

HELIOS

For Orchestra

Composed by Elaine diFalco
2017

HELIOS

by

Elaine diFalco

INSTRUMENTATION

Flute (3)
Oboe (1)
Bb Clarinet (2)
Bb Bass Clarinet (1)
Bassoon (2)
F Horn (4)
Bb Trumpet (2)
Trombone (2)
Bass Trombone (1)
Tuba (1)
Timpani (1)
Vibraphone (1)
Harp (1)
Violin I (5)
Violin II (5)
Viola (4)
Violoncello (5)
Contrabass (3)

DURATION

Approx. 8 min.

University of North Texas

2017

PROGRAM AND ANALYSIS NOTES

This piece was inspired by the science of helioseismology, the study of acoustic waves that propagate and reverberate within the Sun. The tempo is set to sixty beats per minute, appropriate for the sexagesimal system that governs the quantification of time based on the motion of the Sun's daily path across our sky. At approximately eight minutes duration, the time it takes to perform this piece is roughly the time it takes for a photon that escapes the Sun's surface to reach the Earth after having spent several thousand years journeying from its origination of nuclear fusion deep within the Sun's core.

The use of natural harmonics is employed throughout much of the instrumentation to represent the phenomenon of acoustical heliophysics and the aesthetics of solar wind. As if moving through the Sun, micropolyphonic* texture (from measures 56 – 100) replicates the millions of oscillating modes that proliferate throughout our star. This section is inspired by the sonifications created by Alexander Kosovichev at Stanford University of helioseismic data from the Michelson Doppler Imager onboard the SOHO spacecraft.



The scale of the thematic material is derived from the pitches of a type III solar flare recorded on November 23, 1998 by Peter Messmer et al at the Institute of Astronomy in Switzerland. An orchestrated interpretation of this flare can be heard in measures 30, 41, 48, 62, 70, and 108. Another sound from the same flare is orchestrated with minor variation at measures 45, 67, and 103.

Measures 31 – 36 feature an orchestrated interpretation in the string section of another type III solar flare recorded by Don Gurnett et al at the University of Iowa on November 4, 2003 using the Radio and Plasma Wave Science instrument onboard the Cassini spaceprobe.

In order to interpret and appropriate the material referenced above, I used the software program SPEAR created by Michael Klingbeil to analyze the frequency spectrum and other properties of the audio files.

* A term borrowed from György Ligeti.

DEDICATION

This piece is lovingly dedicated to Frederick Charles Chalenor, an exceptional composer and bassist. He has been the most musically influential person in my life, my mentor, collaborator, and dear musical brother. I would not be the musician I am today without his immeasurable impact and unwavering gentle encouragement to experiment with sound, and musically challenge and trust my intuitions.

His initials provide the fundamentals for the harmonic series that gives this piece its form. The first three minutes are based on F, minutes three through five are based on C, and minutes six and seven are based on C#.

The Sun, though it shines in a manner that we sense as eternal, is indeed ephemeral from the perspective of cosmic time. It will eventually exhaust itself and its existence, as we know it, will end long after our species has likely run its course. May this piece remind us of how fortunate we are to witness and explore life and to have an opportunity to know and express love whenever and wherever we can. Life is fleeting but love touches our senses in a way that feels as eternal and reliable as the Sun.

ACKNOWLEDGEMENTS

I would like to give a special thanks to the helioseismology team at Stanford University. In particular, Tim Larson for his enthusiasm and time helping me understand helioseismology and providing an enormous amount of sonification files that will surely come to great use in future projects. Thanks also to Phil Scherrer for forwarding my initial inquiry around to the folks in the department. Thanks also to Alexander Kosovichev for kindly responding to my email with encouragement and permission to use his files for this project.

Thank you to Dr. Joseph Klein for giving his excellent advice from a composer and conductor's perspective.

A very special thanks goes to Dr. Kirstin Broberg for the world-class expert instruction, and most importantly, for providing a safe space for this daunting process.

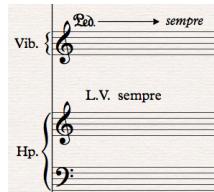
I would also like to acknowledge Dr. Kevin Walczyk who kindly gave me a copy of the score for his *Symphony No. 2, Epitaphs Unwritten* (nominated for a Pulitzer Prize) from which I borrowed his approach to these opening pages. In fact, my performance notes regarding multiple sonorities and angled beams are almost verbatim. Like Fred, his influence and guidance in my musical development continues to inspire and motivate me and will surely always continue to do so.

