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Music Inspired by Astronomy: A Resource Guide Organized by Topic

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Abstract

This annotated resource guide presents 133 pieces of music inspired by astronomical ideas, discoveries, or history, organized in 22 subject categories. Both classical and popular music are included, but only when a clear connection to astronomy could be established. Depending on your musical tastes, you are likely to find some pieces resonating with you and others like the squeaking noise on a blackboard when chalk is held at the wrong angle. But some of the ideas and analogies the pieces represent may intrigue you and your students. Only music available on CD is included, so that educators who want to use some of these in the classroom can purchase a legal copy. A short appendix lists a number of astronomers who have recorded songs and self-published them.

1. INTRODUCTION

For several decades, I have used music related to astronomy in my introductory college astronomy classes as a change of pace, a technique for involving students, an honors paper topic, and a way to showcase that scientists and artists can have a common meeting ground. I have also, from time to time, published short lists of the pieces I use ([Fraknoi 1977](#), [1979](#)) and ideas for how to use music in the classroom ([Fraknoi 2006](#)).

I have not been alone in this somewhat unusual educational interest. [Ronan \(1975\)](#), for example, has written informative pieces about his own astronomical music collection and Kristine Larsen, Laurie Reed, and others have given papers about the topic at *Cosmos in the Classroom* meetings over the years. In 2009, as part of the celebration of the International Year of Astronomy, the IAU posted my list of music inspired by serious astronomical ideas on the IYA web site ([Fraknoi 2008](#)). This led colleagues from around the world to write to me and suggest additional pieces of music that I had not heard about.

As a result, I now have a catalog of astronomy music that is much more extensive than anything published before. As my alphabetical list grew, however, practicing instructors of astronomy who have used it reminded me that they are busy people with many other responsibilities. They strongly hinted that such a long music list needed to be in a format that is more immediately useful.

Accordingly, I have now recast this much larger list so that it is organized by topic in astronomy and emphasizes the topical connections of the music more clearly. 133 musical pieces (both classical and popular music) are organized into 22 subject categories. So if you need a piece to go with a class or lecture on Mars, just go to the planets category and Mars pieces will be much easier to find.

This listing of both classical and popular music inspired by astronomy is not comprehensive, but restricts itself to music that is available on a CD and has real science in it – not just an astronomical term or two in the title or lyrics. For example, we do not list Gustav Holst’s popular symphonic suite *The Planets*, because it draws its inspiration from the *astrological*, and not astronomical, characteristics of the worlds in the solar system. Similarly, songs like Soundgarden’s “Black Hole Sun” or the Beatles’ “Across the Universe” just don’t contain enough serious astronomy to make it into our guide. Nor do we list Philip Glass’ opera *Galileo*; it has plenty of astronomy, but is not yet available on a CD.

Additions to this list are most welcome (as long as they follow the above guidelines); please send them to the author at: `fraknoi {at} fhda {dot} edu`

2. THE TOPICAL LISTING

2.1. The Subject Categories

- Asteroids
- Astronomers
- Astronomy in General
- Black Holes
- Calendar, Time, Seasons
- Comets
- Constellations
- Cosmology
- Eclipses
- Einstein
- Galaxies and Quasars
- History of Astronomy
- Meteors and Meteorites
- Moon
- Physics Related to Astronomy
- Planets
- SETI
- Sky Phenomena
- Space Travel
- Stars and Stellar Evolution
- Sun
- Telescopes and Observatories

2.2. The List of Music by Topic

2.2.1. Asteroids

Saariaho, Kaija *Asteroid 4179: Toutatis* (with *The Planets* by Holst, conducted by Simon Rattle, on EMI Classics). Short piece based on the complex rotational motion of this near-Earth asteroid.

Turnage, Mark-Anthony *Ceres* (with *The Planets* by Holst, conducted by Simon Rattle, on EMI Classics). Inspired by the composer reading about asteroids. Tries to portray collisions between asteroids and other bodies, like Earth. (The composer later wrote two companion pieces called *Juno* and *Torino scale*.)

