

Orbits

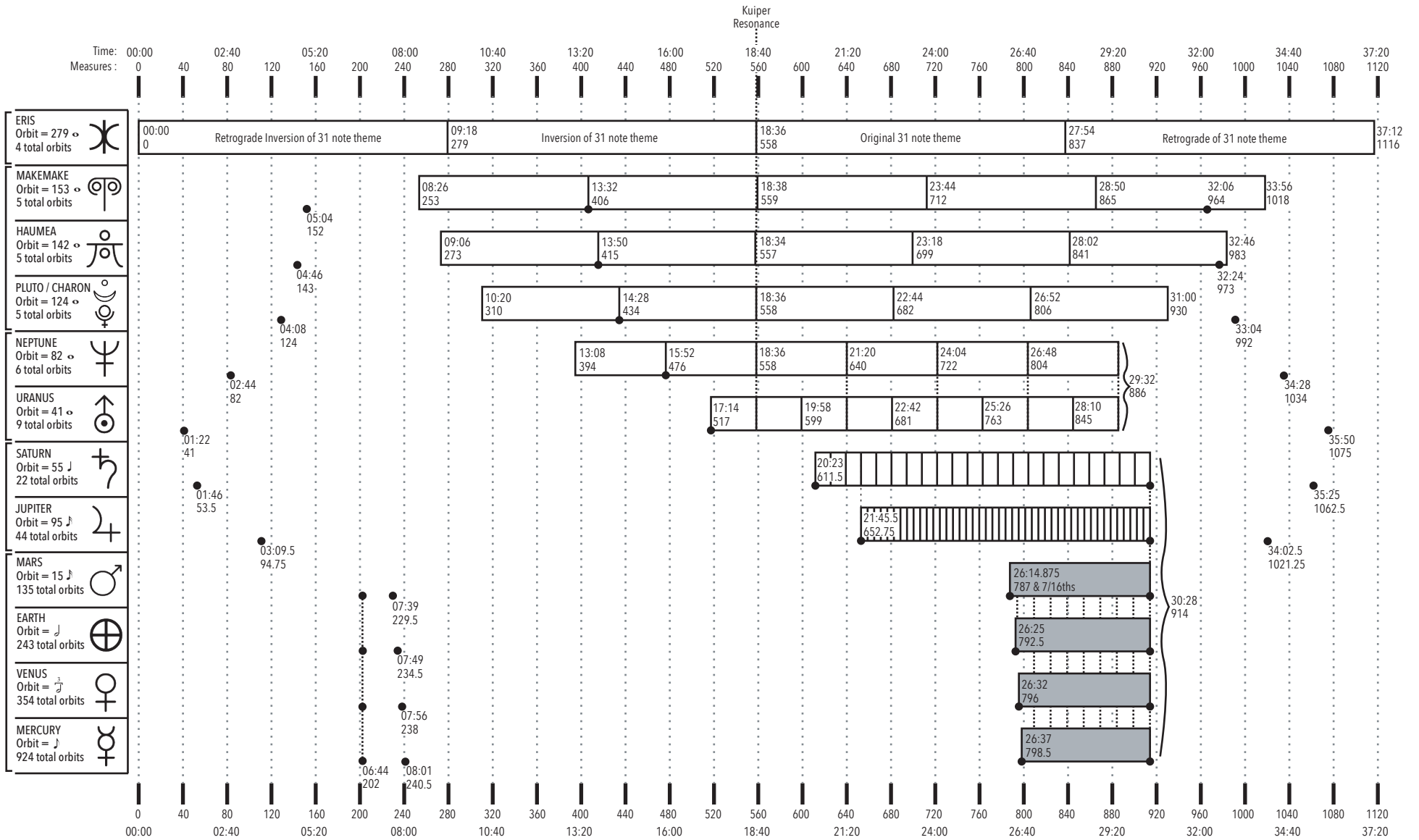
FROM ORBITS TO MUSIC
(COMPOSITION & PERFORMANCE NOTES)

Alex T. Robilotta
2024

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ORBITAL RESONANCE MAP



The Orbital Resonance Map can be viewed in a larger format on the first page of the 11x17 score.



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TIMING IS EVERYTHING. My process of composing music involves a balancing of musical dimensions; pitch, timbre, volume, time, space. When I begin conceptualizing a piece I start by figuring out how much control over the final sound is given to each of these forces. In much of the composing I've done I have a tendency to give time a bit more than its equal share of consideration. All of the musical dimensions are essential ingredients in a musical stew but my favorite flavors rely heavily on the spice of rhythm. In my opinion, *when* something happens is at least slightly more important than *what* exactly happens. Events occurring at the same time tell the listener that the musicians have it right, even if the notes sound wrong. I often demonstrate this concept to my students by playing total nonsense on the piano and asking them what they think about it. Then I play total nonsense that has some rhythmic organization. Every student immediately notices the difference. Time instantly gives structure and meaning to the random notes I bang away at. Time makes music possible.

TIME is a big word. In music, in our lives, and even in the life of a galaxy all events occur within this fourth dimension of the universe and nothing can escape it. We live our entire lives within the walls of time, but time is a mystery that I don't think can be fully understood by humanity. Is time infinite? Can it be stopped? Is it a constant or is time constantly speeding up or slowing down? How can time be speeding up or slowing down if there is nothing outside of time to observe it speeding up and slowing down? We occupy such a tiny part of the 13.7 billion years since the big bang that our short lives seem irrelevant and a 37 minute piece of music seems extremely irrelevant! And how many big bangs have there been? Maybe the continual expansion and contraction of the universe creates a multi trillion year pulse that is the true rhythm of the universe. A cosmic heartbeat.

Given my self-proclaimed propensity for rhythm I'm surprised that this is the first piece I have written for percussion. The cause for this could be that the notation and techniques used for percussion instruments are not as familiar to me as other instruments, so my laziness has led me to more familiar mediums. Awhile back I considered writing something for percussion based on the life cycles of the North American genus of Cicada, *Magicicada*. There are 23 "broods" of these insects. Each brood emerges from their underground hibernation every 13 or 17 years (very interesting to me that they come in primes). I experienced the 17 year emergence of brood II in New Jersey during the summer of 2013. I don't particularly like large insects flying around, pelting me on bike rides, or crunching under my cars tires, but at times the sound of their song was incredible. This experience had me chewing on the idea of using naturally occurring rhythmic cycles in musical compositions. For a piece based on *Magicicada* I envisioned some type of structure based around these 2 prime number groupings that would come together every 221 years to create a super swarm. I had got as far as planning the piece for 2 marimbas each played by 2 performers. Maybe I'll actually write it some day, maybe I won't. In any case, many of the structural ideas and compositional techniques used in *Orbits* were first dreamt up while formulating this still to be realized Cicada composition.