Finally, a very warm embrace and heartfelt thanks to Diane Kintrea for being such a beautiful soul.

PERFORMANCE NOTES



Multiple Sonorities: Multiple sonorities, or double stops, based on natural harmonics are required in the flute section. Traditional fingerings are used for all multiple sonorities. The diamond notehead represents the sounding pitch and the traditional notehead represents the fingering. Please refer to Robert Dick's *The Other Flute: A Performance Manual of Contemporary Techniques*, 2nd edition (Multiple Breath Company, 1989). [Note: I have reversed the diamond versus traditional notehead from Dick's notation.]



Sempre: Both the harp and vibraphone are to let all notes sustain throughout without exception. This is indicated at the first measure of almost every page as a courtesy except on a few pages where it would crowd the notation.



Natural String Harmonics: All of the harmonics notated for the strings are natural rather than artificial harmonics. A diamond indicates finger location (the exact string is specified in the parts) and a round note with a circle above it indicates sounding pitch.[†]



Angled Beams: Angled beams are used to indicate a gradual speeding up of successive pitches within the notated duration.

[†] Borrowed from Cliff Colnot's treatise on string harmonics.

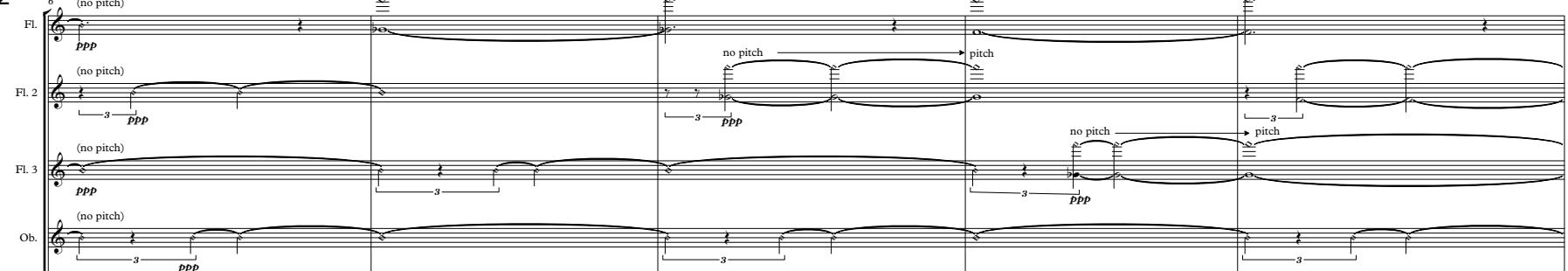
Dedicated with love to Fred Chalenor

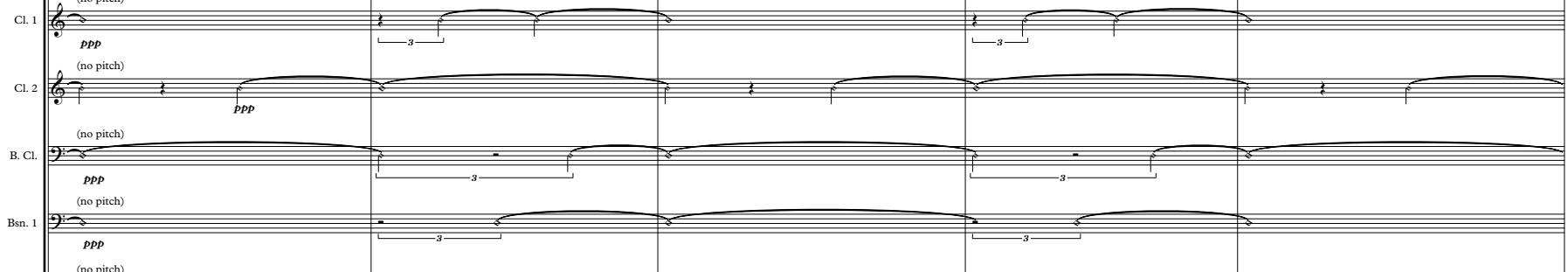
HELIOS

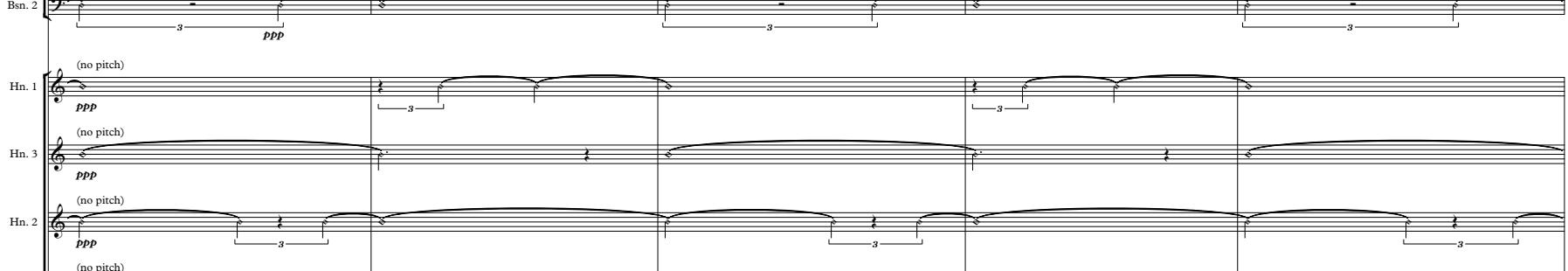
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2017

• = 60

Whispery, ethereal

Fl. (no pitch) 

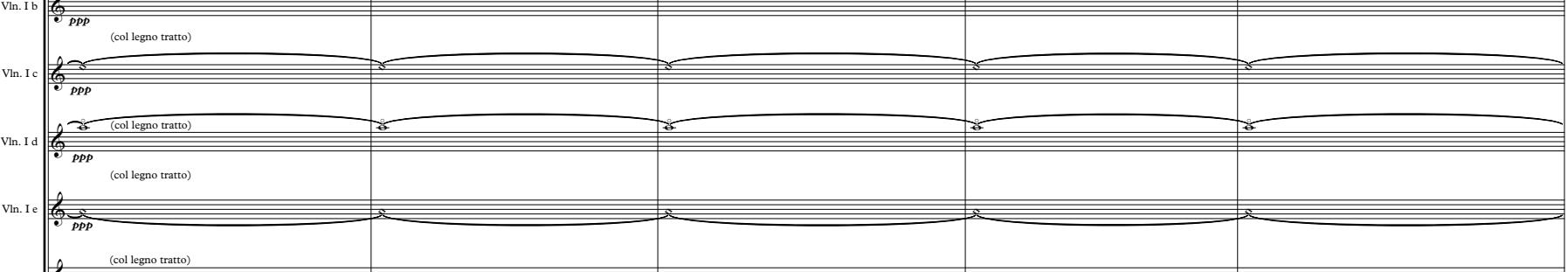
Fl. 2 (no pitch) 

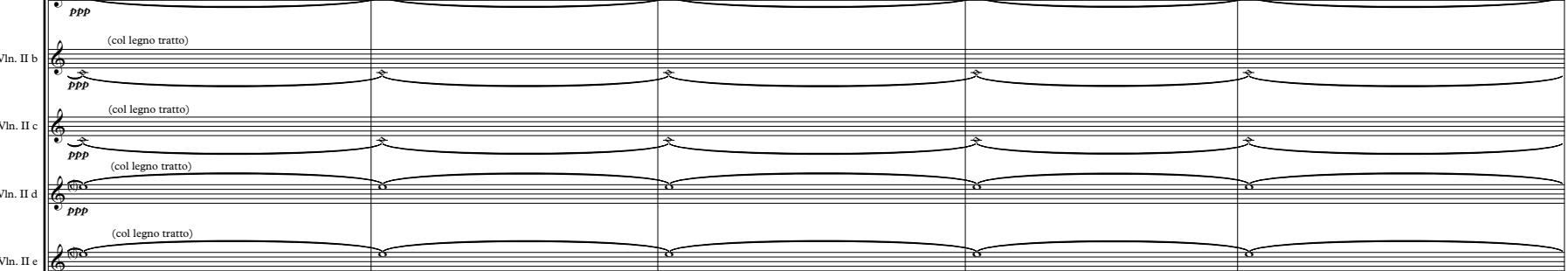
Fl. 3 (no pitch) 

