chord in "Totality" functions as a filtered sonification—one loosely based on scientific data to represent the planets but strongly tailored towards practical orchestration.

The second climax of the first movement triumphantly celebrates the revelation of the sun's corona by injecting brightness into the musical texture. The music reprises the opening fusion motif (oscillating second) in counterpoint, emphasizing the E major and D major seventh chords. The woodwinds return with the rhythmic (quintuplet) motif, maintaining E major pentatonic scale amidst the shifting harmony. The superimposition of E major tonality over D major results in an extended Lydian scale (D-E-F#-G#-A-B-C#-D#), augmenting the brightness inherent to Lydian sonorities in the harmony. The sparkling high woodwinds, piano, harp and percussion combined with the brass and strings allow the harmony to resonate with brilliance, evoking the luminosity of the Sun's corona. The first movement ends by disintegrating the rhythmic motif and introducing a brooding pedal tone on G in the bassoons, contrabassoon, bass clarinet, trombones, tuba, cellos, and basses, representative of the shadow of the Moon.

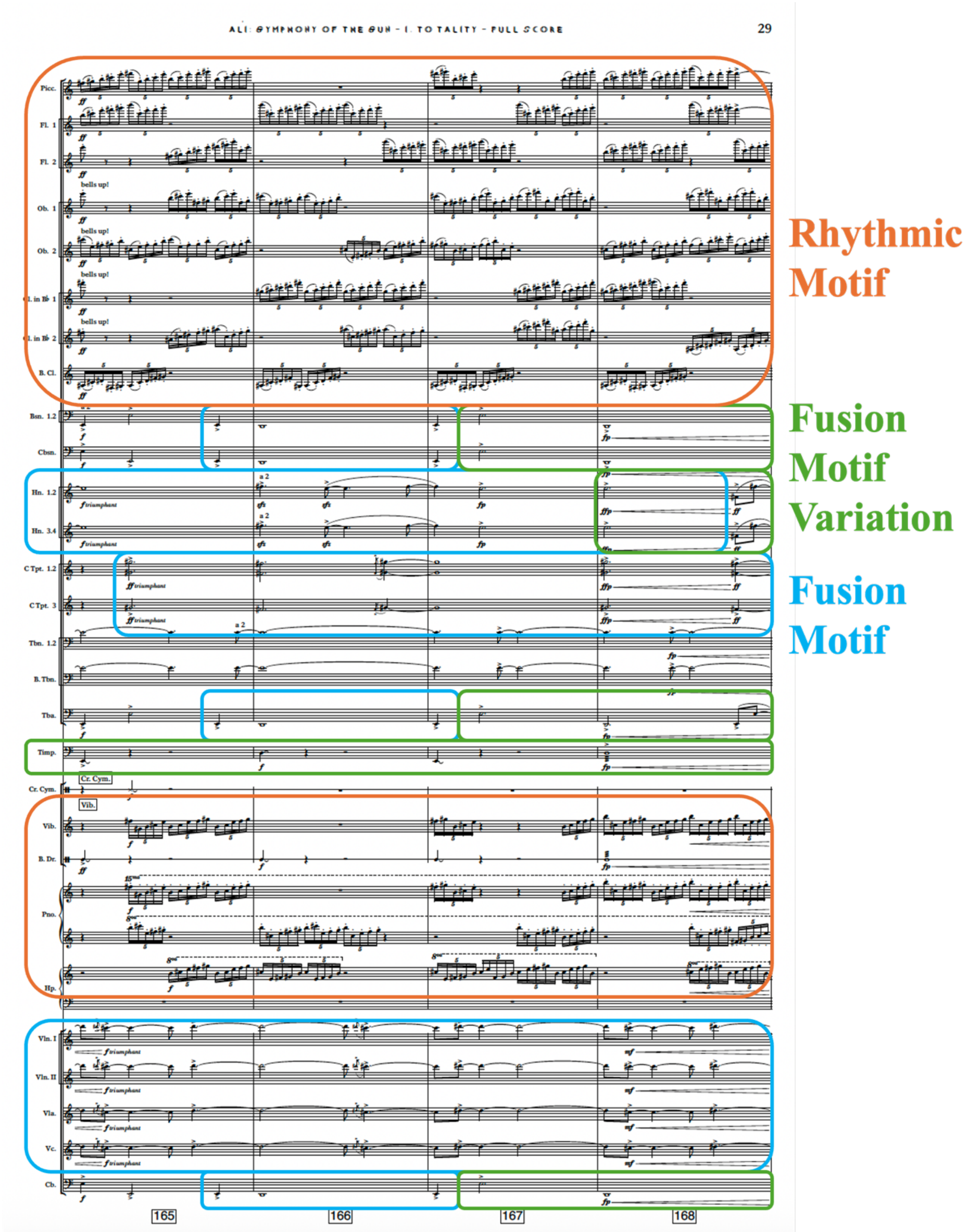


Figure 4.7. Bars 165-168 of “Totality,” annotated.

The second movement, “Harmony of the Spheres,” exploits the same duality of *Die Harmonie der Welt*: the universe, while beautiful in its mystery, is not perfectly harmonically proportioned as the Pythagoreans predicted. In the context of the eclipse, the second movement explores totality from a new perspective by exposing terrifying phenomena revealed by the eclipse: solar prominences and coronal mass ejections. Harmony in the world is contrasted with danger and disaster. For example, a powerful solar flare can eject coronal mass towards the Earth. Upon impact with the Earth’s magnetic field, this cosmic event can deteriorate the orbits of crucial earthbound satellites and disrupt electronics on the surface. With a strong enough solar flare, entire continents could lose their electrical grids, descending society into chaos. On a grander scale, the eventual fate of the Earth is to be consumed by the Sun’s corona—when in five billion years the Sun’s hydrogen and helium fuel runs out and causes the Sun to expand and swallow Mercury, Venus, and potentially Earth. While a destructive solar flare thankfully did not occur on April 8th, 2024, the eclipse inspired me to consider the ramifications of the Sun’s corona impacting the Earth as part of the program of the symphony. Thus, “Harmony of the Spheres” juxtaposes the beauty of the corona against the terror of its destructive potential.