During the dark days of the COVID-19 pandemic the idea of writing a percussion ensemble piece emerged from its hibernation and started swarming around my brain. A friend of mine, David Charles, recognizing my rhythmic tendencies, suggested it. Throughout 2020 I let this idea marinate while I took on all the projects that I suddenly had all the time in the world to complete.¹

Sometime in the Summer of 2021 things started to get serious. The ideas went from marinating, to prepping and preheating the oven. Looking back in my notebooks from 2021 traces of the solar system start popping up; lists of planets with scribbles of scientific data mixed in among musical sketches and transcriptions. The first traces I can find of this piece in my notebooks are probably from spring or early summer of 2021 and read as follows...

Percussion Ensemble Piece -IDEAS-

-phase structures

-pointilist

-shifting subdivisions

-slowly changing density (or very quickly changing)

-interlocking clave patterns

-that morph w/ changing subdivisions

-Rhythmic Ideas = Thematic / Organized / Serialized?

-Harmonic + Melodic Ideas = Intuitive

Spoken Word? Samples?

Marimba

Vibraphone

Toms

Wood Blocks

Cymbals / Bell

Bass

Snare

Shakers

Whistles

¹ From 2020-2022 I wrote 3 large compositions for Quintet (*At Dusk, Rebel Alliance, Excursions*), a series of 13 quartet compositions (*Quartet Structures*), a series of 9 trio compositions (*Trio Structures*), a book of 40 improvisation templates (*Book of Secrets*), and I practiced a lot, possibly too much. I also began a large ensemble arrangement of The Beatles, *Magical Mystery Tour* album and remodeled a bathroom.

I find it interesting that many of the concepts put onto paper at the earliest stages of conceptualizing this piece ended up being central to the final product. At the bottom of one page from later that summer, there is a note.

Time Map Created in Logic - 8.25.21

Finish Composition by End of Year?

1 Earth year = Half Note

1 Astronomical Unit \approx 10 measures.

Little did I know the piece wouldn't be completed until December of 2023. It could have been finished by the end of the year, but with this piece I tended to work in bursts. Generally a month or two of intense work followed by a few months off. Normally I get very wrapped up and finish compositions quickly, but this one was mentally overwhelming at times and I think I needed those breaks to take a step back and consider the direction and goals of the finished product. In order to keep track of my thoughts and progress, I kept a log of what I was doing each day and tried to keep everything organized in a graphing paper score, a MIDI file, and a written manuscript score.

In my collection of improvising exercises called *Book of Secrets* (2021), I included, towards the end, an idea I called *Explore*. It was just a drawing of the solar system with some facts about various planets. It looks more like something out of a grade school science class, rather than a piece of music. But the idea would be for the musicians to travel around the solar system improvising in a way they see fit for the various planets. In the process of creating this piece I did a lot of research into the solar system and found it all extremely interesting. The resonances, and near resonances, that occur between the orbits of moons and planets were of particular interest, but were not included in *Explore*. A resonance is when the orbits of two planets or moons, or the rotations of them, can be expressed by a ratio of two small integers. If one moon orbits a planet twice in the time it takes another to orbit a planet three times, those moons have a 2:3 orbital resonance. The orbital lengths and resonances of the planets as they orbit the sun are the basis for this piece. The solar system is a polyrhythmic structure of unimaginable scale. To humans it's just history and mystery, but to beings with a different perception of time it might be music. This was the seed that began growing into *Orbits* in my brain box. The idea of translating the solar system into music really got under my skin. With any luck, I did the initial idea justice. Either way, it was an experience and a challenge. Although maddening at times, it's helped me discover new things about how we relate to Time in a musical context, and more importantly how we fit into this dimension as human beings hurtling through space on our little rock called Earth.

Alex T. Robilotta

1.22.2024 - Earth

COMPOSITION NOTES

Step 1: CONCEPTUALIZING (shrinking the solar system)

O*rbits* is based on the various lengths of time it takes 12 celestial bodies to orbit the sun and how those orbital lengths relate to each other. In addition to the 8 planets, I chose 5 Trans-Neptunian Objects to be included; Eris, Makemake, Haumea, Pluto/Charon. These orbiting bodies were chosen because their orbits proved useful, but also because of their historic and mythological meaning to human beings. The asteroid belt is also represented. Note: Pluto and its largest moon, Charon, are in the same orbit but played by separate players because they are technically a binary system. This makes for 13 total heavenly bodies portrayed by 13 percussionist. I will use the terms “heavenly bodies”, “bodies”, and “planets” interchangeably from here on.

The Orbits of the planets create a massive polyrhythm system of resonances, near resonances, and orbital chaos. Every planet has a different length year and day, but they all exist within the universal grid of time. In order to make these massive polyrhythmic structures accessible to musical performance, time itself had to be compressed considerably. One Earth year in real time is compressed into one half note in 4/4 time at 120BPM. This is equal to one second. The other 12 orbits were estimated as closely as possible within this time scale using reasonably accessible subdivisions, the smallest being sixteenth notes. The entrance of the planets begins from the most distant from the sun, Eris, and progresses to the nearest, Mercury. I imagine the entrances being akin to the way an interstellar traveler would

arrive in our solar system, entering each orbit and learning more about the solar system as they make their way closer to the sun, then being slingshotted back into interstellar space by the sun's gravity, left only with the memories of our planetary neighborhood. This concept was inspired by the interstellar object *Oumuamua* that made its way through our solar system in 2017. The timing of the entrances are based on each planet's average distance from the sun, measured in Astronomical Units. One astronomical unit is roughly the distance from the Earth to the Sun, 93 million miles or 8.3 light minutes. In the musical context of this piece, the time it takes our friendly experiencers to travel one astronomical unit is 10 measures, or 20 seconds. The easiest way to see this in the piece is to look at the entrances of the inner planets. Mars enters at measure 787 and is 1.5 astronomical units from the sun. Approximately 5 measures later Earth enters because it is 1au from the sun. Approximately 3 measures later Venus enters because it is 0.7au from the sun. Approximately 3 measures after that Mercury enters because it is 0.4au from the sun. This can also be observed in the entrance of all the other planets when their distance from the sun is compared to the preceding planet's distance from the sun.

Once the math of all this was done, the first draft of the Orbital Resonance Map was created.² This diagram, originally hand drawn on graphing paper, laid out the entire piece in time; 1,116 measures or 37 minutes and 12 seconds. There were changes

² The Orbital Resonance Map is shown on page 1 and at the beginning of the score in a larger format.

from the original; mainly that Makemake, Haumea, Pluto/Charon, Neptune, and Uranus all originally ended much earlier in the piece. The Trans-Neptunian Objects were extended to 5 orbits each and the Ice Giants to measure 884.

Now that I could see it all laid out in front of me I could begin to develop techniques for actually writing the music.

