

# *Andromeda Memories*

*for three retuned, computer-driven pianos*

*by Kyle Gann*

*2016-17*

## Technical Specifications

The 33-pitch tuning of the three pianos (the same in every octave) is as follows, given first in the number of cents above E-flat, and then as ratios to the E-flat 1/1:

Piano	1		2		3	
D	1088	15/8	977	225/128	1044	117/64
Db	969	7/4	938	55/32	906	27/16
C	857	105/64	773	25/16	840	13/8
B	738	49/32	755	99/64	729	195/128
Bb	702	3/2	590	45/32	609	91/64
A	551	11/8	551	11/8	481	169/128
Ab	471	21/16	440	165/128	408	81/64
G	386	5/4	320	77/64	342	39/32
Gb	204	9/8	275	75/64	275	75/64
F	155	35/32	192	143/128	192	143/128
E	92	135/128	53	33/32	27	65/64
Eb	0	1/1	1103	121/64	1173	63/32

Note that no string needs to be raised higher than its natural tuning except for the B-flat on piano 1, which is 2¢ sharp (or if one prefers, 2¢ could be subtracted from all quantities).

For electronic realization of the piece, it can prove helpful to reconfigure the tuning as a reference pitch in cycles per second for each piano, and ratios derived from that standard:

Tuning pitch:	38.891 cps	36.7641 cps	38.2833 cps
D	15/8	225/121	13/7
Db	7/4	20/11	12/7
C	105/64	200/121	104/63
B	49/32	18/11	65/42
Bb	3/2	180/121	13/9
A	11/8	16/11	169/126
Ab	21/16	15/11	9/7
G	5/4	14/11	26/21
F#	9/8	150/121	25/21
F	35/32	13/11	143/126
E	135/128	12/11	65/63
Eb	1/1	1/1	1/1

In the configuration of certain tuning softwares, the following sequences might facilitate getting the required tuning:

Piano 1:

38.891 = Eb0

1/1, 135/128, 35/32, 9/8, 5/4, 21/16, 11/8, 3/2, 49/32, 105/64, 7/4, 15/8

Piano 2:

36.7641485 = Eb0

1/1, 12/11, 13/11, 150/121, 14/11, 15/11, 16/11, 180/121, 18/11, 200/121, 20/11, 225/121

Piano 3:

38.283333 = Eb0

1/1, 65/63, 143/126, 25/21, 26/21, 9/7, 169/126, 13/9, 65/42, 104/63, 12/7, 13/7

For purposes of analysis, the entire scale (which I refer to as my 8x8 scale) is given below, grouping its pitches into eight harmonic series' on the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup>, 9<sup>th</sup>, 11<sup>th</sup>, 13<sup>th</sup>, and 15<sup>th</sup> harmonics of E-flat, and naming each pitch in a typographical equivalent of Ben Johnston's just-intonation notation:

Pitch name	Ratio	Cents	1/1	3/2	5/4	7/4	9/8	11/8	13/8	15/8
Db^^-	121/64	1103						11		
D	15/8	1088	15	5	3					1
Db13	117/64	1044					13		9	
C#+	225/128	977								15
Db7	7/4	969	7			1				
C^	55/32	938			11			5		
C+	27/16	906		9			3			
C7+	105/64	857				15				7
Cb13	13/8	840	13						1	
B	25/16	773			5					
Bb^	99/64	755					11	9		
Cb77+	49/32	738				7				
Bb13	195/128	729							15	13
Bb	3/2	702	3	1						
Bbb713	91/64	609				13			7	
A+	45/32	590		15	9		5			3
Ab^	11/8	551	11					1		
Abb1313	169/128	481							13	
Ab7+	21/16	471		7		3				
G^	165/128	440						15		11
G+	81/64	408					9			
G	5/4	386	5		1					
Gb13	39/32	342		13					3	
Gb7^	77/64	320				11		7		
F#+	75/64	275			15					5
F+	9/8	204	9	3			1			
Fb13^	143/128	192						13	11	
F7+	35/32	155			7	5				
E+	135/128	92					15			9
Eb^	33/32	53		11				3		
Eb13	65/64	27			13				5	
Eb	1/1	0	1							
Eb7+	63/32	1173				9	7			

In Johnston's notation, + raises a pitch by 81/80, # raises it by 25/24, b lowers it by 24/25, 7 lowers it by 35/36, ^ raises it by 33/32, 13 raises it by 65/64, and F-A-C, C-E-G, and G-B-D are all perfectly tuned 4:5:6 major triads.