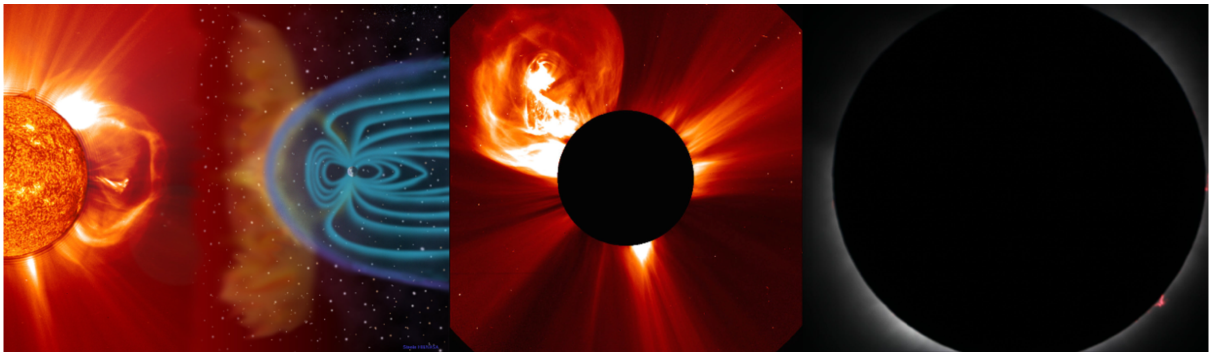


Figure 4.8. Left to right: (1) ESA illustration of a coronal mass ejection, (2) photo of a coronal mass ejection imaged by the SOHO/LASCO C2 coronagraph on January 4th, 2002, (3) photo of totality with a fiery red solar prominence in the bottom right corner taken by Grant Fischer on April 8th, 2024 at the Dallas eclipse viewing site. The white glow around the black disk of the Moon is the Sun's corona.

The second movement begins by reprising the bright E major tonality (representing the corona) from the first movement. However, the harmony ventures further with more extensions, symbolic of the peak of coronal revelation. Whereas the first movement utilizes a Lydian scale plus one tone to elicit brightness, the second movement adds two Lydian pentascales to the already-dense F# major seventh over E major seventh polychord: [D♭-E♭-F-G-A♭] and [E♭-F-G-A-B♭]. The resulting 10-tone harmony is a luminous double polychord, voiced in seconds in the upper register, crafting a shimmering orchestral cluster sonority.

The extreme brightness of the first orchestral hit in the second movement mirrors the intensity of a violent solar flare—such as the one in May 2024, which triggered the most powerful geomagnetic storm on Earth since 1989. In the orchestral texture, the *glissandi* in the brass, timpani, harp, and strings and the fluttering scales in the woodwinds represent the warping of mass from the Sun as it is ejected from the surface.

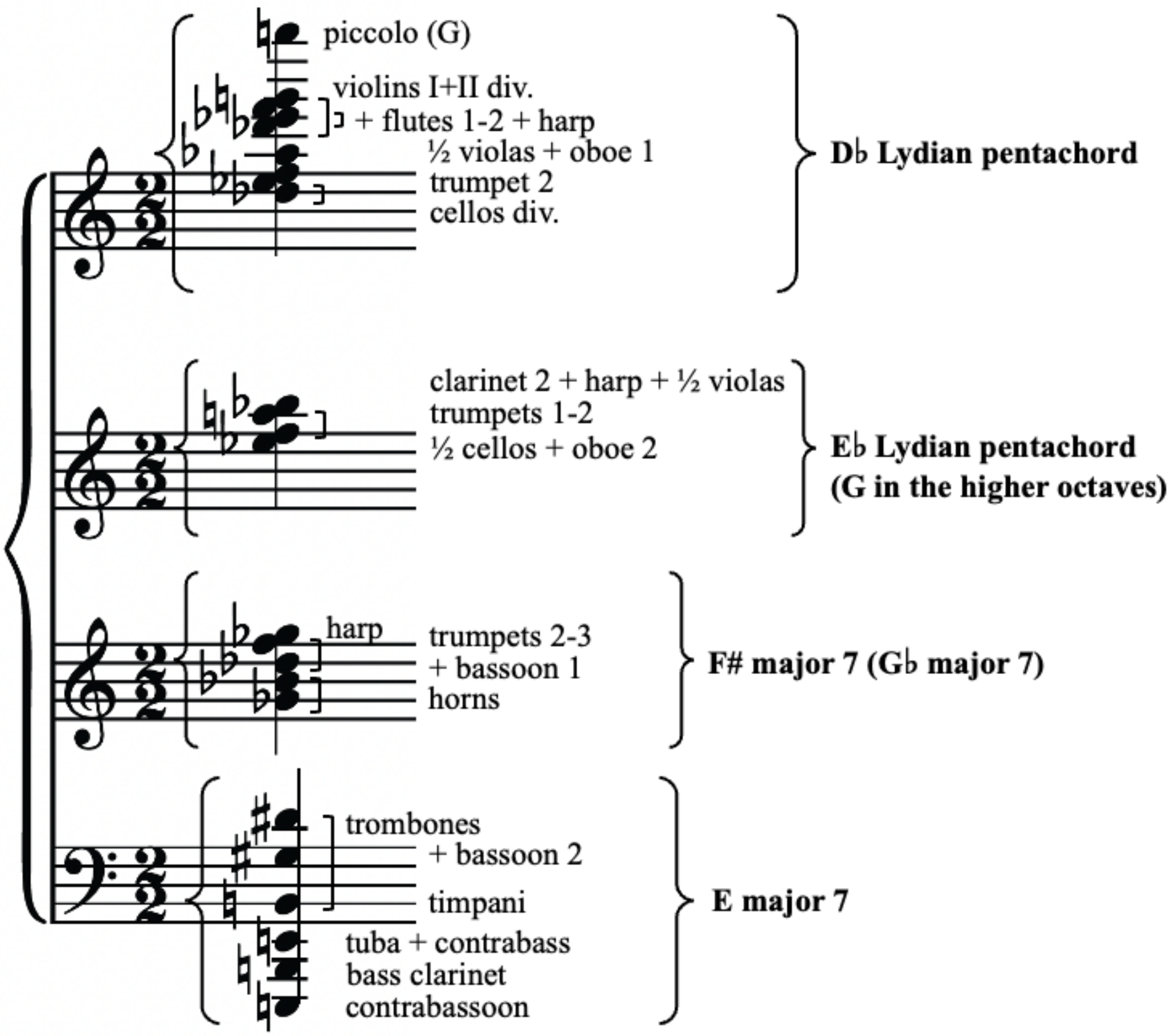


Figure 4.9. Orchestral reduction of the double polychord chord in bar 1 of "Harmony of the Spheres."

Additionally, during the second movement, the strings are often scored in harmonics. As mentioned in Chapter I, harmonics are important in *Symphony of the Sun* because they reveal overtones by covering a fundamental, like an eclipse reveals the corona by covering the Sun's disk. Furthermore, the Sun's rotation cycle also exhibits periodicities in its behavior at harmonic intervals—a kind of cosmic resonance—analogous with the harmonic series found in mathematics, nature, and musical instruments. The Sun typically completes a rotation (called a synodic period) every 27 days. Scientists have observed variations in data such as solar wind speed, solar radio flux, and cosmic ray intensity at intervals consistent with the harmonics of the Sun's synodic period: registering at 13.5 days (second harmonic), 9.1 days (third harmonic), 6.8 days (fourth harmonic), 5.5 days (fifth harmonic), and 4.2 days (sixth harmonic) (Singh, Y. P., and Badruddin). While the strength of these subperiodicities can vary over time, the empirical pattern offers a powerful metaphor: the same fundamental concept behind the physics of a musical instrument shows up in the Sun's rotation.