2.2.2. Astronomers

Adams, John *Dr. Atomic* (an opera; DVD’s available with the Metropolitan Opera and the Netherlands Opera). Focuses on the emotions and thoughts of J. Robert Oppenheimer and those closest to him on the eve of the first test of the atomic (nuclear fission) bomb. We include this because, early in his career, Oppenheimer did work on neutron stars and black holes.

Bentzon, Niels “Chronicle on Rene Descartes” on *Contemporary Danish Orchestra Music, vol. 1* (Danish National Radio Symphony Orchestra on BIS). One movement is inspired by Descartes’ ideas on “vortexes.”

Borresen, Hakon *At Uranienborg: Tycho Brahe’s Dream* (Aalborg Symphony on Dacapo). A 1924 ballet that takes place at Tycho’s observatory on the island of Hven, and features dancers who are stars, a comet, and the supernova of 1572.

Glass, Philip *Kepler: An Opera* (on 9 mm Orff CD and DVD, recorded at the Upper Austrian State Theater). 2009 opera explores scientific and personal themes in Kepler’s work.

Gorecki, Henryk *Symphony 2 (Copernican)* (Polish National Radio Symphony Orchestra on Naxos). Commissioned to celebrate the 500th anniversary of Copernicus’ birth; includes some text from his book *De Revolutionibus*.

Grant, Amy “Galileo” on *Heart in Motion* (on A&M). Compares the singer’s attraction to her lover to Galileo’s attraction to starlight.

Hindemith, Paul *The Harmony of the World* (Berlin Rundfunk Symphony on Wergo) An opera, first performed in 1957, about the life and musical ideas of Johannes Kepler, who thought there was an intimate connection between the harmony of planetary motions and the harmonies in music. (Symphonic suite available separately.)

Knopfler, Mark “Sailing to Philadelphia” on *Sailing to Philadelphia* (on Warner Brothers). About Mason and Dixon (known for the Mason-Dixon line in the U.S.) and their surveying expedition; refers to the fact that Mason was an astronomer.

Koechlin, Charles *Vers la Voute Etoilee (Toward the Starry Vault)* (Stuttgart Radio Symphony Orchestra on Hanssler). An orchestral nocturne dedicated to the memory of French astronomer and astronomy popularizer Camille Flammarion, whose books originally led the composer to think about a career in astronomy, before he turned to music. He described the piece as “...a journey to very distant places, far away from the Earth...”

Rundgren, Todd “Hawking” on *Nearly Human* (on Warner Brothers). Meditation on Hawking’s work and disability.

Smit, Leo “Copernicus: Narrative and Credo” on *American Masters: Leo Smit Collection* (on CRI). With text by astronomer Fred Hoyle. Written in honor of the 500th anniversary of Copernicus’ birth; contains a moving declaration of cosmic belief from Hoyle.

See also “Einstein”.

2.2.3. Astronomy in General

Armor for Sleep “Slip Like Space” on *Dream to Make Believe* (on Equal Vision Records.) Dissatisfied with life on Earth, the singer dreams of traveling through space, past the Moon, into the Milky Way, through a wormhole.

Bock, Jerry and Harnick, Sheldon “Perspective” in *She Loves Me* (on Decca/Polydor) A song in this old-fashioned 1963 musical takes a cosmic view of human goings-on and has a nice series of astronomy images.

Echo Movement *Love and the Human Outreach* (on Jersey Shore Island Beat). On this 2012 album, the reggae-rock-space-music band uses actually transit data from two candidate star systems in the Kepler mission catalog (processed by the Georgia Tech Sonification Lab) as rhythm elements and includes some audio from the Voyager golden record.

Eotvos, Peter “Cosmos” on *IMA* (on Budapest Music Center). Piece for two pianos, inspired by Yuri Gagarin’s first space flight; includes a mixture of astronomical ideas, including the Big Bang, comets, asteroids, meteorites; ends “a quarter of a second before the next big bang.”