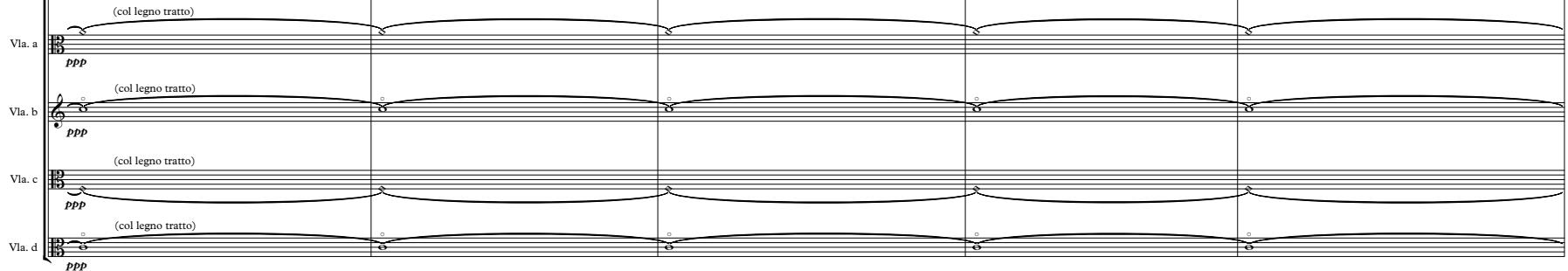
Ob. (no pitch) 

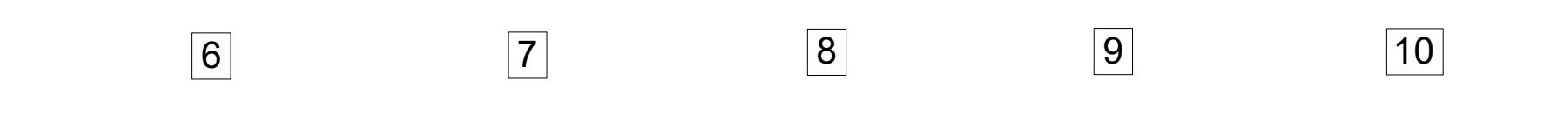
Cl. 1 (no pitch) 

Cl. 2 (no pitch) 

B. Cl. (no pitch) 

Bsn. 1 (no pitch) 

Bsn. 2 (no pitch) 

Hn. 1 (no pitch) 

Hn. 3 (no pitch)

Hn. 2 (no pitch)

Hn. 4 (no pitch)

Tpt. 1 (no pitch)

Tpt. 2 (no pitch)

Tbn. 1 (no pitch)

Tbn. 2 (no pitch)

B. Tbn. (no pitch)

Tba. (no pitch)

Timpani

Vib. (arco)

L.V.

sim.

Hp. L.V. sempre

(col legno tratto)

Vln. I a (col legno tratto)

Vln. I b (col legno tratto)

Vln. I c (col legno tratto)

Vln. I d (col legno tratto)

Vln. I e (col legno tratto)

Vln. II a (col legno tratto)

Vln. II b (col legno tratto)

Vln. II c (col legno tratto)

Vln. II d (col legno tratto)

Vln. II e (col legno tratto)

Vla. a (col legno tratto)

Vla. b (col legno tratto)

Vla. c (col legno tratto)

Vla. d (col legno tratto)

Fl.

Fl. 2

Fl. 3

Ob.

Cl. 1

Cl. 2

B. Cl.

Bsn. 1

Bsn. 2

Hn. 1

Hn. 3

Hn. 2

Hn. 4

Tpt. 1

Tpt. 2

Tbn. 1

Tbn. 2

B. Tbn.

Tba.

Tim.

Vib.

Hp.