# Andromeda Memories

Kyle Gann  
2016-17

$\text{♩} = 50$

Piano 1

*p*

*pp*

Piano 2

*p*

$\text{♩} = 50$

Piano 3

*p*

4

The musical score consists of three systems, each for a different piano part (Pno1, Pno2, Pno3). Each system contains four staves: a grand staff (treble and bass clefs) and two additional bass clef staves. The music is in 13/8 time and is divided into two measures per system. Pno1 features a complex rhythmic pattern in the first measure with dynamic markings of *pp* and *p*, and a more melodic line in the second measure with *p* and *pp* markings. Pno2 has a similar rhythmic pattern in the first measure with *pp* and *mp* markings, and a melodic line in the second measure. Pno3 also features a complex rhythmic pattern in the first measure with *pp* and *mp* markings, and a melodic line in the second measure with *pp* markings. The score includes various musical notations such as slurs, ties, and dynamic markings.



The musical score is for three pianos (Pno1, Pno2, Pno3) in 13/8 time. The piece begins at measure 9. Pno1 features a complex rhythmic pattern with sixteenth-note runs and sixteenth-note chords, marked *pp* and *p*. Pno2 and Pno3 play similar rhythmic patterns, also marked *pp* and *p*. The score includes dynamic markings such as *pp* (pianissimo) and *p* (piano), and articulation marks like accents and slurs. The piece concludes with a final chord in Pno1 and Pno3.



10

Musical score for measures 10-11. The score is divided into three piano parts: Pno1, Pno2, and Pno3. Pno1 consists of two staves (treble and bass clef). Pno2 is a single treble clef staff. Pno3 consists of two staves (treble and bass clef). Measure 10 features a complex chordal texture with sixteenth-note runs in the upper staves. Measure 11 continues with similar textures, including a prominent bass line in Pno3. Dynamics include *pp* (pianissimo) and *ppp* (pianississimo). Fingerings and articulation marks are present throughout.

11

Musical score for measure 11. The score is divided into three piano parts: Pno1, Pno2, and Pno3. Pno1 consists of two staves (treble and bass clef). Pno2 is a single treble clef staff. Pno3 consists of two staves (treble and bass clef). Measure 11 features a complex rhythmic texture with sixteenth-note runs in the upper staves. Measure 12 continues with similar textures, including a prominent bass line in Pno3. Dynamics include *pp* (pianissimo) and *ppp* (pianississimo). Fingerings and articulation marks are present throughout.

12

Pno3

13

Pno1

Pno2

Pno3

15

The musical score is divided into two systems, Pno1 and Pno2, each with a treble and bass staff. The key signature has one sharp (F#) and the time signature is 4/4. The score begins at measure 15. Pno1's treble staff has a rest in measure 15, followed by a series of chords and notes in measures 16-18, with a *pp* marking in measure 16. Pno1's bass staff has a rest in measure 15, followed by notes in measures 16-18, with a *pp* marking in measure 16. Pno2's treble staff has a rest in measure 15, followed by notes in measures 16-18, with a *pp* marking in measure 16. Pno2's bass staff has a long note in measure 15, followed by notes in measures 16-18, with a *pp* marking in measure 16. Dynamic markings *p* appear at the end of the first system in measures 18 and 19.

16

The musical score consists of three systems, each for a different piano part. The first system, labeled 'Pno1', has four staves. The first two staves are treble clef, and the last two are bass clef. It begins at measure 16 in 8/8 time. The first measure contains a complex rhythmic pattern with eighth and sixteenth notes. The second measure is a whole rest. The third measure is a 3/2 time signature change, and the fourth measure is a 7/4 time signature change. The second system, labeled 'Pno2', has three staves (treble, bass, bass). It starts with a whole rest in the first measure, followed by a complex rhythmic pattern in the second measure. The third measure is a whole rest, and the fourth measure is a 3/2 time signature change. The third system, labeled 'Pno3', has one staff (treble clef). It starts with a whole rest in the first measure, followed by a complex rhythmic pattern in the second measure. The third measure is a whole rest, and the fourth measure is a 3/2 time signature change. The fifth measure is a 7/4 time signature change, and the sixth measure is a whole rest.

