SOLSTICE 1991

An Astronomical Sonification of June 19, 1991

Thomas F Heston

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A Piano Composition in Four Parts

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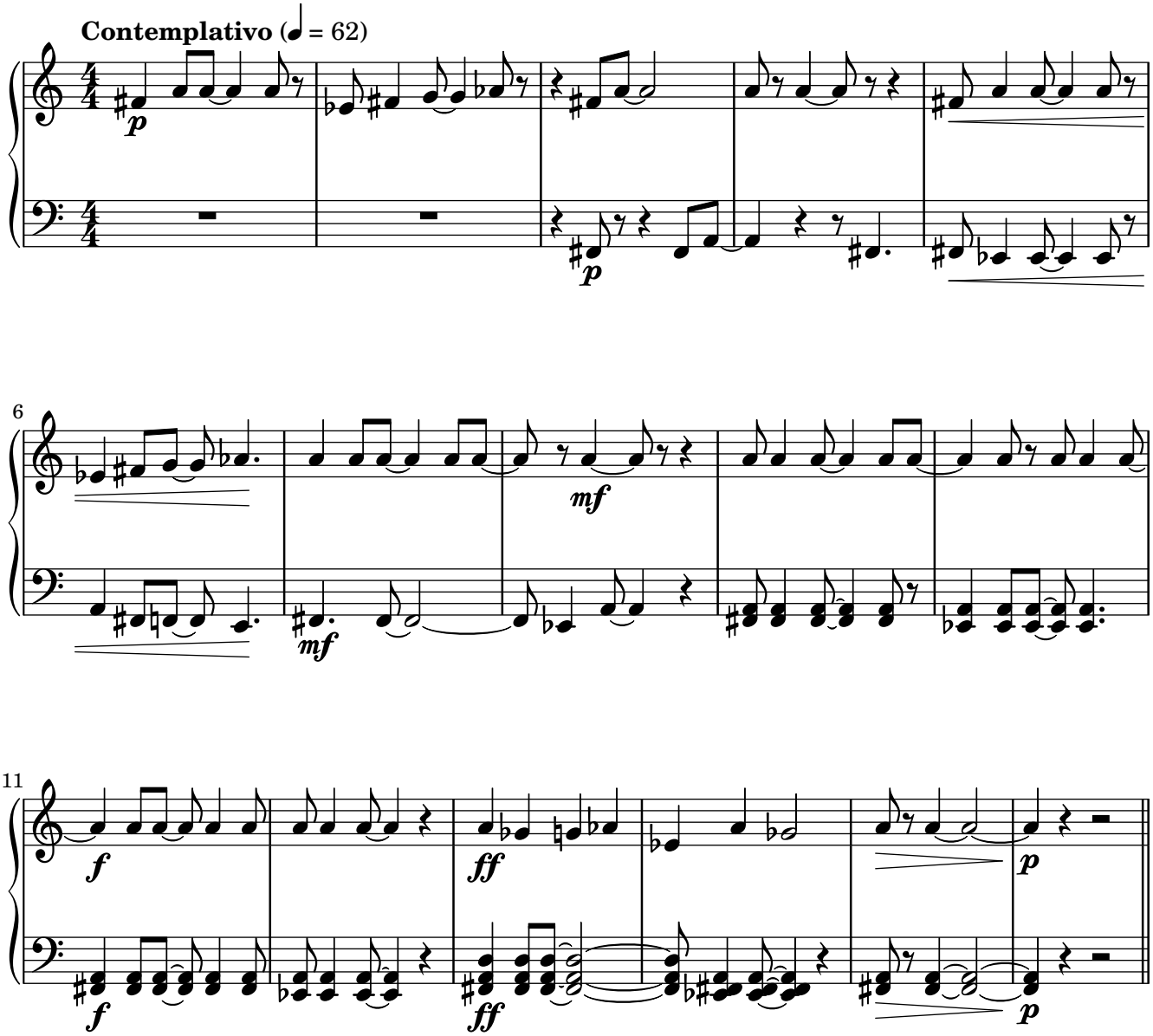
Contents:

Planetary Convergence

Venus, Mars, and Jupiter

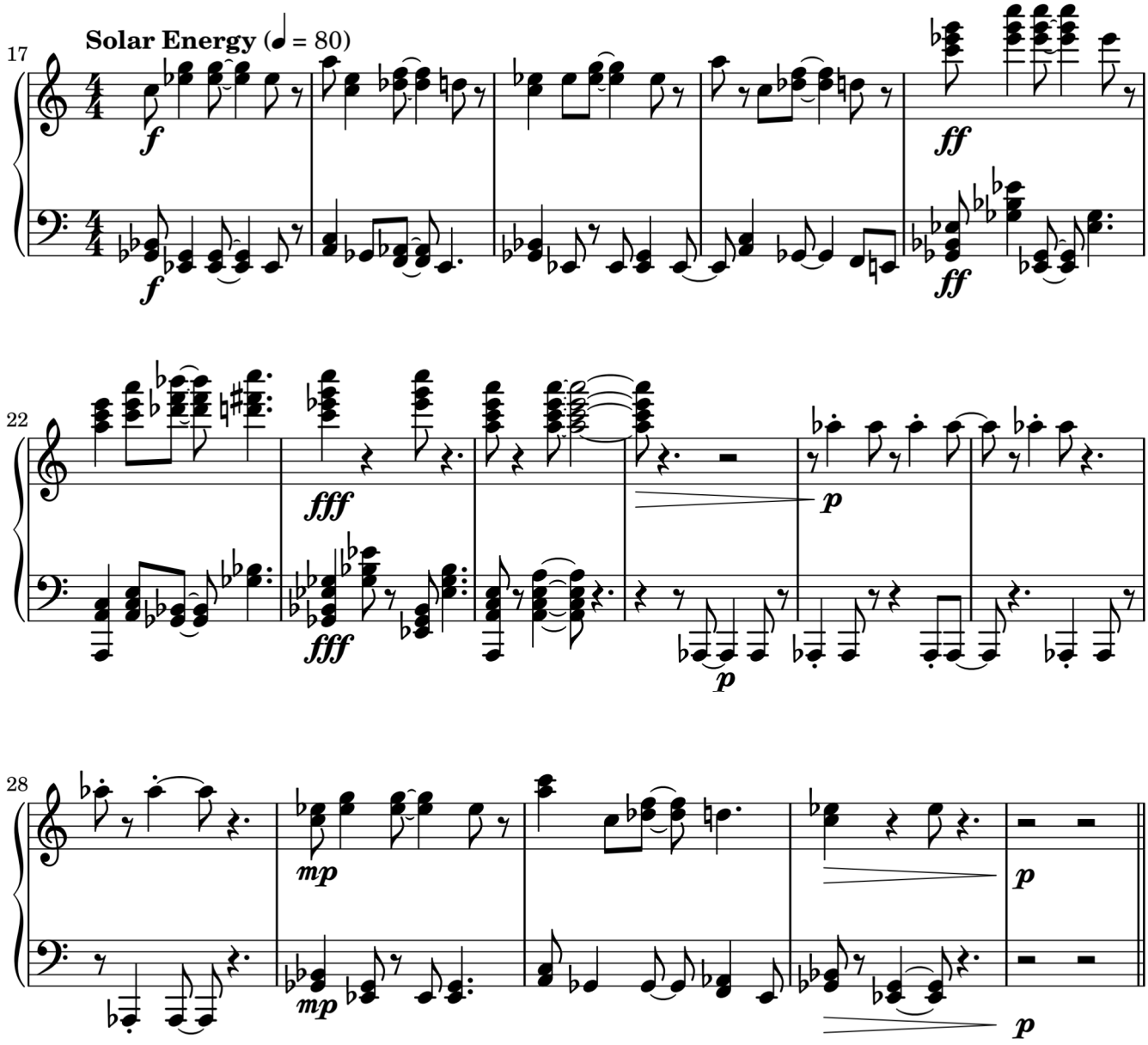


Performance Notes:

- Maintain twelve-tone row integrity throughout
- Use legato pedaling for connected planetary harmony
- Planetary conjunction (mm. 9-12): emphasize repeated A's as Venus-Mars-Jupiter converge
- Dynamics represent celestial brightness: planets above equator = forte
- Venus rhythm pattern (mm. 7-8) uses simple eighth note patterns
- Mars rhythms (mm. 9-12) emphasize steady eighth note pulse
- Jupiter entrance (mm. 13-14) maintains clear quarter and eighth note rhythm
- Rhythm focuses on musical flow rather than complex subdivisions

Solar Noon Climax

Solar elevation 65.8° at 1:11 PM, Saturn opposition

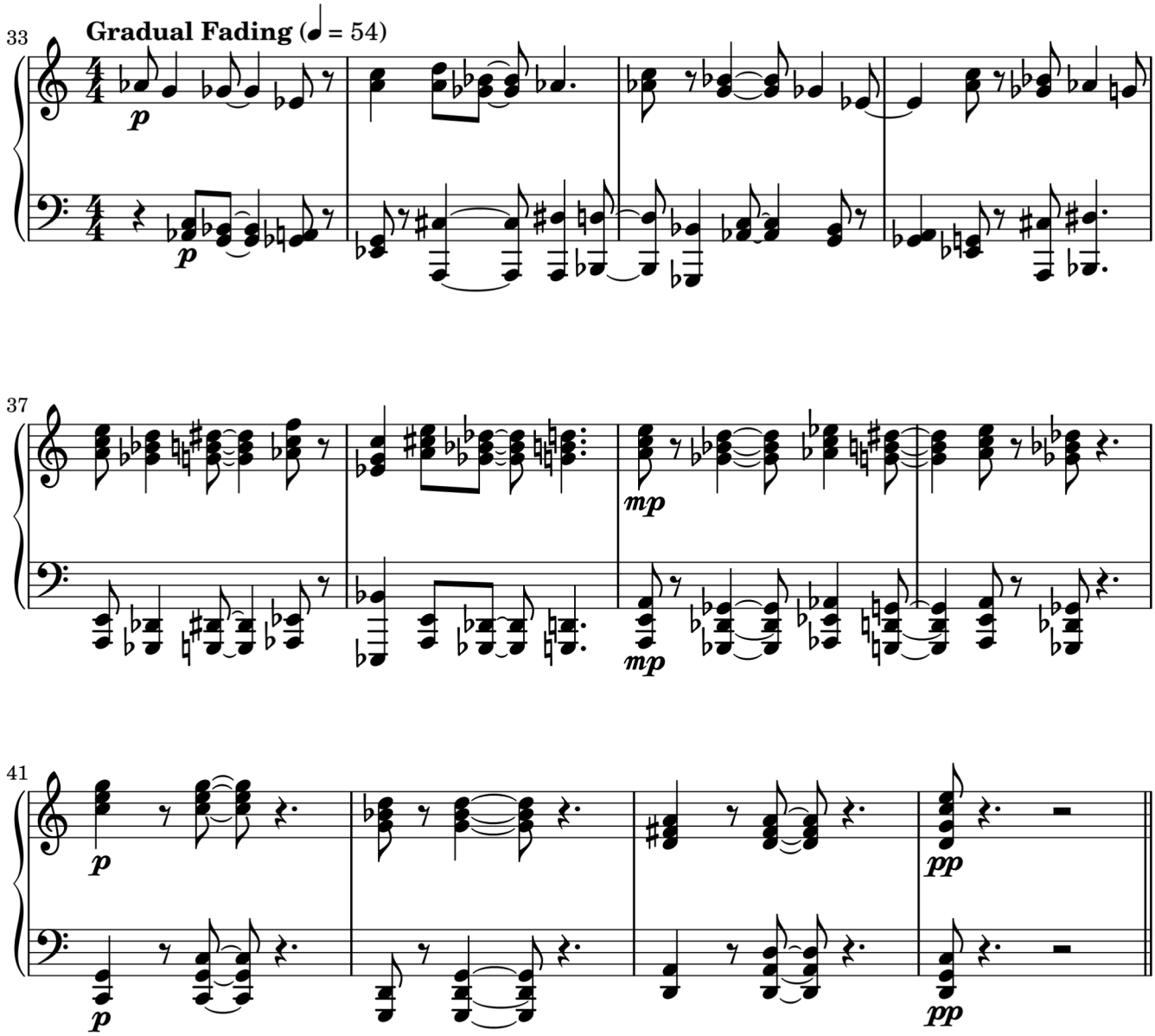


Performance Notes:

- Uses P6 transposition: C-Eb-Eb-Eb-A-C-Db-D
- Solar noon climax (mm. 21-24): fortissimo with high register representing maximum elevation
- Saturn opposition (mm. 25-28): isolated staccato Ab notes, contrasting with solar warmth
- Use full pedal for solar climax, staccato pedaling for Saturn
- Octaves in mm 17-20 represent the power and intensity of approaching solar noon
- High C‴ in m. 23 represents the 65.8° solar elevation peak
- Saturn's 20h Right Ascension = Ab, placed in opposition to the solar keys

Twilight Returns

Summer Triangle rising: Vega, Deneb, Altair

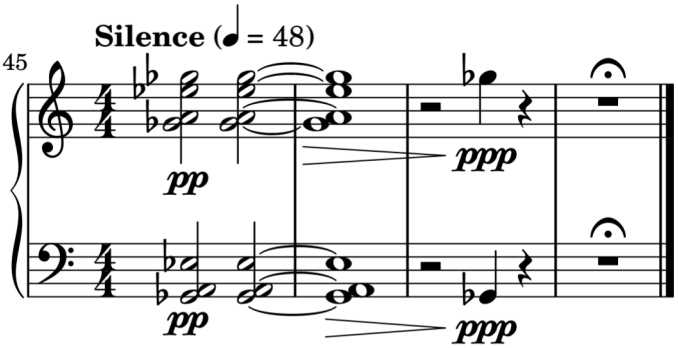


Performance Notes:

- Uses R0 (retrograde): Ab-G-Gb-Eb-A-A-A-Gb
- Tempo slowed to 54 BPM (81m transition ÷ 1.5) for atmospheric effect
- Piano and pianissimo dynamics throughout - gentle transitional atmosphere
- Use half-pedal technique for transitional, hazy sound
- Planetary convergence returns gently in mm. 37-40
- Summer Triangle (mm. 41-44): Vega=C''', Deneb=G'', Altair=D''
- Final chord represents three bright stars rising in eastern sky

The Infinite Night

Astronomical twilight ends at 11:59 PM



Performance Notes:

- Tempo slowed to 48 BPM - representing the approach to midnight
- Pianissimo to niente (ppp to silence) - complete fade
- Final chord contains key planetary Right Ascension pitches (Gb-A-Eb)
- Measure 45: Use full sustain pedal, let chord resonate
- Measure 46: Gradual decay, maintain pedal throughout
- Measure 47: High Gb represents brightest star (Vega) alone in darkness
- Measure 48: Complete silence with fermata - infinite night
- Release pedal only in the final silence
- Total duration should be relaxed, like watching the last light fade from the sky

The Infinite Night: An Astronomical Sonification of June 19, 1991

The solstices mark humanity's most ancient astronomical observations, occurring when Earth's axial tilt reaches its maximum orientation toward or away from the Sun. During the summer solstice, the Northern Hemisphere experiences its longest day as the Sun reaches its highest elevation in the sky, while the winter solstice brings the shortest day and lowest solar arc. These celestial events have guided civilizations for millennia, serving as temporal anchors that connect us to the cosmos through the predictable dance of our planet's orbital mechanics. The solstices remind us that we are passengers on a world in motion, experiencing the consequences of celestial mechanics played out on a scale both vast and intimate.

On June 19, 1991, as the summer solstice approached, the night sky above Seattle presented a remarkable astronomical tableau. Three planets—Venus, Mars, and Jupiter—had converged near the constellation Gemini, creating what astronomers call a planetary conjunction. This celestial gathering occurred against the backdrop of the approaching solar noon, when the Sun would reach its peak elevation of 65.8 degrees at 1:11 PM Pacific Daylight Time. Meanwhile, Saturn maintained its distant opposition, isolated in Capricornus at a Right Ascension of 20 hours, standing in stark contrast to the planetary cluster at 9 hours. As twilight descended, the Summer Triangle—composed of the brilliant stars Vega, Deneb, and Altair—began its ascent in the eastern sky, heralding the deep night that would follow. These planetary positions, precisely measurable and historically unique, provided the numerical foundation for transforming astronomical data into musical expression.