Vln. I a

Vln. I b

Vln. I c

Vln. I d

Vln. I e

Vln. II a

Vln. II b

Vln. II c

Vln. II d

Vln. II e

Vla. a

Vla. b

Vla. c

Vla. d

Vc. 1

Vc. 2

Fl.
Fl. 2
Fl. 3
Ob.
Cl. 1
Cl. 2
B. Cl.
Bsn. 1
Bsn. 2
Hn. 1
Hn. 3
Hn. 2
Hn. 4
Tpt. 1
Tpt. 2
Tbn. 1
Tbn. 2
B. Tbn.
Tba.
Timp.
Vib.
Hpf.
Vln. I a
Vln. I b
Vln. I c
Vln. I d
Vln. I e
Vln. II a
Vln. II b
Vln. II c
Vln. II d
Vln. II e
Vla. a
Vla. b
Vla. c
Vla. d
Vc. 1
Vc. 2
Vc. 3
Vc. 4
Vc. 5
Cb. 1
Cb. 2

21 22 23 24 25

B

Fl. 1
Fl. 2
Fl. 3
Ob.
Cl. 1
Cl. 2
B. Cl.
Bsn. 1
Bsn. 2
(no pitch)
Hn. 1
Hn. 3
Hn. 2
Hn. 4
Tpt. 1
Tpt. 2
(no pitch)
Tbn. 1
Tbn. 2
(no pitch)
B. Tbn.
Tba.
Timpani
Vib.
Hpf.
B (sul ponticello) arco
Vln. I a
Vln. I b
Vln. I c
Vln. I d
Vln. I e
Vln. II a
Vln. II b
Vln. II c
Vln. II d
Vln. II e
Vla. a
Vla. b
Vla. c
Vla. d
Vc. 1
Vc. 2
Vc. 3
Vc. 4
Vc. 5
Cb. 1
Cb. 2
Cb. 3

This is a detailed musical score page from an orchestra and piano piece. The score is organized into multiple systems, each containing multiple staves for different instruments. The instruments listed on the left include Flute 1, Flute 2, Flute 3, Oboe, Clarinet 1, Clarinet 2, Bassoon 1, Bassoon 2, Horn 1, Horn 2, Horn 3, Horn 4, Trumpet 1, Trumpet 2, Trombone 1, Trombone 2, Bass Trombone, Tuba, Timpani, Vibraphone, Harp, Violin I (a, b, c, d, e), Violin II (a, b, c, d, e), Cello (1-5), Double Bass (1-3), and Piano.

The score features several systems of music. In System 1, the woodwind section (Flutes, Oboe, Clarinets, Bassoons) plays sustained notes with grace marks. The brass section (Horns, Trumpets, Trombones, Bass Trombone, Tuba) follows with sustained notes. The strings (Violins, Cellos, Double Basses) provide harmonic support with sustained notes and some rhythmic patterns. The piano part is mostly rests at this point.

System 2 continues the sustained-note pattern, with dynamics such as *p*, *mp*, and *pp*. The brass section has a brief moment of activity with eighth-note chords.

System 3 introduces more complexity with sixteenth-note patterns in the brass and sustained notes in the woodwinds. The strings continue their harmonic function.

System 4 shows a transition with the brass section playing eighth-note chords and the woodwinds continuing their sustained notes.

System 5 features sustained notes from all sections, with the brass section providing harmonic support.

System 6 includes a dynamic marking *ord.* (ordinario) and a performance instruction *con sordino* (with mute).

System 7 includes dynamic markings *mp* and *ord.* (ordinario).

System 8 includes dynamic markings *con sordino* and *mp*.

System 9 includes dynamic markings *ord.* and *con sordino*.

System 10 includes dynamic markings *ord.* and *mp*.

System 11 includes dynamic markings *ord.* and *con sordino*.

System 12 includes dynamic markings *ord.* and *mp*.

System 13 includes dynamic markings *ord.* and *con sordino*.

System 14 includes dynamic markings *ord.* and *mp*.

System 15 includes dynamic markings *ord.* and *con sordino*.

System 16 includes dynamic markings *ord.* and *mp*.

System 17 includes dynamic markings *ord.* and *con sordino*.

System 18 includes dynamic markings *ord.* and *mp*.

System 19 includes dynamic markings *ord.* and *con sordino*.

System 20 includes dynamic markings *ord.* and *mp*.

System 21 includes dynamic markings *ord.* and *con sordino*.

System 22 includes dynamic markings *ord.* and *mp*.

System 23 includes dynamic markings *ord.* and *con sordino*.

System 24 includes dynamic markings *ord.* and *mp*.

System 25 includes dynamic markings *ord.* and *con sordino*.

System 26 includes dynamic markings *ord.* and *mp*.