The solar-harmonic metaphor permeates the second movement of the symphony in the form of the recurring motif of string harmonics. In rehearsal P ("Quasi Come Prima") for example, the second violins hold out an artificial harmonic on A, gradually sliding down to E-flat. In this nebulous texture, the first violins, violas, and cellos oscillate their bow placement from near the fingerboard (*sul tasto*) to near the bridge (*sul ponticello*). When a string bow is placed near the bridge, the fundamental is partially obscured, and the higher partials are excited—illuminating the timbre of the sound with flashes of fluctuating overtones. Thus, the second movement invokes various aspects of harmonics to paint a physical description of the Sun in the eclipse.

"Harmony of the Spheres" also illustrates the solar wind traveling through holes in the solar corona to the Earth using wind instruments. While the solar wind makes no actual sound in the vacuum of space, the NASA Parker Solar Probe team used data sonification to create a digital rendering available on the internet (NASA, Johns Hopkins Applied Physics Lab). Among the many sonifications in the recording, I gravitated to the sounds of wisps of violent air rushing against a surface. Inspired by the Parker probe sounds, I scored the solar wind in the orchestration through pitchless trills and mouthpiece effects in the brass section, unsynchronized key clicks and Aeolean tones in the woodwinds, special harp and piano effects, and aleatoric tam-tam and thundersheet swells.

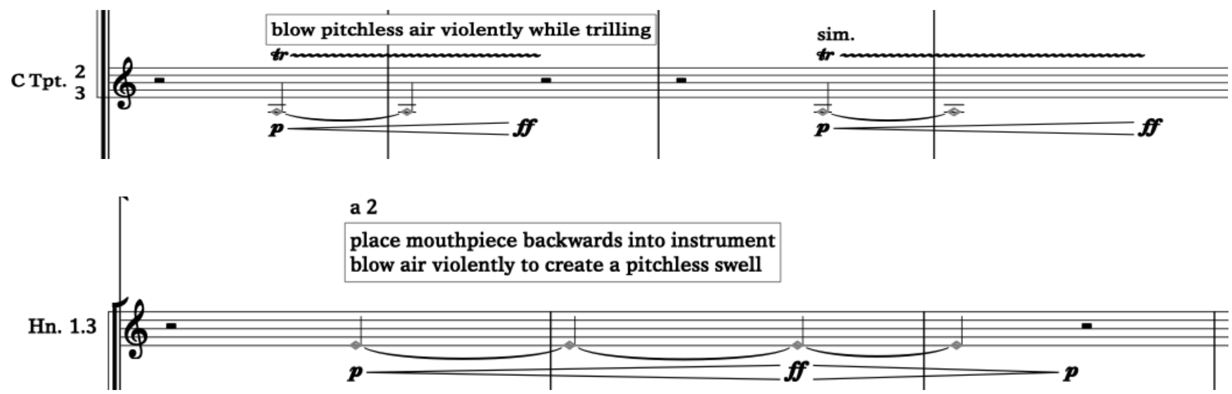


Figure 4.10. Top: “Harmony of the Spheres” bars 37-40 trumpets 2-3. Bottom: Bars 43-45, horns 1-3.

The climax of the second movement at Rehearsal N depicts the impact of the coronal mass ejection on Earth. After a long build-up at the relatively slow tempo of half note = 38 beats per minute, the orchestra suddenly breaks into 32nd notes. The rapid rhythmic shift signals the incredible speed of coronal mass ejections, traveling at up to 3000 kilometers per second (or 1864 miles per second, 1% the speed of light). The tempo then immediately jolts to the quicker quarter note = 116; however, the beat becomes unstable because the meter also changes to 7/8. The 7/8 time signature involves uneven beat groupings, which materialize as groups of 2+2+3 eighth notes. The chaotic orchestration compounds the metric instability by reprising the glissando motif from the opening. The woodwinds, brass, timpani, and strings rapidly ascend and descend in scalar runs and large glissandi, reflecting Earth’s fluctuating geomagnetic field during a solar storm.

Figure 4.11. Bars 182-186 of "Harmony of the Spheres."

The climactic passage develops the double polychord from the first bar of the piece, musically indicating the mass from the Sun has arrived at Earth. In this development, the chord becomes a melodic motif, ascending in transposition over a pedal of E. However, the music constantly thwarts stability, quickly lurching up a half step to a second phrase over the pedal of F.

The meter mirrors the melodic and harmonic mayhem by disrupting the pattern of 7/8 by injecting a bar of 5/8. The changing meter also interrupts the bass drum's booming 4+3 beat cycle and the tam-tam's bellowing eighth notes. This heavy percussion instrumentation maintains the rhythmic momentum and communicates the immensity of the climax in the overall form of the movement. The third phrase returns to the pedal of E, creating a three-phrase pattern of E-F-E in the bass motion and marking a direct reference to the Earth motif of Hindemith's *Die Harmonie der Welt*. The allusion functions programmatically in this climactic section by representing the impact of the Sun's matter on the Earth, using music to tie together the two celestial bodies in the thematic design of the composition.

The final movement of the symphony, "Unveiling Light," depicts the re-emergence of the Sun after the eclipse. The movement begins where the first movement left off: on a G pedal representing the shadow of the Moon. This intra-movement reference creates a palindromic structure to the symphony as a whole, evoking the symmetry of a total solar eclipse. From the lunar shadow emerges string, harp, and trumpet harmonics, superimposing the overtone material developed in the second movement. The trumpets allude to the famous "Sonnenaufgang" ("Sunrise") opening of Richard Strauss's orchestral tone poem *Also Sprach Zarathustra*. The iconic intertextual relationship between the Strauss and the space music genre carries importance: Strauss's theme was used in the Stanley Kubrick science fiction classic *2001: A*

Space Odyssey. By incorporating Strauss's theme, "Unveiling Light," participates in the canon of space music. Furthermore, the "Sonnenaufgang" also bears significance in *Symphony of the Sun* because the title refers to a sunrise. In "Unveiling Light," the re-emergence of the Sun can be likened to the Sun rising again on the same day. Following a total solar eclipse, the sky changes from dark navy blue to the familiar prism of golden hues formed from scattered sunlight in Earth's atmosphere. The similarity to a sunrise is so uncanny that nature responds accordingly—birds begin their morning song. This peacefulness is reflected in the opening to "Unveiling Light," from the stillness of the string harmonics to the floating piano-harp canon like birds flapping their wings.

As the events of the eclipse continue in reverse toward full daylight, the rapid shadow bands reappear—signaled in the music by the fast tempo (quarter note = 144) at rehearsal A. The movement then progresses through various minor and octatonic passages, emphasizing the ominous quality of the still-present shadows.

The main motif of "Unveiling Light" is a cycle of descending fourths, displaced by an octave—reminiscent of Hindemith's cycle of fourths in *Die Harmonie der Welt*. Also like Hindemith, the perfect-fourth motif in "Unveiling Light" represents the 4:3 ratio.