Step 2: COMPOSING (defining the solar system)

Each of the 13 chosen bodies are represented by individual players. Each planet's event distribution is given form and structure by subdivisions of their orbits and their relationship to the orbits of the other planets. For example, Eris has an orbit of approximately 558 Earth years. This equals 279 measures within the context of this piece. Eris' orbit is subdivided 3 ways, 31 subdivisions of 9 measures (represented by bowed crotales), 27 subdivisions of 10 & 1/3 measures (represented by various gongs), and 9 subdivisions of 31 measures (represented by a meditation bell).

The chosen subdivisions of each planet were exploited in various ways to generate musical events in time. The techniques used to generate events for each planet are as varied as the planets themselves. These specific concepts will be explored in depth for each planet later. Although each world is unique the compositional processes for generating events on each of the planets are related in different ways. The following list shows which groups of neighboring planets share compositional processes.

Eris stands alone and acts as a foundational structure for the entire piece.

Kuiper Belt Planets; Makemake, Haumea, Pluto & Charon share a process.

Ice Giants; Neptune and Uranus share a process.

Gas Giants; Saturn and Jupiter share a process.

Asteroid Belt has no real process, just improvised chaos of increasing and decreasing density.

Inner Planets; Mars, Earth, Venus and Mercury, share a process.

The ever shrinking lengths of the planetary orbits that the experiencer is exposed to as they travel closer to the sun leads to a gradual shift in the processes used to create the music. The density of the events naturally increases with the shorter and shorter orbits, also the amount of intuition used in the composition of the material increases. For example, the only real composing done in the creation of Eris was the 31 note theme played by the crotales. The rest of Eris' part is simply the subdivisions of the 279 measure orbit that lays a conceptual skeleton to support the rest of the piece. In contrast, Mercury's single eighth note orbit meant there wasn't much to subdivide and I was forced to actually write something using my own intuition (what a chore!). I thought this was very appropriate considering the much longer and more intimate history we, as humans, have with the nearer planets like Mercury, compared to Eris, which was only discovered in 2005. Because Earthly cultures have interpreted the visible planets in so many ways over the ages, it was natural that the nearer to Earth the planet, the more it is imbued with creative human energy through its composition.

The inner planets orbital lengths are no longer than a measure (Mars = 15 sixteenth notes, Earth = 1 half note, Venus = 1 half note triplet, Mercury = 1 eighth note). This leaves virtually no room for

subdivision. The easiest solution was to have each planet play their orbital rhythms, which does happen as the internal planets begin and end, but that was not the direction I wanted to go for the whole piece. This led to the use of more intuitive ideas instead of the strict scientific interpretation of data. Another property that helps give the inner planets more structure is the Inner Planet Resonance (IPR) that occurs every 15 measures. This relationship was a happy accident caused by my estimation of the orbits and was a useful tool for the composition of this section. The IPR gives structure to the inner planets, fostering a deep connection between these related bodies, while still allowing freedom for intuitive writing. After laying out logical subdivisions and rhythmic concepts within each IPR, the inner planets were very freely composed. The key centers were dictated by Eris' 31 note theme and I always tried to write with full awareness of the complete solar system, but other than those foundations it was just good old-fashioned writing. I thought of each planet as an improviser in "The Soul System Band" trying to follow the harmonic form of the tune (Eris) within the confines of their own rhythmic world (IPR and their own orbits) while constantly being aware of everything else happening around them (all other planets). This is heavily related to how I try to improvise when performing the music commonly referred to as "jazz"; following the form within the confines of my own musical world, but still allowing influences from the other musicians and my surroundings.

In order to be fully aware of the other planets activity while composing each individual part, I created a detailed time map showing all orbital events. I determined all the useful subdivisions of every planet and mapped them out on graphing paper (39 pages).³ This allowed me to see every possible interconnection

throughout the model of the solar system that I had built. Having this detailed view of the entire system in motion meant each planet was able to pay homage to the important moments in its neighbors orbital lives. There was never a note written without full awareness of what was going on with every other planet at that moment. This allows the piece to pulsate with interconnecting energies.

This piece is all about the relationships of these planets and how those relationships change depending on the level of detail with which we observe them. To ancient humans the planets all looked like bright dots in the sky, but with our modern telescopes we see them differently. Imagine how different they would feel to us if we could stand on each of them. With this idea in mind, it is important to remember that each player represents a unique world and should be familiar with how that world is perceived on three levels of understanding.

- A. **Alien Perspective.** What the planet looks and feels like to a theoretical resident. Scientific facts and physical characteristics of the planet that describe what it's like to live there.
- B. **Human Perspective.** What the planet looked and felt like to human beings throughout human history. Mythological and historic meanings of the planet that describe how humans relate to this planet.
- C. **Meta/Musical Perspective.** What the planet looks, feels, and sounds like within this metaphorical musical model. Or further still, what it might be like for the planet to observe itself as a friendly experienter of this performance. An understanding of the structural and compositional techniques used to represent the planet in this piece that describes how we as musicians and listeners will experience this piece.

³ I plan to scan these pages, as well as most of my other hand written notes, and have them available on my website. www.AlexRobilotta.com

OTHER COMPOSITIONAL TECHNIQUES

1. The points marked on the Orbital Resonance Map from measure 41 to 240 are sounds to be made from off stage that foreshadow later events in the piece as they occur within Eris' orbit. The events being foreshadowed are marked on their coinciding parts from measures 406 to 914. They are super imposed onto Eris' first orbit and are accentuated by Eris' first gong strikes. These sounds are reflected onto the end of the piece as well.
2. The asteroid belt is also represented from off stage. played by the performers of the inner planets. The only instruction is the beginning density of events, the peak density of events, and the final density of events. It should sound as if we drifted through a swarm of tiny pebbles. Like a spring rain, it starts with a few drops, builds to a downpour and tapers off again. I suggest using "small sounds." If Jupiter is a Djembe, what does an asteroid sound like?
3. At measure 558 Eris begins influencing her powers of chaos over the other parts by adding additional events throughout the solar system at specific points within her subdivisions. Up until measure 558 every event from all planets are directly generated by the relationships of the orbits (but Eris won't have that!). Eris' chaos factors begin at their peak, scattering almost 20 events throughout the solar system at measure 558, and fade to the end of the piece. I used this idea to support unity within the piece and also to sow chaos. Eris, being the goddess of strife and discord as well as the overarching structure of the entire piece, seemed like the perfect vehicle for allowing these permutations to occur.