System 27 includes dynamic markings *ord.* and *con sordino*.

System 28 includes dynamic markings *ord.* and *mp*.

System 29 includes dynamic markings *ord.* and *con sordino*.

System 30 includes dynamic markings *ord.* and *mp*.

System 31 includes dynamic markings *ord.* and *con sordino*.

System 32 includes dynamic markings *ord.* and *mp*.

System 33 includes dynamic markings *ord.* and *con sordino*.

System 34 includes dynamic markings *ord.* and *mp*.

System 35 includes dynamic markings *ord.* and *con sordino*.

System 36 includes dynamic markings *ord.* and *mp*.

C

9

C

Musical score for orchestra and piano, page 15, measures 11-12. The score includes parts for Vln. I a, Vln. I b, Vln. I c, Vln. I d, Vln. I e, Vln. II a, Vln. II b, Vln. II c, Vln. II d, Vln. II e, Vla. a, Vla. b, Vla. c, Vla. d, Vc. 1, Vc. 2, Vc. 3, Vc. 4, Vc. 5, Cb. 1, Cb. 2, and Cb. 3. The music features sustained notes with grace notes, dynamic markings like *p*, *mp*, and *pp*, and performance instructions such as "sul ponticello" and "sul tasto".

41

42

43

44

45

Fl. 1
Fl. 2
Fl. 3
Ob.
Cl. 1
Cl. 2
B. Cl.
Bsn. 1
Bsn. 2
Hn. 1
Hn. 3
Hn. 2
Hn. 4
(con sord.)
Tpt. 1
(con sord.)
Tpt. 2
(no pitch)
Tbn. 1
(no pitch)
Tbn. 2
(no pitch)
B. Tbn.
(no pitch)
Tba.
Timpani
Vib.
Hpf.
Vln. I a
Vln. I b
Vln. I c
Vln. I d
Vln. I e
Vln. II a
Vln. II b
Vln. II c
Vln. II d
Vln. II e
Vla. a
Vla. b
Vla. c
Vla. d
Vc. 1
Vg. 2
Vc. 3
Vc. 4
Vc. 5
Cb. 1
Cb. 2
Cb. 3
(gliss. sempre)

12

D Slight stirring

Fl. 1
Fl. 2
Fl. 3
Ob.
Cl. 1
Cl. 2
B. Cl.
Bsn. 1
Bsn. 2
Hn. 1
Hn. 3
Hn. 2
Hn. 4
(con sord.)
Tpt. 1
(con sord.)
Tpt. 2
(no pitch)
Tbn. 1
Tbn. 2
B. Tbn.
Tba.
Timpani
Vib.
Hpf.
D
Vln. I a
Vln. I b
Vln. I c
Vln. I d
Vln. I e
Vln. II a
Vln. II b
Vln. II c
Vln. II d
Vln. II e
Vla. a
Vla. b
Vla. c
Vla. d
Vc. 1
Vc. 2
Vc. 3
Vc. 4
Vc. 5
Cb. 1
Cb. 2
Cb. 3

56

57

58

59

60

13

With commotion

14

E Frenetic, chaotic

16

This page shows the first half of a musical score. The instrumentation includes Flute 1, Flute 2, Flute 3, Oboe, Clarinet 1, Clarinet 2, Bassoon 1, Bassoon 2, Horn 1, Horn 2, Horn 3, Horn 4, Trompete 1 (con sord.), Trompete 2 (con sord.), Trombone 1, Trombone 2, Bass Trombone, Tuba, Timpani, Vibraphone, and Harp. The music is labeled 'Frenetic, chaotic' and starts at measure 76. The dynamics are primarily ff (fortissimo) and ff (double fortissimo). Measures 76-79 show woodwind entries with sixteenth-note patterns. Measures 80-83 show brass entries with eighth-note patterns. Measures 84-87 show woodwind entries with sixteenth-note patterns.

This page continues the musical score from page 16. It includes measures 84 through 91. The instrumentation remains the same. The dynamics are primarily ff (fortissimo) and ff (double fortissimo). Measures 84-87 show brass entries with eighth-note patterns. Measures 88-91 show woodwind entries with sixteenth-note patterns.

E

(pizz.)