Solstice 1991 translates these celestial events into a four-part piano composition using twelve-tone serial techniques derived directly from planetary coordinates. The first part, "Planetary Convergence," employs a tone row generated from the Right Ascension hours of all eight planets, with the Gemini cluster's repeated A notes (representing Venus, Mars, and Jupiter at 9 hours RA) creating harmonic emphasis at a contemplative tempo of 62 beats per minute. "Solar Noon Climax" accelerates to 80 BPM and transposes the row up six semitones, building to a fortissimo climax that mirrors the Sun's peak elevation, while Saturn's isolated staccato passages reflect its 20-hour opposition position.

“Twilight Returns” echoes the opening material, but now transformed through the retrograde tone row and softer dynamics, representing the gentle return of planetary themes in the evening sky. This part slows to 54 BPM, inspired by the fading twilight’s gentle glow. It presents the tone row in retrograde, introducing the Summer Triangle through three distinct harmonic characters: Vega as bright major chords, Deneb as darker

minor harmonies, and Altair as mixed intervals. Finally, "The Infinite Night" decelerates to 48 BPM and dissolves into silence, representing astronomical twilight's end at 11:59 PM.

In my three decades practicing nuclear medicine, I became intimately familiar with the stochastic nature of radioactive decay—each gamma ray emission representing a unique quantum event in an infinite universe of possibilities. Like the scintillation patterns captured by our imaging detectors, the astronomical moments of June 19, 1991, represent a singular configuration that will never recur in precisely the same way. This composition serves as a meditation on the profound beauty inherent in unique sequences within infinite systems. Just as the decimal expansion of π contains endless non-repeating patterns of extraordinary mathematical beauty, human existence unfolds as a finite sequence within the infinite expanse of cosmic time. Each life, each moment, each planetary configuration possesses irreplaceable uniqueness—not because infinite time cannot theoretically reproduce such patterns, but because the contextual matrix of time, space, and consciousness that gives meaning to these patterns exists only once. The astronomical events of that June evening in Seattle created a celestial symphony that had never played before and will never play again, much like the irreducible singularity of conscious experience itself. In capturing these moments through musical notation, we attempt to preserve something of their eternal significance, standing in awe before beauty we can measure but never fully comprehend.

Thomas F Heston, MD. June 2025

Sources:

Planetary positions and astronomical data: NASA Jet Propulsion Laboratory HORIZONS System (https://ssd.jpl.nasa.gov/horizons/)

Solar data for Seattle, WA: U.S. Naval Observatory Astronomical Applications Department (https://aa.usno.navy.mil/)

Constellation and star catalog information: International Astronomical Union (https://www.iau.org/)