STAGES OF COMPOSITION

1. The math! And the creation of the Orbital Resonance Map and LogicX MIDI file.
2. Composition of Eris and the general subdivisions that govern each planet, as well as the creation of the detailed time map that showed all the planets orbits and subdivisions in one place.
3. Composition of the tonal music of the inner planets in its entirety before even thinking about the rest of the planets.
4. Composition of the Kuiper Belt Objects.
5. Composition of the Ice Giants.
6. Addition of Eris Chaos Factors.
7. Composition of the Gas Giants.⁴
8. Final edits, specifically of chaos factors, as well as a detailed proof reading to confirm everything in my hand written score, Finale score, and Logic MIDI file were identical.
9. Creation of individual parts for performance.
10. Writing these notes.
11. The final step in my mind has always been finding 13 skilled musicians with the dedication to perform this mofo!

⁴ The Gas Giants had to be completely scrapped and rewritten 3 times over the course of about 8 months. These two planets caused a large delay because I couldn't come up with a system that balanced the inner planets intuitive writing style with the outer planets mechanical writing style.

ON ESTIMATION.

It would be completely impossible to have written this piece for human performers without estimating the orbits of the planets and fitting them into shared subdivisions. It would be very interesting to create a piece of electronic music that is based on much more precise orbits. Possibly a piece that never ends. Just constant loops that more precisely represent the exact relationships of the planets. But that was not the purpose of this piece. I wanted to write for human performers, and humans have been estimating the movements of the planets with varying levels of accuracy throughout history. What we see in the sky from our little rock in space is very different than an exact scientific measurement. *Orbits* attempts to balance these two perspectives.

ON MYTHOLOGY.

Ancient cultures have looked to many of these planets for answers and given them meaning that has been passed down and refined over generations. As a global human culture we have developed countless interpretations of these distant worlds that were only accessible to us as dots in the sky. In ancient times these interpretations could not be based on the physical properties of the planets themselves because we knew virtually nothing about them, but were instead based on when these moving stars appeared in the sky during the cycles of our earthly lives. From the various astrological systems of ancient times to the sci-fi books and films of recent times, these worlds have been effecting us indirectly for all of history. We've ascribed meaning to them, and through our superstitions we have allowed them to shape our world. Wars have been lost (or won) and famines have been caused (or averted) by human decisions based on the movements of these distant messengers.

In the creation of this piece, it was impossible to be unaware of these mythological ideas. With that in mind, I tried to choose materials and sounds that represented the fictional worlds that we've created in our minds, as well as the physical properties of the planets themselves. Here are some examples of how the instrumentation was effected by some of these ideas. Earth is represented by Marimba, wood, something that lives on earth and can only be found on Earth. Venus is represented by Vibraphone, the sound of metallic clouds and feminine energy. Also made of metal, but very contrasting to Venus is the choice of tubular bells for Mars; barren, red, possibly inhabited by martians, god of war, masculine energy. Makemake and Haumea are represented by wood blocks, a sound that seems suited to representing tiny little rocks in the outer reaches of the solar system. As the planets become closer and more familiar to humans their instrumentation also becomes more familiar and the writing used becomes more human influenced. You can see this transition of instrumentation and compositional style in the progression from Pluto/Charon, to the Ice Giants, to the Gas Giants, to the inner planets.

ON IMPROVISATION.

I think of myself as more of an architect in the creation of this piece than a composer. I leave a lot of freedom to the players. I have written no dynamics. I don't think it is necessary and I feel the players will intuitively know what to do dynamically as the piece is rehearsed and takes shape. There is some notation in parts that I don't necessarily want the players to know the meaning of. This includes all articulation. The articulation markings are strictly descriptive of the underlying orbital structures used to write the music. The performers can discover the meaning as they play the piece and figure out ways to represent that meaning in their personal interpretation of their part. These interpretations should not be solely based on the players intuitive feelings, they should be heavily influenced by a thorough knowledge of the mythology and science of the planet being represented. Sometimes it might make sense to accent notes that are accented, other times, maybe not. Maybe add a flam or another ornament, maybe not. The only hard rule to the performance of this piece is, don't play when there's a rest. But even that rule could be broken if you have a good reason for it! For example, if Pluto feels they should add a flam or an accent onto a certain event in this piece then they should feel free to do it. I only request that the performers be familiar with the totality of the piece and fully aware of their place in the solar system before improvising. Every sound must come from an understanding of the full system on the 3 levels mentioned above; alien perspective, human perspective, meta-musical perspective.

ON SEDNA.

I originally planned to include the very distant exoplanet Sedna in this piece. And even though it's not in the score it still is a possibility for any performance. Sedna's approximate Orbit is 11,400 earth years or 5,700 measures in the scale of this piece. If the production and venue allows; Sedna, represented by any instrument, preferably offstage somewhere or even outside the venue should make a sound exactly 3 hours and 10 minutes before measure 558 (which is the half way mark of the piece), another sound at measure 558, and a final sound exactly 3 hours and 10 minutes after measure 558. This would create 2 complete orbits of Sedna. These opening and closing statements will act as a purifying ritual for the space before the audience is even at the venue and long after they are gone. Also, Sedna's opening statement will set things in motion so that measure zero must start exactly 2 hours 51 minutes, and 24 seconds after Sedna's opening. There will be no waiting for people to get in their seats!

Another unrealized concept would be to write an electronic composition for Sedna that would begin 3 hours and 10 minutes before measure 558 and fade to silence before the performed music begins and then fade back in, in retrograde long after the performed music has concluded. Ending exactly 3 hours and 10 minutes after measure 558.

GENERAL PERFORMANCE NOTES

I've left a lot up to the performers in this piece. Think of the score as a guide to get you through this journey. Creative thinking is encouraged, but don't go nuts. The solar system was built by physical forces acting on matter over the course of billions of years, I translated it to music over the course of a few years, and you have to create the sound over the course of 37 minutes and 12 seconds.

CONDUCTOR OR COUNTER?

As this piece began to take shape I always assumed the most accurate and practical solution for directing the tempo of this piece would be some kind of digital counter rather than a conductor. This makes the most sense to me because of the minimalist introduction and ending, the massive number of measures, and the fact that the tempo should be precisely 120bpm throughout. I envision a two lined digital screen that counts 4 beats on the top line, and shows the measure number on the bottom line. It would be great for each player to have their own counter on the top of their stand. I am very open to suggestions for this, as I do not have any specific means for creating this counting device. A human conductor might work just fine, but I would request that the conductor use a metronome to keep the tempo precise. Also, a digital counter of measure numbers on the conductors stand, where every player can see it, would probably be ideal. I'm mostly a "jazz" musician and rarely work with conductors so I am not very familiar with the limitations of their craft.

DYNAMICS

I have included no dynamics. Please use your intuition. Strive for balance. Ideally all parts should be heard by the listener. As more instruments enter the volume will naturally increase, but always be aware to not drown out the other players. There are natural peaks and valleys in this piece. Listen for them and let them guide the performance.