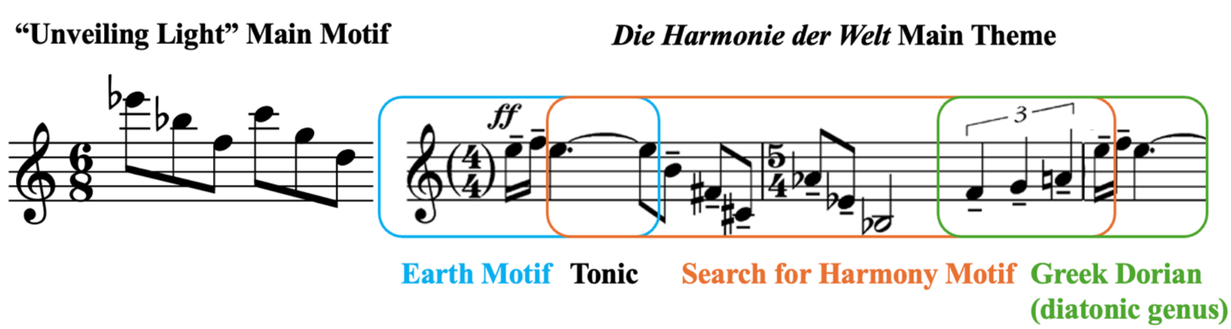


Figure 4.12. Left: "Unveiling Light" main motif. Right: *Die Harmonie der Welt* main theme.

Thus, the third movement of *Symphony of the Sun* obsessively returns to numeric games between the numbers three and four. For example, the piece heavily features the polyrhythm of 4:3, juxtapositions of melodic and harmonic thirds versus fourths, and the 7/8 time signature split into groupings of 4+3.

Figure 4.13. Example of the perfect-fourth (4:3 harmonic ratio) theme superimposed on a 4:3 polyrhythm in the piano left hand and harp in bars 13-15 in "Unveiling Light."

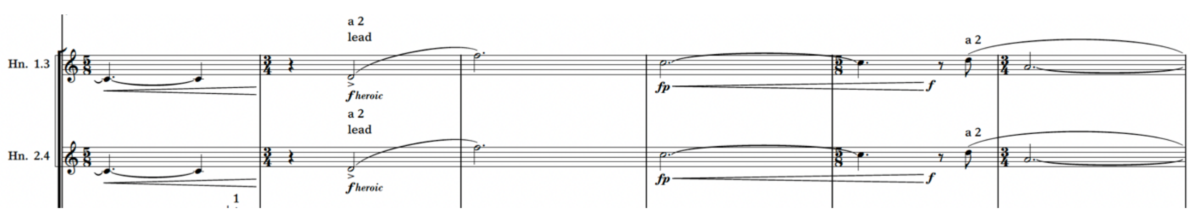


Figure 4.14. Example of a main melodic theme in the third movement from bars 19-24, developed from the cycle of fourths, prominently featuring an ascending minor tenth (a compound octave + minor third). Minor tenths can be formed by stacking three ascending perfect fourths.

After developing the perfect-fourth theme, the music arrives at rehearsal J—a fugue. Derived from the Latin *fuga* meaning "flight" or "escape," a fugue musically depicts a flight or escape by constantly displacing a main theme, or subject, between instruments. The effect of the rapid interchange of the fugue subject between instruments leads to overlapping counterpoint between all the voices—creating an illusion that the subject "escaped" from its starting point into a new realm. The escape analogy applies perfectly to the program of "Unveiling Light," because the fugue marks the escape of the Sun from the Moon's disk.

Rehearsal N reprises the string artificial-harmonic glissandi from the opening of the third movement (developed from the harmonic passages in the second movement). The winds elide with the strings in a spacious chorale, leading to a reverberant ostinato with vibraphone with motor and wine glasses (optionally bowed crotales) at Rehearsal P. The glissando returns, this time *ordinario* with vibrato in the solo violin. Programmatically, the superimposition of the glissando motif and the pitched-percussion ostinato invokes the image of the aurora borealis. The aurora comes from the interaction between the Earth's magnetic field and charged particles from the Sun (from a coronal mass ejection or solar wind, for example). Therefore, by transforming the solar material from the second movement and recontextualizing it with the sparkling auroral percussion, "Unveiling Light" musically portrays the Sun influencing the aurora on Earth.

The finale of the symphony features one more data sonification, tying back to the revelation of the planets in the daytime sky in the first movement. In the third movement, I sonify all eight planets in a chord. In contrast to the first solar system chord in "Totality," which uses average orbital velocities, the second solar system chord sonifies the planets' orbital periods.[3] An orbital period is the amount of time for a planet to complete one revolution around

[3] Average orbital velocity is proportional to the inverse of the square of the semi-major axis of a planet ($v \propto a^{-1/2}$) whereas orbital period is proportional to the semi-major axis of a planet to the 3/2 power ($T \propto a^{3/2}$). Johannes Kepler

the Sun, shown in Table 4.2 in number of days. Without straying too far into math and physics, essentially, the period can be likened to the length of a string. Every orbital period, the planet, like a string rising up and falling down, will have vibrated one time. As shown in the table, planetary periods are astronomically slow—Neptune's orbit translates to a pitch thirty-seven octaves below the piano. The analogy yields musical notes based in science; accordingly, I appropriate the notes into the symphony.

Table 4.2. Orbital periods of the planets converted to frequencies, shown as musical pitches.

Planet	Orbital Period (Days)	Orbital Frequency (Hz)	Equal-Tempered Pitch Reference	Octave	Transposed up 37 Octaves	Cents Flat/Sharp vs Reference
Mercury	87.969	0.0000001315699175	C#	-27	10	33
Venus	224.701	0.00000005150877866	A	-29	8	10
Earth	365.256	0.00000003168756728	C#	-29	8	-31
Mars	686.98	0.00000001684775987	D	-30	7	-25
Jupiter	4332.59	0.000000002671398419	F#	-33	4	-13
Saturn	10759.22	0.000000001075735423	D	-34	3	12
Uranus	30685.4	0.0000000003771850481	G#	-36	1	-2
Neptune	60190.03	0.0000000001922922131	G#	-37	0	31

Like the solar system chord in "Totality," the finale solar system chord involves practical compromises. Due to the different method of sonification, the orbital period chord generates a span of ten octaves. Such a chord, shown on the left in the musical diagram, when transposed up thirty-seven octaves, is audible; however, the ten-octave range poses a serious challenge to orchestras to realistically accomplish. Therefore, I condense the chord as opposed to expanding

is credited with discovering the 3/2 power relationship, codified as Kepler's Third Law or the Law of Harmonies/Periods. Due to the difference in proportionality, the sonification methods in this dissertation yield chords with different degrees of scaling.

the average orbital velocity chord. Furthermore, the pitches are again converted to equal temperament for sake of simplicity and playability in an orchestra.