Pno1

Pno2

Pno3

3:2

7:4

3:2

3:2

7:4

18

Pno1

Pno2

Pno3

3:2

7:4

3:2

7:4

20

Pno1

Pno2

Pno3

6:4 6:4 6:4 6:4 6:4

11:7 11:7

6:4 6:4

11:7

6:4 11:7

The musical score is divided into three systems, each for a different piano part:

- Pno1:** The first system (measures 21-24) features a complex melodic line in the right hand with slurs and ties, and a more rhythmic bass line. Time signatures change from 5/4 to 4/4. Dynamic marking: *mp*.
- Pno2:** The second system (measures 21-24) has a more sparse texture with rests in the first two measures, followed by melodic entries in the right and left hands. Time signatures change from 5/4 to 4/4. Dynamic marking: *mp*.
- Pno3:** The third system (measures 21-24) consists of a single melodic line in the right hand, mostly at rest. Time signatures change from 5/4 to 4/4.

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23

Pno1

Pno2

24

Pno1

Pno2

Pno3

*mp*

*mf*

*mf*

*p*

*p*

*mf*



26

mp

pp

pp

p

Piano score for measures 26-27. The score is in 4/4 time and features a melody in the right hand with a *mp* dynamic. The left hand has a bass line and a *pp* accompaniment. A double bar line is present at the end of measure 26.



27

Piano score for measures 27-28. The score is in 5/4 time and features a melody in the right hand with a *mp* dynamic. The left hand has a bass line and a *pp* accompaniment. A double bar line is present at the end of measure 27.



30

Pno1

Pno3

*pp*

The image shows a musical score for two piano parts, Pno1 and Pno3, spanning measures 30 and 31. Pno1 is in the upper staff, and Pno3 is in the lower staves. Measure 30 features a series of eighth notes in the right hand of Pno1, with fingerings 7 and 9. The left hand of Pno1 has a single note. Pno3's right hand has a melodic line with fingerings 5 and 5, and a *pp* dynamic marking. The left hand of Pno3 has a bass line with a slur. Measure 31 continues the melodic lines, with Pno1's right hand having fingerings 5 and 9, and a triplet of eighth notes. Pno3's right hand has fingerings 7 and 5, and the left hand continues its bass line.

32

Pno1

Pno2

Pno3

mp 5 6 7

5 mp 6 7 5

7 mp

Pno1

35

12:11

Pno2

12:11

Pno3

12:11

36

Pno1

Pno2

Pno3

*mp* 17:10 3:2 5:4

*p* 11

*pp* 7

*mp* 17:10 3:2 5:4

38

The musical score is divided into three systems, each for a different piano part. The first system, labeled 'Pno1', consists of four staves. The first two staves are in treble clef, and the last two are in bass clef. The time signature is 4/4 for the first two measures and 3/4 for the last two. The second system, labeled 'Pno2', also has four staves (two treble, two bass) in 4/4 and 3/4 time. The third system, labeled 'Pno3', has four staves (two treble, two bass) in 4/4 and 3/4 time. The score includes various musical notations such as notes, rests, and dynamic markings.

40

Pno1

Pno2

Pno3

Detailed description of the musical score: The score is for three pianos in 4/4 time. Pno1 consists of five staves. The top staff has a whole rest followed by a quarter note B4. The second staff has a complex chordal passage starting with a sixteenth-note triplet. The third staff has a whole rest followed by a quarter note G4. The fourth staff has a long slur over a whole note B3. The fifth staff has a melodic line: quarter note C4, quarter note D4, quarter note E4, quarter note F4. Pno2 has one staff with a whole rest. Pno3 consists of two staves. The top staff has a whole rest followed by a quarter note G4. The bottom staff has a complex chordal passage starting with a sixteenth-note triplet.



41

Pno1

Pno2

Pno3

13:8 3:2

13:8

13:8 3:2

43

Pno1

Pno2

Pno3

pp

p

pp

p

pp

p



45

Pno2

mp

p

p

pp

13

p

46

Pno1

Pno2

Pno3

pp

11:6

pp 5:3

pp

mp

11:6

5:3

pp

p

p

p

The musical score is divided into three systems, each for a different piano part:

- Pno1:** Features a treble and bass clef. Measure 48 contains a melodic line in the treble and a bass line with a slur. Measure 13 shows a continuation of the treble line and a bass line with a slur.
- Pno2:** Features a treble and bass clef. Measure 48 contains a melodic line in the treble and a bass line with a slur. Measure 13 shows a continuation of the treble line and a bass line with a slur.
- Pno3:** Features a bass clef. Measure 48 contains a melodic line. Measure 13 shows a continuation of the melodic line.

Measure numbers 48 and 13 are indicated above the first and second systems respectively. The score includes various musical notations such as notes, rests, slurs, and dynamic markings like *p* and *#*.