PERFORMANCE SPACE

Almost any space that allows for this size ensemble and audience would be acceptable to me. A traditional theater would be fine, but if the opportunity presents itself I am open to a more interactive spatial relationship between the performers and audience—indoor, outdoor, theater, gymnasium. The audience could be seated or free to roam the space. Anything is possible, as long as the space chosen doesn't add any difficulty to the creation or enjoyment of the music. One idea Marianne thought of is to have the performance in a planetarium with the stars above. The screen could just show a still image or this could be a very effective way to feature the possible visualization discussed in the next section.

POSSIBLE VISUALIZATION

I would love to work with an animator or computer programmer that could design and animate a visualization of the orbits to be synchronized with the music and whatever digital counter is employed in the performance. Simple concentric circles to represent the orbits would be sufficient, no need to take orbital eccentricities into account. The planets on these paths could just be colored dots rotating around the circles that flash when they hit the top of the circle. This would be more than enough to demonstrate what's going on with the music visually. I'm sure a skilled animator could come up with something far more artistic, but I'd prefer whatever is created to not be overly distracting from the music. Demonstrating when the planets complete their orbits and resonate with each other would be all that's needed. I would love for the audience to be able to see the resonances visually as they feel them musically, but I'd prefer they come to the performance to hear the music without too much visual distraction.

PERSONAL RESEARCH

Every player is encouraged to read up on the scientific facts and mythology of the planet they represent. Thorough background knowledge about the planets being represented is absolutely necessary for a meaningful performance. I have come to see this piece as another chapter in our human history of celebrating the planets through ritual, festival, and art. I believe there is a lot more going on here than music alone, and I hope the players can get into that frame of mind as well. In the following notes for individual performers, I have included some facts that I found interesting when researching, but there is far more to learn than what I've included here. Performers should get on wikipedia or the Nasa website and discover everything they can about their planet.

ASTEROID BELT

Beginning at measure 712 and lasting until measure 766 the four inner planets are asked to represent the asteroid belt. These sounds should be small sounds and arhythmic. If possible these sounds should come from offstage. The performers can move around the space. I recommend light sticks or the back end of mallets to hit things in the room, or bring small noise makers. Be creative but remember what you're representing. The sounds should begin at measure 712 with each player making approximately 1 sound every two measures and gradually build to measure 739 when each player will be making 5+ sounds per measure (or more), then fade back to nothing, ending at measure 766. Sounds can be singles, flams, drags, very short rolls. Be creative, but remember that you're representing the asteroid belt, the sounds should be the random pelting of tiny rocks on the outside of our imaginary space craft. Like a spring rain that comes and goes.

NOTES FOR INDIVIDUAL PLAYERS

There is some redundancy between each players notes, but it would be ideal for all players involved to look over all the individual notes. You may find details here that can help develop your interpretation though a deeper understanding of how the planets interact.

ERIS

Mythology: Greek goddess of strife and discord. Daughter of Night. She haunts the battlefield and delights in human bloodshed.

"I am chaos. I am the substance from which your artists and scientists build rhythms. I am the spirit with which your children and clowns laugh in happy anarchy. I am chaos. I am alive, and I tell you that you are free." - *The Principia Discordia*, Greg Hill & Kerry Wendell Thornley, 1963.

Human Discovery: January 5th, 2005.

Physical Characteristics: Trans-Neptunian Object in the scattered disk with a highly eccentric orbit. Most massive of the known dwarf planets. Rotates at almost the same rate as earth. One Eris day is equal to 1.07 Earth days. Eris' surface area is comparable in size to South America.

Instrumentations: Bowed Crotales (above staff). Mediation Bell (on staff). Assorted Gongs & Cymbals (below staff).

Structure: 4 Orbits of 279 measures subdivided three ways. The crotales occur 31 times per orbit, playing a 31 note theme, one note every 9 measures. This theme is played in its original form, as well as, retrograde, inversion, and retrograde inversion. The mediation bell occurs 9 times per orbit, one strike every 31 measures. These 31 measure units are subdivided by 3 to create

10 & 1/3 measure units. This divides the orbit into 27. The gongs play on the 27ths that the meditation bell does not play on. The gongs are added slowly and selectively in the beginning, but after a certain point they play on every 2nd and 3rd triplet subdivision of the meditation bell's 31 measure unit.

Eris' four orbits provide the foundation of this piece. As well as dividing the piece into two halves and four quarters, her influence ripples through the solar system bringing organization where there seems to be none and encouraging unexpected chaos from the other orbiting bodies.

Performance: Bowed crotales should fade in and sustain for as long as feels right from their starting point. But there should be substantial silence between these bowed notes. Mediation bell strikes should occur precisely as written and cut like a beam of light through the darkness of space. The performer should choose a large variety of gongs, cymbal and possibly other metallic objects and use them as they see fit to precisely express the triplet subdivisions. When multiple instruments play at once, strike the mediation bell and gongs precisely on the beat and fade in the crotale as soon after those strikes as is possible.

MAKEMAKE

Mythology: Creator of Humanity from the Rapa Nui mythology of Easter Island. God of fertility. Chief deity of the Bird-man sect. Worshiped in the form of sea birds.

Human Discovery: March 31st, 2005

Physical Characteristics: Classical Kuiper Belt Object. Very similar orbital path to Haumea. Exists outside of Neptunes gravitational influence, but coincidentally is at a near 13:7 resonance with Neptune. Rotates at about the same rate as Earth. One Makemake day is about 0.95 Earth Days.

Instrumentation: Woodblock, higher tone than Haumea, type of mallet to be determined.

Structure: 5 orbits of 153 measures subdivided into 9 repetitions of a 17 measure theme. The thematic material for Makemake's 17 measure theme is extracted directly from relations with the other orbits. All events in Makemake's theme are exact representations of its orbits relation to the orbits of the other planets.

Performance: The accents and other symbols attached to the notes do not have any specific musical meaning. They are there to show that those notes have certain relationships to other events within the overall structure of the piece. Their musical meaning is to be discovered by the player and used to intuitively expand on the written music.

HAUMEA

Mythology: Hawaiian Goddess of Fertility and Childbirth. Haumea transforms herself from old to young and returns to periodically marry one of her offspring and give birth to new humans. When her identity is discovered she leaves humanity behind forever.

Human Discovery: December 28th, 2004

Physical Characteristics: Classical Kuiper Belt Object. Very similar orbital path to Makemake. Exists outside of Neptunes gravitational influence, but coincidentally has an intermittent 7:12 orbital resonance with Neptune. Extremely fast rotation. One Haumea day is about 4 hours long. This extremely fast rotation has made the planet ellipsoid. The planet is about twice as long as it is wide.

Instrumentation: Woodblock, lower tone than Makemake, type of mallet to be determined.