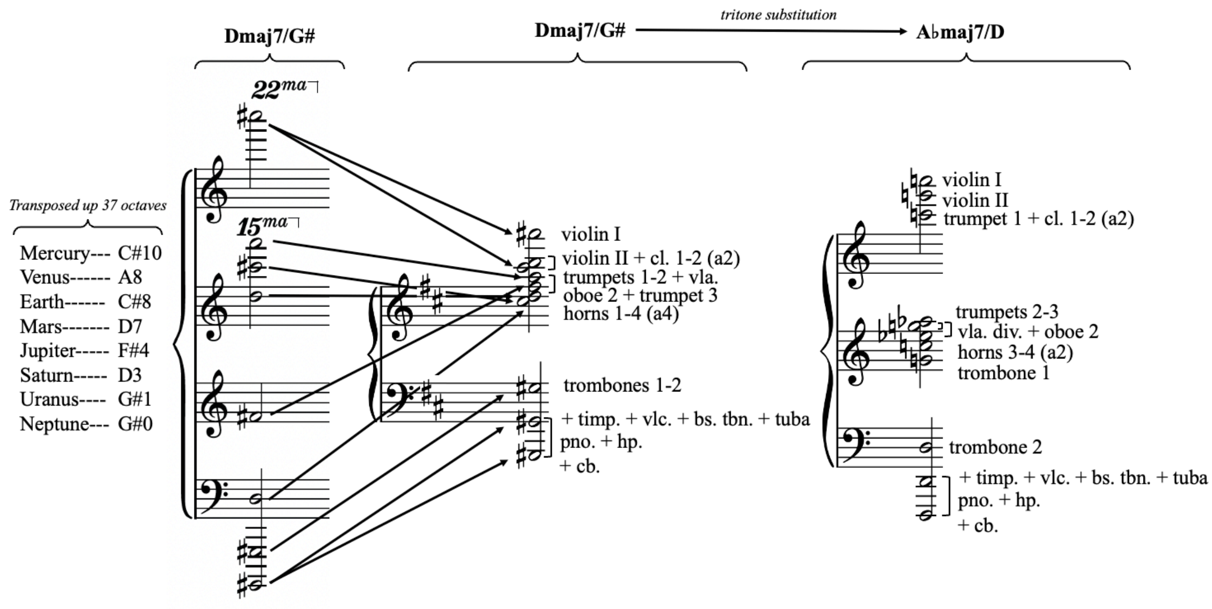


Figure 4.15. Solar system chord in bars 312 (middle) and 313 (right) of "Unveiling Light."

In the context of the movement, when transposed by a tritone from Dmaj7/G# to A♭maj7/D, the solar system chord falls into the key of E-flat. The tension created by the A♭maj7 against the leading tone of D propels the piece to the final chord—an extended E-flat major 13th chord.

4.2 Anthropomorphic Narrative

"We are a way for the universe to know itself. Some part of our being knows this is where we came from. We long to return. And we can, because the cosmos is also within us. We're made of star-stuff."

—Carl Sagan, astrophysicist

Symphony of the Sun anthropomorphizes the Sun, the Moon, and the Earth in a story about death, revelation, and resurrection. Across the three symphonic movements, the narrative becomes a metaphor for the eclipse, allowing emotions to be projected on the celestial characters as they interact. The symphony inserts me as an observer of the eclipse, enabling my own emotions and personal experience to influence the composition.

In the first movement, "Totality," the Moon murders the Sun. This narrative explains the aforementioned violent and dissonant portrayal of totality in the composition. In bar 145, the first instance of autobiographical anthropomorphism appears when the trumpet enters—the instrument I play—representing me witnessing the event. Amongst the trumpet melody, doubled by wailing bassoon, trombone, oboe, and cello, the percussion responds with a deafening crack in the brake drum. This violent moment marks the metaphorical death of the Sun.

Furthermore, the passage at rehearsal I, marked Meno Mosso (quarter note = 56 beats per minute), characterizes the tragedy of the Sun's death. In the orchestration, the ensemble becomes an intimate string orchestra with wind and string soloists.

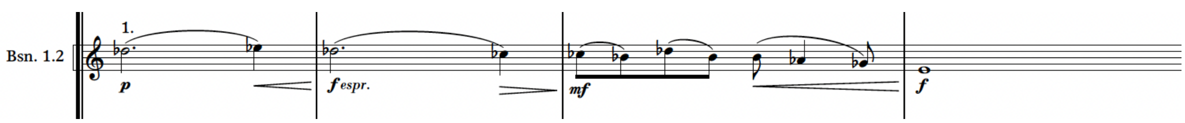


Figure 4.16. Bassoon solo in bars 197-200 of "Totality."

In particular, the bassoon solo in bars 197-200 sings in the bassoon's highest register, injecting an emotional intensity to the orchestra fitting of the Sun's lament. The solo cello doubling at the unison along with the solo violin an octave above add to the impassioned melody, emphasizing a dramatic peak in the context of the passage at Rehearsal I.

In the second movement, "Harmony of the Spheres," the Earth witnesses the revelation of its own demise. In the eclipse, the Earth glimpses the last image it will ever see: the Sun's fiery corona. The story connects to the real scientific prediction that the Sun will eventually expand and envelop the Earth five billion years in the future. In the symphony, the Earth witnessing the revelation is further personified by autobiographical music. In this movement, I craft the self-reference in the same way Holst did in "Uranus, the Magician" by utilizing musical cryptography. The motif A–S–H–A, derived from the letters of my name, "AuStin H. Ali," translates in the German note-naming system to A–E♭–B–A. Additionally, like Holst and the earlier music in "Totality," I use my own instrument, the trumpet, to play the autobiographical melody; however, I increase the intimacy in this movement by indicating the soloist to use a trumpet in B-flat, the instrument which I own and play. Furthermore, the ASHA motif functions as an *idée-fixe*, corresponding to the central theme "The Perennial Question of Existence" in Charles Ives's *The Unanswered Question* (1908)—also performed by the trumpet. Parenthetically titled "a Cosmic Landscape" in Ives's notes, the famous large chamber work establishes the precedent of pitting a solo trumpet against an ensemble to represent the questioning of reality.

Figure 4.17. ASHA Motif in "Harmony of the Spheres" in bars 49-52.

By the trumpet placement in “Harmony of the Spheres,” I unify the Sun, the Moon, the Earth, and me in the narrative—exactly as the eclipse occurred in real life. In the metaphorical narrative of the piece, I am reflecting on the fate of the Earth. Thus, the conception of this movement’s music is the most existential of the whole symphony.

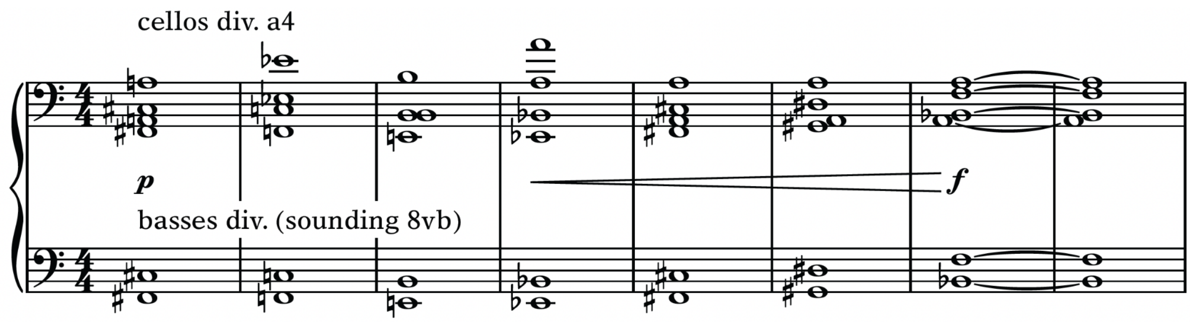


Figure 4.18. Reduction of the chorale from bars 45-52 in “Harmony of the Spheres.”