Celestial Coordinates and Timing Data			
Astronomical Events on June 19, 1991			
Event	**Number**	**Units**	**Application in the song**
TEMPO AND TIMING			
Section A tempo	62	BPM	65.8° solar elevation rounded down for contemplative feel
Section B tempo	80	BPM	Faster than 65.8° baseline to represent peak solar energy
Section A' tempo	54	BPM	81 minutes twilight ÷ 1.5 = 54 BPM for fading effect
Coda tempo	48	BPM	Slower than 54 to approach midnight stillness
Total composition length	48	measures	Julian day 172 ÷ 3.5 = 49, rounded to 48 measures
SOLAR DATA (Seattle)			
Sunrise time	5.18	decimal hours	5 hours + 0.18×60 = 11 minutes → 5:11 AM timing
Sunset time	21.17	decimal hours	21 hours + 0.17×60 = 10 minutes → 9:10 PM timing
Solar noon	13.18	decimal hours	13 hours + 0.18×60 = 11 minutes → 1:11 PM climax
Daylight duration	15.98	decimal hours	Nearly 16 hours → potential 16-note sequences
Solar elevation angle (max)	65.8	degrees	65.8 ≈ 66, adjusted to 62 BPM for base tempo
Solar azimuth at sunrise	53	degrees	53° Northeast → directional harmonic movement
Solar azimuth at sunset	307	degrees	307° Northwest → opposite directional movement
Atmospheric twilight duration	81	minutes	81 ÷ 1.5 = 54 BPM for Section A' tempo
PLANETARY POSITIONS (Right Ascension)			
Mercury RA	6.45	decimal hours	6 hours → semitone 6 → F#/Gb (first row note)
Venus RA	9.16	decimal hours	9 hours → semitone 9 → A (Gemini cluster)
Mars RA	9.2	decimal hours	9 hours → semitone 9 → A (Gemini cluster)
Jupiter RA	9.01	decimal hours	9 hours → semitone 9 → A (Gemini cluster)
Saturn RA	20.56	decimal hours	20 hours → semitone 8 → Ab (opposition note)
Uranus RA	18.9	decimal hours	18 hours → semitone 6 → F#/Gb (Sagittarius)
Neptune RA	19.14	decimal hours	19 hours → semitone 7 → G (Sagittarius)
Pluto RA	15.32	decimal hours	15 hours → semitone 3 → Eb (individual voice)
TWELVE-TONE ROW DERIVATION			
Primary tone row (P0)	6,9,9,9,3,6,7,8	semitones mod 12	RA hours mod 12 → Gb-A-A-A-Eb-Gb-G-Ab row
Section A form	P0	twelve-tone form	Original RA sequence for planetary convergence
Section B form	P6	twelve-tone form	+6 semitones = solar energy transposition
Section A' form	R0	twelve-tone form	Reversed sequence = time flowing backward
Coda key pitches	Gb,A,Eb	semitones	Most prominent RA values (6,9,3) simplified
CONSTELLATION GROUPINGS			

Gemini cluster planets	3	planets	3 planets at 9h RA → triple A harmony
Sagittarius cluster planets	2	planets	2 planets at 18h,19h RA → Gb-G pairing
Gemini cluster harmony	A-A-A	repeated pitch	Three 9h RA planets → repeated A notes
Saturn opposition	180	degrees	20h vs 9h RA = opposition → isolated staccato
SUMMER TRIANGLE STARS			
Vega brightness	-0.03	magnitude	Brightest (negative) → highest/loudest chord
Deneb brightness	1.25	magnitude	Dimmer positive → middle register/softer
Altair brightness	0.77	magnitude	Medium brightness → intermediate dynamics
Vega representation	C-E-G	major chord	Bright magnitude → bright major harmony
Deneb representation	G-Bb-D	minor chord	Higher magnitude → darker minor harmony
Altair representation	D-F#-A	mixed chord	Medium magnitude → mixed intervals
FORM AND STRUCTURE			
Section A measures	16	measures	48 total ÷ 3 sections = 16 measures each
Section B measures	16	measures	48 total ÷ 3 sections = 16 measures each
Section A' measures	12	measures	48 - 32 (A+B) = 16, reduced to 12 for fading
Coda measures	4	measures	48 - 44 (A+B+A') = 4 final measures
Gemini cluster emphasis	4	measures each	16 measures ÷ 4 sections = 4 measures per idea
Solar climax peak	4	measures	13.18h solar noon × 0.3 ≈ 4 measures duration
DYNAMIC MAPPING			
Positive declination	forte	dynamics	Above 0° declination → forte volume
Negative declination	piano	dynamics	Below 0° declination → piano volume
Solar maximum	fortissimo	dynamics	65.8° highest angle → loudest dynamic
Saturn opposition	staccato piano	dynamics	-19° declination + isolation → soft staccato
Summer Triangle	pianissimo	dynamics	Evening emergence → softest dynamics
Final silence	niente	dynamics	11:59 PM twilight end → complete silence
PEDALING PATTERNS			
Gemini cluster	legato	pedaling	3 planets close together → connected pedaling
Saturn sections	staccato	pedaling	20h RA isolation → detached pedaling
Twilight sections	half-pedal	pedaling	Atmospheric twilight → hazy half-pedal
Solar climax	full pedal	pedaling	Maximum solar energy → maximum resonance
Coda silence	long pedal to release	pedaling	Fade from sound to silence → gradual release