Structure: 5 orbits of 142 measures subdivided into 8 repetitions of a 17.75 measure theme. The thematic material for Haumea's 17.75 measure theme is extracted directly from relations with the other orbits. All events in Haumea's theme are exact representations of its orbits relation to the orbits of the other planets.

Performance: The accents and other symbols attached to the notes do not have any specific musical meaning. They are there to show that those notes have certain relationships to other events within the overall structure of the piece. Their musical meaning is to be discovered by the player and used to intuitively expand on the written music.

PLUTO & CHARON

Mythology: Pluto, Ruler of The Greek Underworld & Charon, Ferryman of The Greek Underworld

Human Discovery: February 18th, 1930

Physical Characteristics: Kuiper Belt Object existing within Neptunes gravitational influence. Pluto & Charon exist as a binary system. Charon is just over half the size of Pluto. This causes the barycenter of their orbits to lie somewhere between the two planets. They share an orbital length around the sun, but because they are the only binary system included in this piece I chose to represent them with two performers. Their orbit is at a 2:3 resonance with Neptune.

Instrumentation: Lower bongos (Pluto). Higher bongos (Charon). Both played with sticks or mallets. Exact size of drums and type of sticks or mallets, to be determined. The pitches of the drums should interlock. The pitch of Pluto's higher drum should be between Charon's and the pitch of Charon's lower drums should be between Pluto's.

Structure: 5 orbits of 124 measures subdivided into 8 repetitions of a 15.5 measure theme. The thematic material for both Pluto and Charon's 15.5 measure theme is extracted directly from relations with the other orbits. All events in Pluto and Charon's themes are exact representations of their orbits relation to the orbits of the other planets.

Performance: The accents and other symbols attached to the notes do not have any specific musical meaning. They are there to show that those notes have certain relationships to other events within the overall structure of the piece. Their musical meaning is to be discovered by the player and used to intuitively expand on the written music.

These two parts are strongly related and interlocking. I suggest rehearsing as a duo to help it really groove.

NEPTUNE

Mythology: Roman God of Freshwater & The Sea. (Greek god Poseidon, brother of Jupiter and Pluto).

Human Discovery: Direct observation on September 23rd, 1846. Previously known by mathematical predictions based on changes in the orbit of Uranus.

Physical Characteristics: Ice Giant. Fourth largest planet. Neptunes gravitational field controls the orbits of the Kuiper Belt and holds them in many resonances with itself. 2:3, 3:4, 3:5, 4:7, and 2:5. Visited by Voyager 2 on August 25th 1989.

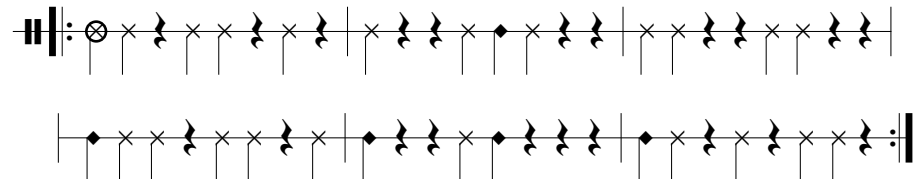
Instrumentation: Low to mid range toms. Exact size of drums and type of sticks or mallets, to be determined.

Structure: 6 orbits of 82 measures. These 82 measures are filled with 11 repetitions of a 27 event theme spread over 48 pulses (Ex.1). This theme is compressed and expanded in a palindromic pattern. The 11 changing subdivisions of the theme that make up the entire orbit are as follows; eighth notes, quarter note triplets, quarter notes, quarter note triplets, eighth note triplets, eighth notes, eighth note triplets, quarter note triplets, quarter notes, quarter note triplets, eighth notes. This pattern is also used to expand and contract Uranus' theme. The thematic material for Neptunes 27 event 48 pulse theme is extracted directly from relations with the other orbits. All events in Neptune's theme are exact representations of its orbits relation to the orbits of the other planets.

Performance: The accents and other symbols attached to the notes do not have any specific musical meaning. They are there to show that those notes have certain relationships to other events within the overall structure of the piece. Their musical meaning is to be discovered by the player and used to intuitively expand on the written music.

Neptune's concept and material is strongly linked to Uranus. I suggest these two planets rehearse together as a duo to see the connections.

Neptunes 27 event, 48 pulse theme



Ex. 1

URANUS

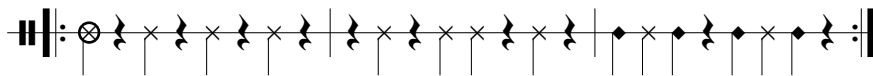
Mythology: Greek Personification of The Sky. Son and Husband of Gaia (Earth). Father of Cronus (Saturn), Grandfather of Zeus (Jupiter), Great Grandfather of Ares (Mars).

Human Discovery: Earliest definite sighting, 1690 by John Flamsteed. Not officially named Uranus until 1782. Uranus may have been observed and labeled a star by the Greek astronomer Hipparchus in 128 BC, and (in my opinion) almost certainly was observed by other ancient civilizations whose knowledge is lost to us.

Physical Characteristics: Ice Giant. 13 identified vertical rings. Magnetic field does not originate from its geometric center. Visited by Voyager 2 on January 24 1986.

Instrumentation: Brazilian sordu (large floor tom if sordu is unavailable) played with one soft mallet and one hand for muting.

Uranus' 14 event, 24 pulse theme



Ex. 2

Structure: 9 orbits of 41 measures. These 41 measures are filled with 11 repetitions of a 14 event theme spread over 24 pulses (Ex.2). This theme is compressed and expanded in a palindromic pattern. The 11 changing subdivisions of the theme that make up the entire orbit are as follows; eighth notes, quarter note triplets, quarter notes, quarter note triplets, eighth note triplets, eighth notes, eighth note triplets, quarter note triplets, quarter notes, quarter note triplets, eighth notes. This pattern is also used in Neptune's composition. The thematic material for Uranus' 14 event 24 pulse theme is extracted directly from relations with the other orbits. This pattern is also used to expand and contract Neptune's theme. All events in Uranus' theme are exact representations of its orbits relation to the orbits of the other planets.

Performance: The muting hand is not notated but can be audible as a response to the strikes with the mallet. Use your intuition here. Make music. The accents and other symbols attached to the notes do not have any specific musical meaning. They are there to show that those notes have certain relationships to other events within the overall structure of the piece. Their musical meaning is to be discovered by the player and used to intuitively expand on the written music.

Uranus' concept and material are strongly linked to Neptune. I suggest these two planets rehearse together as a duo to see the connections.

SATURN

Mythology: Roman God of Time, Wealth, Agriculture, and Liberation. Father of Jupiter, Neptune, and Pluto. Saturns mythological reign was a time of abundance and peace.

Human Discovery: Known since prehistoric times.