Like the chorale in the first movement, the chorale in the second movement (Figure 4.18) similarly conveys a sense of existentialism through drama in the harmony and orchestration. In two of the four voices of the cello choir, the ASHA motif is sounded verbatim in whole notes, creating a ghostly parallel-octaves effect. The contrabasses in their lowest register also double two voices of the cellos in octaves, adding depth and gravity. By infusing the autobiographical motif with the darkness in the orchestration, the passage encapsulates the existential reflection on death. The Sun is the giver of all life—its light feeds our ecosystems and warms our Earth; yet, the Sun has the power to destroy every living thing on Earth. This tension comprises the emotional core of the “Harmony of the Spheres” movement of *Symphony of the Sun*.

In the third movement, “Unveiling Light,” the Sun is resurrected. As the Sun re-emerges from the shadow of the Moon, the existential dread is transformed into triumph. The movement reprises the chorale from the second movement and reharmonizes the same bass line. The resulting harmonies are full sonorities: extended tertian and quartal chords. The chorale iterates six times as a kind of passacaglia, reminiscent of the *Die Harmonie der Welt* finale passacaglia.

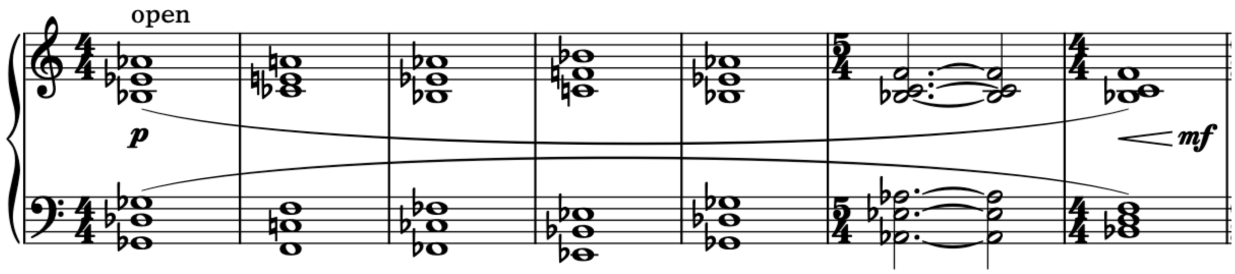


Figure 4.19. Reduction of the brass chorale in "Unveiling Light" in bars 174-180.

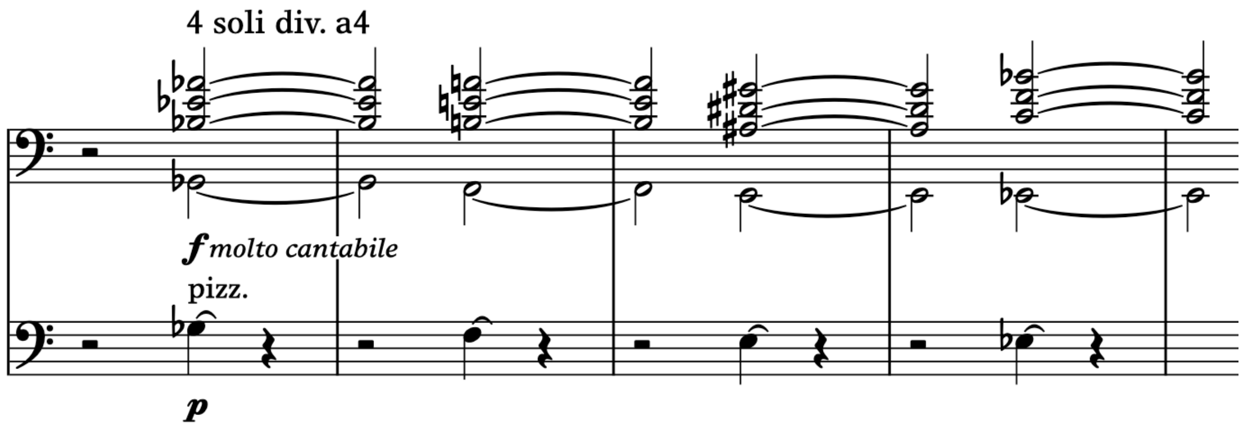


Figure 4.20. Cello and bass choir in bars 212-215 of "Unveiling Light." Basses sound 8vb.

In the final iteration, the cellos and bass return from the second movement, this time with the cellos singing in their high register and the bass in buoyant pizzicato. The tension of the dark second movement chorale has been resolved through this musical transformation.

The final movement concludes with a resolution of the autobiographical narrative. The piece ends in a Blues-influenced Mixolydian dance in 7/8 time. In this instance of 7/8, the meter serves as both a reclamation of the dissonant solar flare music of the second movement—but also another self-reference: 7/8 is my favorite time signature and connects back to my ancestral roots in the dance music of Afghanistan. The final rehearsal mark in the symphony is AA—a deliberate, albeit cheeky, autograph of my first and last initials—as if to say I am dancing along to the celestial music as it concludes with a fortissimo bang.

4.3 Program Notes

TOTALITY

"Totality" is the first movement of *Symphony of the Sun*, a deeply personal composition inspired by the once-in-a-lifetime total solar eclipse occurring over my childhood home of Dallas, Texas on April 8th, 2024.

In the music, I incorporated the image of the Moon swallowing the Sun whole by contrasting extreme dark and light. The composition begins with a spacious adagio painting the stellar landscape behind the celestial event, inspired by my first trip to the Mojave Desert. From the ethereal texture emerges a bouncy string ostinato, bringing the energy of a new day. From this daytime music, a soaring horn solo forewarns the coming eclipse, followed by a violent variation of this solo in the percussion, announcing the moment of totality. As day rapidly descends into night, a primal cry erupts from the winds and solo cello in the darkest moment. Just as quickly as the Moon's shadow came over the Earth, the brilliance of the Sun's corona highlights the sky, shining in a full orchestral tutti.

HARMONY OF THE SPHERES

"Harmony of the Spheres" depicts a revelation to the Earth during the eclipse. With the fiery solar corona in full view, the fate of the Earth becomes clear: the Sun will eventually envelop the Earth. Thus, the music juxtaposes the intense beauty of the Sun with its terrifying destructive power.

The composition features a prominent trumpet solo pitted against the whole orchestra, representing the individual in the face of the entire cosmos. The climax of the movement illustrates the impact of a coronal mass ejection from the Sun on the Earth, a reminder of the Sun's ability to reach across the solar system and touch the Earth.