50

Pno1

Pno2

Pno3

51

Pno1

Pno2

Pno3

13-3

5

13

5

53

Pno1

Pno2

Pno3

The musical score is divided into three piano parts. Pno1 consists of four staves: the top two are in treble clef and the bottom two are in bass clef. Pno2 is a single bass clef staff. Pno3 consists of four staves: the top two are in treble clef and the bottom two are in bass clef. The score begins at measure 53. Pno1 starts with a rest in the first two staves, followed by a melodic line in the third staff and a bass line in the fourth. Pno2 has a rest in the first two measures, followed by a single note in the third measure. Pno3 has a rest in the first two staves, followed by a melodic line in the third staff and a bass line in the fourth. The score includes treble and bass clefs, time signatures (8/8 and 4/4), and dynamic markings like 'mp'. The key signature changes from one flat to two flats.

56

*mp*

*p*

*mp*

*mp*

Pno1

Pno2

Pno3



57

Pno1

pp 13 13

11 pp 11

Pno2

pp 13 13

pp 11 11

mp

Pno3

pp 13 13

pp 11 11

58

Pno1

Pno2

60

Pno1

Pno2

Pno3

61

The musical score is divided into three systems, each for a different piano part:

- Pno1:** Features a melodic line in the right hand with a '13:10' marking. The left hand provides harmonic support with chords and moving lines.
- Pno2:** Shows a more active right hand with chords and a melodic fragment. The left hand has a few notes and rests.
- Pno3:** Includes a complex right hand passage with a '13:10' marking and a triplet of sixteenth notes. The left hand has a descending line and some chords.

Time signatures change from 5/4 to 3/4 and then to 4/4 across the systems. The score uses various note values, including eighth and sixteenth notes, and rests.

64

Pno1

Pno2

Pno3

Detailed description of the musical score: The score is for three pianos, labeled Pno1, Pno2, and Pno3. The music is in 5/4 time and begins at measure 64. Pno1 (top system) features a complex, rhythmic melody with many beamed eighth and sixteenth notes, including some triplets. Pno2 (middle system) provides a sparse accompaniment with occasional chords and single notes. Pno3 (bottom system) consists of two grand staves. The upper grand staff contains a large, multi-voice chordal structure with several voices held together by a long slur, while the lower grand staff has a few notes and rests. The overall texture is intricate and layered.

65

Pno1

Pno2

Pno3

Detailed description of the musical score: The score is for three piano parts, labeled Pno1, Pno2, and Pno3. It begins at measure 65. Pno1 consists of two staves (treble and bass). The treble staff has a long sustain line from measure 65 to the end of the system, with a melodic line starting in measure 66. The bass staff has a long sustain line from measure 65 to the end of the system, with a rhythmic line of eighth notes starting in measure 66. Pno2 consists of two staves. The treble staff has a melodic line with chords in measures 65, 66, and 67, followed by a long sustain line. The bass staff has a few notes in measures 65, 66, and 67, followed by a long sustain line. Pno3 consists of two staves. The treble staff has a long sustain line from measure 65 to the end of the system. The bass staff has a few notes in measures 65, 66, and 67, followed by a long sustain line.

66

Pno1

Pno2

Pno3

The musical score is arranged in three systems, each for a different piano (Pno1, Pno2, Pno3). Each system consists of two staves: a treble clef staff and a bass clef staff. The key signature is one sharp (F#) and the time signature is 4/4. Measure 66 is indicated at the top left. Pno1 features a complex melodic line in the treble staff and a bass line in the bass staff. Pno2 has a melodic line in the treble staff and a bass line in the bass staff. Pno3 has a melodic line in the treble staff and a bass line in the bass staff. The score includes various musical notations such as notes, rests, accidentals, and dynamic markings.

67

Pno1

Pno2

Pno3

The musical score consists of three systems, each for a different piano (Pno1, Pno2, Pno3). The first system (Pno1) starts at measure 67. The right hand of Pno1 has a complex melodic line with many sixteenth and thirty-second notes. The left hand of Pno1 has a sustained bass line with some moving notes. Pno2 has a sparse accompaniment with some chords and single notes. Pno3 has a melodic line in the right hand and a bass line in the left hand. The score is written in a key with one flat and a common time signature.