Physical Characteristics: Gas Giant. Second largest planet. One eighth the density of Earth, but 95 times more massive. Nearly the size of Jupiter but only one third Jupiters mass. Extensive ring system. Native planet of visionary big band leader Sun Ra. At the north polar vortex of Saturn there is a rotating hexagonal wave pattern in its atmosphere. Each side of the hexagon is about 9,000 miles long, longer than the diameter of Earth.

Instrumentation: 2 conga drums. Notated for 2 drums, but the player can add as many as they see fit.

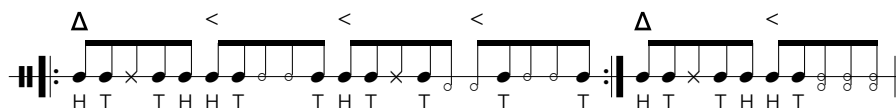
Structure: 22 orbits of 55 quarter notes. In the score Saturns orbital theme can first be observed in its complete form from measure 694 beat 1 through measure 707 beat 3. Saturns orbital pulse is felt in groups of 5 eighth notes that have been grouped into 5 saturnalian measures of 20 eighth notes and 1 measure of 10 eighth notes. The pattern is shown below written in its native five-tuplet meter (Ex.3). This theme exists throughout every orbital repetition of Saturn, but it is manipulated at times. Saturns thematic pattern is not derived from the orbits of the other planets, but it is influenced by them. Saturn and Jupiter serve as a bridge connecting the very scientific music of the exoplanets and the Ice Giants with the more intuitive writing style of the inner planets.

Notation: I use typical conga notation for 2 drums. Heel (H), Toe (T), Open Tone (o), Slap (x). Accents are there to show the groupings of eighth notes and groupings of Saturnalian measures. I do not specify right or left hand. I think a proficient conga player will be able to work out logical hand patterns.

Performance: The player must be intimately familiar with the orbital theme. I recommend memorizing and practicing it on its own. While practicing, work on being proficient in changing your feel from feeling the groups of 5 eighth notes as the down beats to feeling it as it's written in the piece, super imposed over 4/4 time. Once this pattern is internalized, the player is free to alter and augment the part the way a skilled conga player will alter and augment the patterns of traditional afro cuban music. Fills, the addition of a higher pitched drums, and any other appropriate alterations are encouraged.

This is a difficult part, so don't get carried away with experimentation until you are confident that you will not get lost or flip the pattern. It's even more difficult when trying to sync and groove with the Djembe, played by Jupiter. I strongly encourage these two musicians to work together as a duo to master their constantly phasing groove.

Saturn's orbital theme



5x's

Ex. 3

JUPITER

Mythology: Roman King of The Gods, God of The Sky and Diurnal Thunder. Equivalent to the Greek god Zeus. Represented the Babylonian God Marduk. Vedic Astrology named the planet after Brihaspati, the religious teacher of the gods and often referred to it as Guru.

Human Discovery: Known since prehistoric times.

Physical Characteristics: Gas Giant. Largest planet. Third brightest object in the night sky after the Moon and Venus. Features a giant storm system known as The Great Red Spot. This storm is larger than Earth. In the 1800s it was estimated to be 25,500 miles across. Today it is about 16,500 miles across. It's estimated to be decreasing in length by 580 miles per Earth year.

Instrumentation: Large Djembe

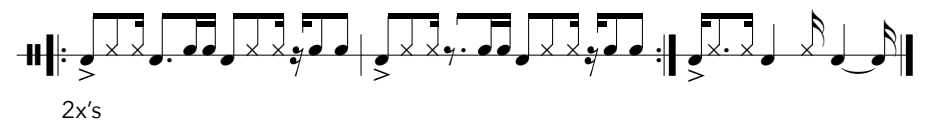
Structure: 44 orbits of 95 sixteenth notes. Jupiters orbital theme can first be observed in its complete form from the up beat of 2 in measure 688 through the first sixteenth note of beat 2 of measure 694. The themes pulse is felt in groups of 5 sixteenth notes that have been grouped into 4 Jovian measures of 20 sixteenth notes and 1 measure of 15 sixteenth notes. The pattern is shown below written in its native five-tuplet meter (Ex.4). This theme exists throughout every orbital repetition of Jupiter, but it is manipulated at times. Jupiter's thematic material is not derived from the orbits of the other planets, but it is influenced by them. Saturn and Jupiter serve as a bridge connecting the very scientific music of the exoplanets and the Ice Giants with the more intuitive writing style of the inner planets.

Notation: I use what I think is typical Djembe notation. Notes below the staff represent the full bass tone, struck in the middle of the drum. Notes above the staff are an open tone, struck on the edge of the drum. Notes above the staff with (x) note heads are a slap sound, struck on the edge of the drum. I do not specify right or left hand. I think a proficient Djembe player will be able to work out logical hand patterns.

Performance: The player must be intimately familiar with the orbital theme. I recommend memorizing and practicing it on its own. While practicing, work on being proficient in changing your feel from feeling the groups of 5 sixteenth notes as the down beats to feeling it as it's written in the piece, super imposed over 4/4 time. Once this pattern is internalized, the player is free to alter and augment the part the way a skilled Djembe player will alter and augment the patterns of traditional west African music. Fills and other appropriate alterations are encouraged.

This is a difficult part, every repetition shifts by a sixteenth note, so don't get carried away with experimentation until you are confident that you will not get lost or flip the pattern. This part is even more difficult when trying to sync and groove with the Conga played by Saturn. I strongly encourage these two musicians to work together on their constantly phasing groove.

Jupiters orbital theme



2x's

Ex. 4

MARS

Mythology: Roman God of War, Agricultural Guardian. Son of Jupiter and Juno. Ancient Sumerian “Nergal” God of War and Plague. Mythical home to Martian beings.

Human Discovery: Known since prehistoric times.

Physical Characteristics: The Red Planet. Only known desert planet. Large amounts of frozen water in its polar ice caps. Surface visited by crafts from Earth multiple times. Home to the largest known volcano in the solar system, *Olympus Mons*, twice as tall as Mount Everest.

Instrumentation: Tubular Bells. C4-F5 plus B3, Bb3, G3. Ideally the 3 additional bass tones should be played by bass bells but if that’s not possible, they could be played by bell plates or another metallic solution. If no solution can be found those notes can be brought up an octave. The type of mallets used and the possibility of varying levels of dampers need to be explored by the player and discussed with the composer. These elements can change throughout the performance as the player sees fit. For instance in measures 873-914 full opened bell sounds are needed but for many preceding sections we may want to experiment with some sort of dampening or muting.