UNVEILING LIGHT

After the moon swallows our closest star, the Sun re-emerges, as if it had risen twice in one day. "Unveiling Light" explores the rebirth of the Sun, beginning in the darkness and ultimately revealing the brightest light.

I traveled back home to Texas while composing this movement to witness the eclipse. Therefore, the composition also reflects the journey home. The Earth, the Moon, the Sun, my hometown, and my loved ones all aligned during the sun's spectacular show.

Musically, the main motifs include a rhythmic ostinato (an *Austin-ato*) driving the piece and a triumphant series of leaping melodies. The piece culminates in a fugue (referring to the Latin *fuga*, meaning "escape"), representing the escape of the Sun from its metaphorical death in the eclipse.

4.4 Premiere Notes

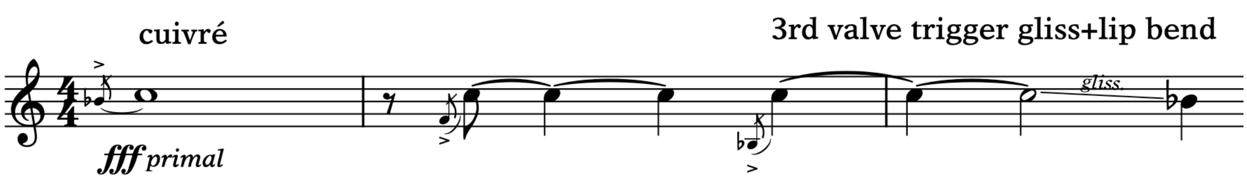
5/13/25 — Premiere of *Symphony of the Sun*, I. "Totality" at UCLA, conducted by the composer in Los Angeles, CA

6/26/24 — Premiere of *Symphony of the Sun*, III. "Unveiling Light" by the Filarmonia Arturo Toscanini, conducted by Tonino Battista in Siena, Italy

6/15/24 — Reading session of *Symphony of the Sun* I. "Totality" by the New England Philharmonic, conducted by Eric Nathan in Boston, MA

4.5 Performance Notes and Links to Full Score and Recordings

1. All glissandi should occur over the duration of the glissando line. (Ex: gliss. over beats 2 and 3 in the third bar of this excerpt).



(Excerpt from the first movement, trumpet 1, bars 145-147.)

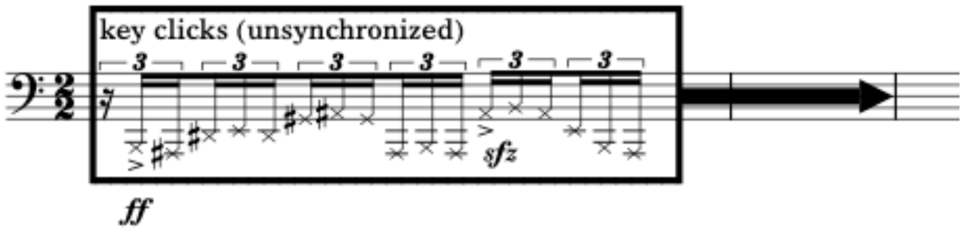
2. All harp harmonics should sound one octave higher than written.

3. Complex time signatures:

- All 5/8 and 5/4 bars are conducted 3+2.
- All 7/8 bars are conducted 2+2+3.
- The eighth note remains the same when transitioning to and from complex meter.

4. In the first movement, all grace notes occur ON the beat. In the second and third movements, all grace notes occur BEFORE the beat.

5. Aleatoric notation: repeat the figure ad lib. until the end of the arrow.



(Excerpt from the second movement, bassoon 1, bars 39-40.)

6. All trill accidentals are notated with the upper trilled note in parentheses.

(Excerpt from the third movement, oboe 1, bars 352-353.)

Please visit the QR code or the following link to view the full score and listen to the audio of *Symphony of the Sun*: https://www.austinali.com/product/symphony-no-1-symphony-of-the-sun/

Symphony Total Estimated Duration: 32 min.

CHAPTER V: CONCLUSION

5.1 Comparison Between the Holst, Hindemith, and Ali

<u>SCIENCE</u>

Across the spectrum of science to art in this dissertation, *Symphony of the Sun* lands the closest to the science side of the three works examined, with Hindemith lying in between the Holst and my symphony. While Holst's *Planets*, especially "Neptune," deals with space itself and culturally resonates as an popular celestial composition, the piece as a whole does not as deeply engage with science as *Die Harmonie der Welt* or *Symphony of the Sun*. Likewise, while Hindemith's symphony wrestles with the philosophy of the Harmony of the Spheres, incorporates Kepler's sonification as a motif, and epitomizes microcosm-macrocosm symmetry, the work does not venture as far as *Symphony of the Sun* into the science itself. *Symphony of the Sun* incorporates and reimagines several sonifications such as those from the Parker Solar Probe or my own conversions of orbital data into chords. Additionally, the piece explicitly portrays scientific phenomena such as nuclear fusion, the eclipse, solar flares, and coronal mass ejections. Therefore, *Symphony of the Sun* engages with astronomy from multiple angles and deeply interweaves the science into the construction of the entire composition, solidifying its place as closest to the science side of the spectrum among the three works studied.

The Spectrum from Science to Art through the Lens of Music

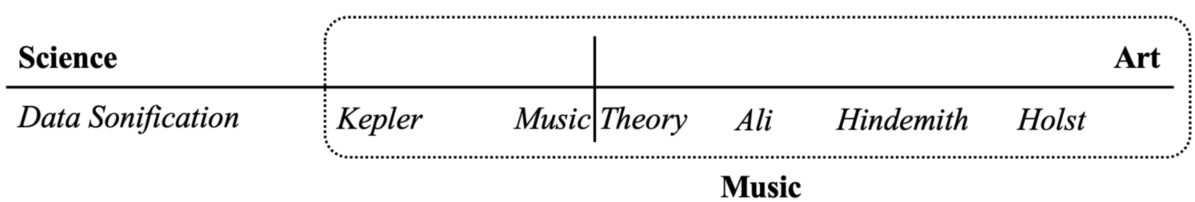


Figure 5.1 (Figure 1.2). The spectrum from science to art through the lens of music.

Why does *Symphony of the Sun* engage with science so deeply? The piece connects profoundly to science because of greater access to scientific knowledge and the link between auditory cognition and time-based phenomena. Firstly, *Symphony of the Sun* (2025) was written many decades after *The Planets* (1916) and *Die Harmonie der Welt* (1951). Since the early-to-mid twentieth century, humanity has vastly increased our understanding of the universe throughout the Space Age. Spacecraft and space telescopes provide a cosmic perspective, brimming with new knowledge and discoveries. For example, NASA launched the Voyager and New Horizons probes, gaining high-definition photos of the planets in the solar system, most recently Pluto in 2015 by New Horizons. The James Webb Space Telescope (JWST), with its extremely powerful imaging capabilities, illuminates details previously unknown in the night sky, such as discovering a new moon of Uranus or glimpsing the earliest images of the universe.