This page concludes the musical score from page 16. It includes measures 92 through 100. The instrumentation remains the same. The dynamics are primarily ff (fortissimo) and ff (double fortissimo). Measures 92-95 show woodwind entries with sixteenth-note patterns. Measures 96-99 show brass entries with eighth-note patterns. Measure 100 ends with a ff (double fortissimo) dynamic.

Fl. 1
Fl. 2
Fl. 3
Ob.
Cl. 1
Cl. 2
B. Cl.
Bsn. 1
Bsn. 2

Hn. 1 *ff*
Hn. 3 *ff*
Hn. 2 *ff*
Hn. 4 *ff*
(con sord.)
Tpt. 1 *ff*
(con sord.)
Tpt. 2 *ff*
Tbn. 1 *ff*
Tbn. 2 *ff*
B. Tbn.
Tba.
Tim. *ff*
(soft mallets)
Vib. *Rd. sempre*
L.V. *sempre*
Hp.

Vln. I a (pizz.)
Vln. I b *ff*
Vln. I c *ff*
Vln. I d *ff*
Vln. I e *ff*
Vln. II a (pizz.)
Vln. II b *ff*
Vln. II c *ff*
Vln. II d *ff*
Vln. II e *ff*
Vla. a *ff*
Vla. b *ff*
Vla. c *ff*
Vla. d *ff*
Vc. 1 *ff*
Vc. 2 (pizz.) *ff*
Vc. 3 *ff*
Vc. 4 *ff*
Vc. 5 *ff*
Cb. 1 *ff*
Cb. 2 *ff*
Cb. 3 *ff*

the storm breaks

18

Fl.

Fl. 2

Fl. 3

Ob.

Cl. 1

Cl. 2

B. Cl.

Bsn. 1

Bsn. 2

Hn. 1

Hn. 3

Hn. 2

Hn. 4 (con sord.)

Tpt. 1 (con sord.)

Tpt. 2 (con sord.)

Tbn. 1

Tbn. 2

B. Tbn.

Tba.

Timp.

Vib.

L.V. sempre

Hp.

Vln. I a

Vln. I b (pizz.)

Vln. I c

Vln. I d

Vln. I e (pizz.)

Vln. II a

Vln. II b (pizz.)

Vln. II c

Vln. II d

Vln. II e (pizz.)

Vla. a

Vla. b (pizz.)

Vla. c

Vla. d (pizz.)

Vc. 1

Vc. 2

Vc. 3

Vc. 4

Vc. 5

Cb. 1

Cb. 2

Cb. 3

the storm breaks

86

87

88

89

90

20

Fl. 1
Fl. 2
Fl. 3
Ob.
Cl. 1
Cl. 2
B. Cl.
Bsn. 1
Bsn. 2

Hn. 1
Hn. 3
Hn. 2
Hn. 4
Tpt. 1
Tpt. 2
Tbn. 1
Tbn. 2
B. Tbn.
Tba.
Tim.
Vib.
Hpf.
Vln. I a
Vln. I b
Vln. I c
Vln. I d
Vln. I e
Vln. II a
Vln. II b
Vln. II c
Vln. II d
Vln. II e
Vla. a
Vla. b
Vla. c
Vla. d
Vc. 1
Vc. 2
Vc. 3
Vc. 4
Vc. 5
Cb. 1
Cb. 2
Cb. 3

96 97 98 99 100

F Whispers, ethereal 101

21

F 101

Fl. 1
Fl. 2
Fl. 3
Ob.
Cl. 1
Cl. 2
B. Cl.
Bsn. 1
Bsn. 2
Hn. 1
Hn. 3
Hn. 2
Hn. 4
Tpt. 1
Tpt. 2
Tbn. 1
Tbn. 2
B. Tbn.
Tba.
Timpani
Vib.
Harp

L.V. semper (soft mallets) L.V. (arco) mf

F 102

Vln. I a arco pp

Vln. I b pp

Vln. I c pp

Vln. I d pp

Vln. I e pp sul ponticello

Vln. II a pp sul ponticello

Vln. II b pp (sul ponticello)

Vln. II c pp (sul ponticello)

Vln. II d pp (sul ponticello)

Vln. II e pp (sul ponticello)

Vla. a pp (sul ponticello)

Vla. b pp (sul ponticello)

Vla. c pp (sul ponticello)

Vla. d pp (sul ponticello)

Vc. 1 pp (sul ponticello)

Vc. 2 pp (sul ponticello)

Vc. 3 pp (sul ponticello)

Vc. 4 pp (sul ponticello) col legno tratto

Vc. 5 pp (col legno tratto)

Cb. 1 pp (col legno tratto)

Cb. 2 pp (col legno tratto)

Cb. 3 pp

103

104

105

22

Fl.