Structure: 135 orbits of 15 sixteenth notes. The four inner planets were composed with their individual orbital lengths in mind as well as the *Inner Planet Resonance* that occurs in 15 measure intervals. In addition to this, all the inner planets were composed with a full awareness of what is happening with the outer planets orbits and subdivisions. Their tonality is a reflection of Eris’ 31 note theme and much of their form and structure is a reflection of the outer planets. When any other planet has an important orbital moment the inner planets try to augment that moment. But for all this interconnectivity, the inner planets are not derived from the other orbits with the mathematical precision that was used in the Kuiper Belt Objects and Ice Giants. These parts were written intuitively with the goal of magnifying the listeners awareness of the other planets behavior.

Notation & Performance: The notation is straight forward, but the accents are not always meant to be played louder. The accents are there to show how the internal subdivisions are working. The meaning of the accents are for you to discover as you learn the piece. They may mean louder or they may mean to strike the bell with the handle of the mallet or with a different material all together, or possibly some variant that only a skilled percussionist would come up with.

The inner planets are a composition inside a composition. These four players should spend some serious time rehearsing as a quartet. Then add Saturn and Jupiter to make a sextet. Then begin working with the full ensemble.

Asteroid Belt: See page 14.

EARTH

Mythology: Gaia. Third Rock From The Sun. Home.

“All things come from Earth, and all things end by becoming Earth.” - Xenophanes, *On Nature*

Human Discovery: We didn't discover it. Earth discovered us.

Physical Characteristics: Water world. Densest planet in the solar system. Formed 4.5 billion years ago. The oceans were formed and life began during the first billion years. Life slowly evolved and became human only 300,000 years ago.

Instrumentation: Marimba, 4.3 octaves. A2-C7. Mallets to be determined.

Structure: 243 orbits of 1 half note. The four inner planets were composed with their individual orbital lengths in mind as well as the *Inner Planet Resonance* that occurs in 15 measure intervals. In addition to this, all the inner planets were composed with a full awareness of what is happening with the outer planets orbits and subdivisions. Their tonality is a reflection of Eris' 31 note theme and much of their form and structure is a reflection of the outer planets. When any other planet has an important orbital moment the inner planets try to augment that moment. But for all this interconnectivity, the inner planets are not derived from the other orbits with the mathematical precision that was used in the Kuiper Belt Objects and Ice Giants. These parts were written intuitively with the goal of magnifying the listeners awareness of the other planets behavior.

Notation & Performance: The notation is straight forward, but the accents are not always meant to be played louder. The accents are there to show how the internal subdivisions are working. The same applies to phrase markings. They show you how the piece is built, but don't necessarily tell you how to play it. The meaning of the accents and phrase markings are for you to discover as you learn the piece. They may mean louder or they may mean something else entirely. Flam's, octave displacement or octave doubling, maybe you stomp your foot on the accents. You have to figure this out for yourself.

The inner planets are a composition inside a composition. These four players should spend some serious time rehearsing as a quartet. Then add Saturn and Jupiter to make a sextet. Then begin working with the full ensemble.

Asteroid Belt: See page 14.

VENUS ♀

Mythology: Roman Goddess of Love, Beauty, Desire, Sex, Fertility, Prosperity, & Victory. The Morning Star. *Aphodite* to the Greeks. *Inanna* to the Sumerians. *Chac ek* to the Maya.

Human Discovery: Known since prehistoric times.

Physical Characteristics: Third brightest object in Earth's sky after the Sun and the Moon. Carbon dioxide atmosphere and sulfuric acid cloud cover. Clouds cause an extreme greenhouse effect making the mean temperature on the surface 867 degrees Fahrenheit.

Instrumentation: Vibraphone, F3-F6. Mallets and use of tremolo to be determined.

Structure: 354 orbits of 1 half note triplet. The four inner planets were composed with their individual orbital lengths in mind as well as the *Inner Planet Resonance* that occurs in 15 measure intervals. In addition to this, all the inner planets were composed with a full awareness of what is happening with the outer planets orbits and subdivisions. Their tonality is a reflection of Eris' 31 note theme and much of their form and structure is a reflection of the outer planets. When any other planet has an important orbital moment the inner planets try to augment that moment. But for all this interconnectivity, the inner planets are not derived from the other orbits with the mathematical precision that was used in the Kuiper Belt Objects and Ice Giants. These parts were written intuitively with the goal of magnifying the listeners awareness of the other planets behavior.

Notation & Performance: The notation is straight forward. But the accents are not always meant to be played louder. The accents are there to show how the internal subdivisions are working. The same applies to phrase markings. They show you how the piece is built, but don't necessarily tell you how to play it. The meaning of the accents and phrase markings are for you to discover as you learn the piece. They may mean louder or they may mean something else entirely. Flams, singing or whistling the note, octave displacement or doubling. You have to figure that out for yourself. I have also left the deployment of the sustain pedal up to the performer. Vibraphone can be very loud, so be sure to strive for a balance, especially with the other inner planets. Using a variety of mallets may be necessary.

The inner planets are a composition inside a composition. These four players should spend some serious time rehearsing as a quartet. Then add Saturn and Jupiter to make a sextet. Then begin working with the full ensemble.

Asteroid Belt: See page 14.

MERCURY

Mythology: Messenger of The Gods. Roman God of Financial Gain, Communication, Travelers, Luck, Trickery, & Thieves. Guide of Souls to The Underworld.

Human Discovery: Known since prehistoric times.

Physical Characteristics: 3:2 Spin-orbit resonance. One day is 58.6 Earth days. No atmosphere. Surface temperature ranges from -280 degrees Fahrenheit to 800 degrees Fahrenheit.

Instrumentation: Xylophone, F3-C7. Mallets to be determined.

Structure: 924 orbits of 1 eighth note. The four inner planets were composed with their individual orbital lengths in mind as well as the *Inner Planet Resonance* that occurs in 15 measure intervals. In addition to this, all the inner planets were composed with a full awareness of what is happening with the outer planets orbits and subdivisions. Their tonality is a reflection of Eris' 31 note theme and much of their form and structure is a reflection of the outer planets. When any other planet has an important orbital moment the inner planets try to augment that moment. But for all this interconnectivity, the inner planets are not derived from the other orbits with the mathematical precision that was used in the Kuiper Belt Objects and Ice Giants. These parts were written intuitively with the goal of magnifying the listeners awareness of the other planets behavior.

Notation & Performance: The notation is straight forward. But the accents are not always meant to be played louder. The accents are there to show how the internal subdivisions are working. The same applies to phrase markings. They show you how the piece is built, but don't necessarily tell you how to play it. The meaning of the accents and phrase markings are for you to discover as you learn the piece. They may mean louder or they may mean something else entirely. Flams, dance movements, octave displacement or doubling. You have to figure that out for yourself.

The inner planets are a composition inside a composition. These four players should spend some serious time rehearsing as a quartet. Then add Saturn and Jupiter to make a sextet. Then begin working with the full ensemble.

Asteroid Belt: See page 14.