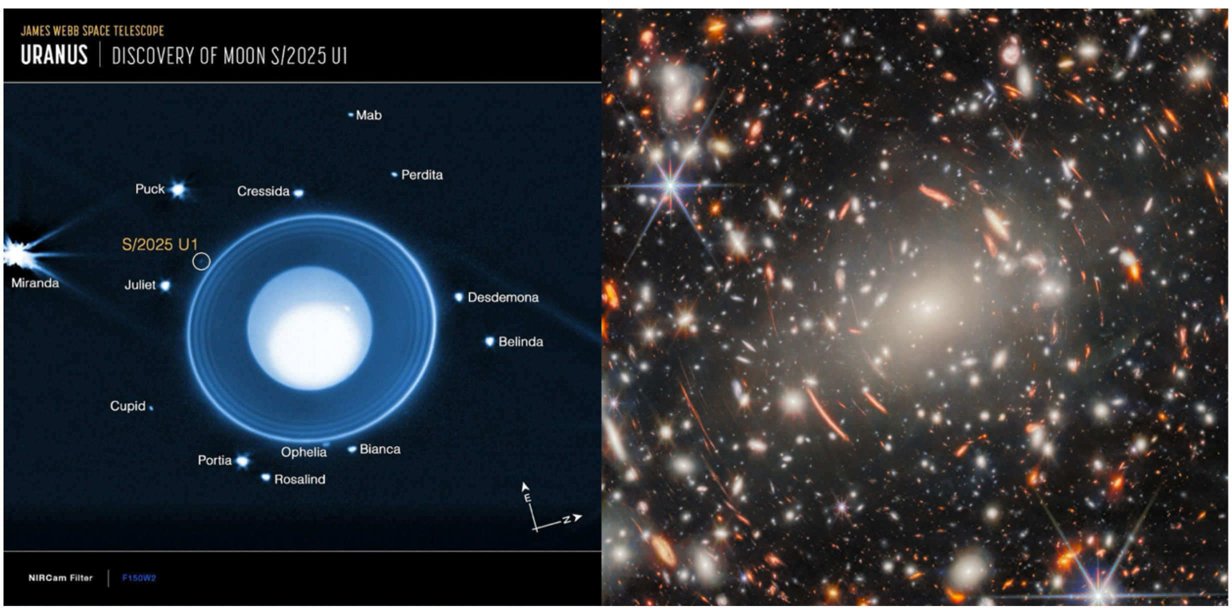


Figure 5.2. Credit: James Webb Telescope (NASA, ESA, CSA, STScl) 2025. Left: discovery of Moon S/2025 UI orbiting Uranus. Right: Webb's deepest look back on a single target to date using a deep field long exposure over 120 hours.

Due to my exposure to an explosion of space knowledge and my insatiable curiosity, I have translated my journey of learning about the universe into the composition of *Symphony of the Sun*.

Furthermore, the link between auditory cognition and perceiving time-based phenomena also motivates my incorporation of astronomy into the symphony. In the field of neuroscience and psychoacoustics, according to Burr et al., “sound does tend to dominate the perceived timing of audio-visual stimuli.” In layman’s terms, some science suggests that humans may perceive time-based phenomena more accurately through their auditory sense than their visual sense. Thus, *sonifying* data (as opposed to or in addition to *visualizing*) data provides insight to the brain about the passage of time—applicable in fields such as astronomy. In a growing interdisciplinary field, scholars such as Misdariis et al. have established the Audible Universe Project, which

> aims to create dialogue between two scientific domains investigating two distinct research objects: stars and sound… we present basic elements gathered by sound experts in their respective fields (sound perception/cognition, sound design, psychoacoustics, experimental psychology), to anchor sonification for astronomy in a more well-informed, methodological and creative process. (Misdariis, et al.)

In summary, due to the potential power of sonification to more precisely perceive astronomy, I investigate the cosmos through the language of music, gaining a deeper perspective on the true form of the universe.

ANTHROPOMORPHIC NARRATIVE

All three works personify celestial objects and include autobiographical anthropomorphism. *The Planets* are cosmic character pieces, with a special character of Holst as Uranus, the Magician, conjurer of worlds. *Die Harmonie der Welt* is an allegory for Hindemith's fraught political time through Johannes Kepler's search for universal harmony, and the work transforms the characters into planets in the finale of the opera and symphony. *Symphony of the Sun*, like a religious parable, depicts the Sun, the Moon, and Earth as characters with lives, able to be killed and even resurrected.

Additionally, all three works incorporate their celestial characters into a narrative. Holst's character in "Saturn" undergoes the journey of life itself, passing between the worlds of the terrestrial and the afterlife in the heavens. *Die Harmonie der Welt* follows a singular story across all three movements, progressing from "misery and famine" in the Earthly marches to the finale passacaglia among the stars. *Symphony of the Sun* also traces a single story across all three movements, animating the descent from brightness to existentialism and back to light.

However, *Symphony of the Sun* incorporates a new element: the observer as a character in the narrative. The piece includes the autobiographical narrative of witnessing the eclipse and contemplating Earth's existence through musical cryptograms and the *idée-fixe* trumpet solo. Why did I include me as an observer in the narrative? The event of the eclipse of April 8th, 2024 was significant in my life because it occurred in my hometown, and I was there to witness it with my loved ones. The personal and celestial aligned in a way that motivated me to compose a profoundly intimate work.

Figure 5.3. Left: attendees of the eclipse party. Right: my face reflected over the live image of the eclipse.

5.2 Further Questions

In the process of researching the music of the cosmos, I came across dozens of examples of musical pieces worth studying in greater detail. Here is a list of some I wish to study in detail:

Asteroid 4179: Toutatis, Kaija Saariaho (2005)

Pluto, the Renewer, Colin Matthews (2000)

Nova Plexus, Derrick Skye (2023)

Prometheus: The Poem of Fire, Alexander Scriabin (1910)

Motet, Harmony of the World, Dave Soldier (2022)

Night on the Galactic Railroad, Ian Krouse (2022)

Event Horizon, Adam Gilberti (2011, rev. 2024)

How does the framework of comparing science and anthropomorphic narratives apply in these compositions? What other analytical frameworks exist that can aid in the comparison of these diverse musical works? For the living composers, how do they themselves conceive of these works and implement the cosmos into their compositions?

Furthermore, I am curious about incorporating more data sonification of the solar system into a musical piece. How would a piece sound that transposed the entire solar system with *variable* orbital velocities according to the elliptical orbits? In *Symphony of the Sun,* I used average orbital velocities and constant frequencies across an orbital period. As Kepler demonstrated, the frequencies of the planets are oscillating themselves—a second-order operation not explored in *Symphony of the Sun*. Also, how would the celestial music sound if it were truly microtonal and not quantized to equal temperament? I imagine an electro-acoustic piece in surround sound called *Orrery*, named after a dynamic model of the solar system, exploring these sonifications in space and time.

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