Fl. 2

Fl. 3

Ob. (no pitch) *p* *mp* *3* *pp*

Cl. 1 (no pitch) *p* *mp*

Cl. 2 (no pitch) *p* *mp*

B. Cl. *p* (no pitch) *3*

Bsn. 1 *p* (no pitch) *p* *mp*

Bsn. 2 *p* (no pitch) *mp* *3* *p*

Hn. 1 *p* (no pitch) *3*

Hn. 3 *p* (no pitch) *3*

Hn. 2 (no pitch) *3* *p* *3*

Hn. 4 (no pitch) *3* *p* *3*

Tpt. 1 *p* (no pitch)

Tpt. 2 *p* (no pitch)

Tbn. 1 *p* (no pitch)

Tbn. 2 *p* (no pitch)

B. Tbn. *p* (no pitch) *p*

Tba. *p*

Tim. C R C R C R C R

Vib. *p* (gliss. sempre) *2d* → *sempre* arco *L.V.* *mf* sim.

Hp. *sul ponticello* *mf* *3*

Vln. I a *pp* (sul ponticello)

Vln. I b *pp* (sul ponticello)

Vln. I c *pp* (sul ponticello)

Vln. I d *pp* (sul ponticello)

Vln. I e *pp* (sul ponticello)

Vln. II a *pp* (sul ponticello)

Vln. II b *pp* (sul ponticello)

Vln. II c *pp* (sul ponticello)

Vln. II d *pp* (sul ponticello)

Vln. II e *pp* (sul ponticello)

Vla. a *pp* (sul ponticello) col legno tratto *3* *ppp*

Vla. b *pp* col legno tratto *3* *ppp*

Vla. c *pp* *3* *ppp* col legno tratto

Vla. d *ppp* (col legno tratto)

Vc. 1 *ppp* (col legno tratto)

Vc. 2 *ppp* (col legno tratto)

Vc. 3 *ppp* (col legno tratto)

Vc. 4 *ppp* (col legno tratto)

Vc. 5 *ppp* (col legno tratto)

Cb. 1 *ppp* (col legno tratto)

Cb. 2 *ppp* (col legno tratto)

Cb. 3 *ppp* (col legno tratto)

24

116 (no pitch)

Fl.

Fl. 2

Fl. 3

p (no pitch)

Ob.

(no pitch) 3

Cl. 1

p (no pitch)

Cl. 2

p (no pitch)

B. Cl.

p 3 (no pitch)

Bsn. 1

p (no pitch)

Bsn. 2

p (no pitch)

Hn. 1

p (no pitch) 3

Hn. 3

p (no pitch) 3

Hn. 2

p (no pitch)

Hn. 4

p (no pitch)

Tpt. 1

p (no pitch)

Tpt. 2

p (no pitch)

Tbn. 1

p (no pitch)

Tbn. 2

p (no pitch)

B. Tbn.

p (no pitch)

Tba.

p

Tim. R C R C R

L.V. ppp

Vib. mp arco L.V.

L.V. sempre

Hp. mf

col legno tratto

Vln. I a

p (col legno tratto) N

Vln. I b

p (col legno tratto) N

Vln. I c

p (col legno tratto) N

Vln. I d

p (col legno tratto) N

Vln. I e

p (col legno tratto) N

Vln. II a

p (col legno tratto) N

Vln. II b

p (col legno tratto) N

Vln. II c

p (col legno tratto) N

Vln. II d

p (col legno tratto) N

Vln. II e

p (col legno tratto) N

Vla. a

p (col legno tratto) N

Vla. b

p (col legno tratto) N

Vla. c

p (col legno tratto) N

Vla. d

p (col legno tratto) N

Vc. 1

p (col legno tratto) N

Vc. 2

p (col legno tratto) N

Vc. 3

p (col legno tratto) N

Vc. 4

p (col legno tratto) N

Vc. 5

p (col legno tratto) N

Cb. 3