69

Pno1

21

19

3

Pno2

19

21

Pno3

19

21

70

Pno1

Pno2

Pno3

21 3 3 3

3 19

21

3 19

21 19

71

Pno1

Pno2

Pno3

21

19

pp

3

3

3

21

3

pp

3

3

19

pp

pp

pp

pp

11

11

pp

pp

72

Pno3

3:2

3

3

13:10

3

3

23:20

pp

73

Pno1

Pno2

Pno3

*p*

19

23

23

23

74

Pno1

19 23 3

Pno2

19 23

Pno3

19 23

*pp*

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75

Pno3

19

17



76

Pno3

19

17

77

Pno1

Pno2

Pno3

5:3

The musical score is arranged in three systems, each for a different piano part (Pno1, Pno2, Pno3). The time signature is 3/8. Pno1 consists of two staves with a treble clef. Pno2 consists of three staves with a treble clef, a bass clef, and a bass clef. Pno3 consists of four staves with a treble clef, a bass clef, a bass clef, and a bass clef. The score includes various musical notations such as rests, notes, and a 5:3 ratio marking. The page number 77 is at the top left, and the page number 43 is at the top right.

78

Pno1

Pno2

Pno3

The musical score is written for three pianos (Pno1, Pno2, Pno3) in 4/4 time, starting at measure 78. The key signature is one sharp (F#). Pno1 and Pno3 play similar rhythmic patterns with accents and slurs, marked with dynamics like *p* and fingering numbers 6 and 7. Pno2 has a more complex melodic line with slurs and a dynamic marking of *p*. The score includes various musical notations such as dynamics (*p*), articulation (accents), and fingering (6, 7, 9:8).



79

Pno1

Pno2

Pno3

The musical score is divided into three systems. The first system, labeled 'Pno1', consists of three grand staves. The top staff has a treble clef and contains notes with accidentals (sharps and flats) and fingerings of 5. The middle staff has a treble clef and contains notes with accidentals and fingerings of 9. The bottom staff has a treble clef and contains notes with accidentals and fingerings of 5. The second system, labeled 'Pno2', consists of a grand staff with a treble and bass clef. The top staff has a treble clef and contains notes with accidentals and fingerings of 7 and 9. The bottom staff has a bass clef and contains notes with accidentals and fingerings of 7 and 9. The third system, labeled 'Pno3', consists of two grand staves. The top staff has a treble clef and contains notes with accidentals and fingerings of 5. The bottom staff has a treble clef and contains notes with accidentals and fingerings of 9.

80

Pno1

Pno2

11

9

11

9

81

Pno1

Pno2

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83

Pno1

Pno2

Detailed description: This system contains measures 83 and 84. Pno1 is written in 4/4 time with a key signature of one flat. It features a complex melodic line with a triplet of 13 notes in measure 83 and another 13-note phrase in measure 84. The bass line consists of a steady eighth-note accompaniment. Pno2 is in 4/4 time and contains whole notes in both measures.

85

Pno1

Pno2

Pno3

Detailed description: This system contains measures 85 and 86. Pno1 is in 4/4 time, featuring a dense 13-note triplet in measure 85 and a 13-note phrase in measure 86. Pno2 is in 4/4 time with a 11-note triplet in measure 85 and another 11-note triplet in measure 86. Pno3 is in 4/4 time, with a 13-note phrase in measure 85 and an 11-note phrase in measure 86. A double bar line with repeat dots is located at the beginning of this system.

87

Pno1

*pp*

Pno2

*pp*

89

Pno1

*pp*

Pno2

Pno3

*pp*

91

Pno1

Pno2



92

Pno1

Pno2

Pno3

93

Pno1

Pno2

Pno3

The musical score is divided into three systems, each for a different piano (Pno1, Pno2, Pno3). The first system (Pno1) starts at measure 93 in 9/8 time. At measure 94, the time signature changes to 4/4. Pno1's treble staff has a melodic line with a slur and a dynamic marking of *ppb*. The bass staff has a bass line with a dynamic marking of *p*. The second system (Pno2) also starts at measure 93. At measure 94, the treble staff has a melodic line with a slur and a dynamic marking of *pp*. The bass staff has a bass line. The third system (Pno3) starts at measure 93. At measure 94, the treble staff has a melodic line with a slur and a dynamic marking of *pp*.

The musical score consists of three systems, each for a different piano part. The key signature has one sharp (F#) and the time signature is 9/8. The first system, labeled 'Pno1', features a treble clef with a melodic line of eighth notes and a bass clef with a steady eighth-note accompaniment. The second system, labeled 'Pno2', has a treble clef with a melodic line starting with a piano (*p*) dynamic and a bass clef with a single note held across measures. The third system, labeled 'Pno3', has a treble clef with a melodic line of eighth notes. The score concludes with repeat signs and first/second endings in the final measure of each system.



97

Pno1

pp 6 6 11:7

Pno2

pp 6 6 11:7

Pno3

pp 6 6

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