Jethro Tull “Astronomy” on *Under Wraps* (on Chrysalis). Stuck in a traffic jam, the singer fantasizes about doing astronomy and seducing “Miss Galileo” (mentions telescopes, black holes, quasars and the Big Bang.)

Monty Python “Galaxy Song” on *Monty Python Sings* (on Virgin). This comic song about our insignificance in the scheme of the Universe includes an array of astronomical facts.

Moody Blues “The Best Way to Travel” on *In Search of the Lost Chord* (on Deram). Including several astronomical references, this “spacey” song emphasizes (as does every astronomy course) that “thinking is the best way to travel” over interstellar distances.

Oldfield, Mike “Saved by a Bell” on *Discovery* (on Blue Plate Caroline). Lyrics are about an observing session, looking at Sagittarius, Aquarius, the Milky Way and planets.

Pickard, John *A Starlit Dome* (Raymond Clarke, piano, on Diversions). A 1965 “astronomical nocturne”, which the composer says was inspired by his being a “keen amateur astronomer.” The piece reflects his feelings about watching celestial sights, such as the Orion Nebula, through his telescope.

Prado, Almeida *Cartas Celestes (Celestial Charts)* (part one is a piano piece available in several recordings and in performance on YouTube). Jose Antonio Rezende de Almeida Prado was a Brazilian composer who wrote a series of pieces entitled Celestial Charts, the first of which—for piano— was commissioned for the planetarium in Sao Paolo. The pieces take their names and draw inspiration from a wide range of astronomical objects. In the first one, the globular cluster M13 has a recurring turn.

Ruders, Poul *Serenade on the Shores of the Cosmic Ocean* (a piece for accordion and string quartet; with Mikko Louma on Bridge). Inspired by Carl Sagan’s book/TV series *Cosmos*, this piece by a living Danish composer explores with music some ideas about space and our thinking about cosmic perspective on Earth.

Simpson, Robert *String Quartet No. 7* (Delme String Quartet on Hyperion). Written for the 100th anniversary of the birth of astronomer James Jeans, by a composer who was himself an avid amateur astronomer (and a Fellow of the Royal Astronomical Society), this piece shows a universe “quiet and mysterious, yet pulsating with energy.”

2.2.4. Black Holes

Aqualung “Black Hole” on *Memory Man* (on Sony). Compares the hopelessness of a relationship to the hopelessness of getting out of a black hole. Uses words from astronomy: singularity, supernova, lines versus circles, etc.

Black, Frank “Places Named After Numbers” on *Frank Black* (on Electra). This is a love song to a black hole, with lyrics such as “And though it seems from here, That she was never there, Light beams disappear, Into her blackened hair.”

Gamma Ray “Beyond the Black Hole” on *Somewhere Out in Space* (on Noise). Heavy metal song about falling into a black hole (with an emphasis on the idea that you don’t come back.)

Gandolfi, Michael *The Garden of Cosmic Speculation* (Robert Spano and the Atlanta Symphony on Telarc). The “Black Hole Terrace” section of this suite of music (inspired by a Scottish garden that embodies ideas in modern physics) features such sections as “The Distant Grasp of the Black Hole,” “Crossing the Event Horizon,” “The Energy Jet,” and “Beyond the Black Hole.”

Labelle “Black Holes in the Sky” (on the album *Phoenix*, now available on CD as part of *Nightbirds/Phoenix/Chameleon* on 101 Distribution). Offers the death of stars and black holes as a metaphor for the careers of rock stars.

Lear, Amanda “Black Holes” on *Never Trust a Pretty Face* (1979 album, now out of print; the song is available on greatest hits CD’s, such as Sony’s *The Sphinx*). Compares an all-consuming love to a black hole; lyrics include; “Like a black hole in the sky, You crush me from your universe, What you want you just erase without a trace, Like a fantastic goodbye.”

Rush “Cygnus X-1” on *Farewell to Kings* (on Mercury/Universal). Portrays ideas around the discovery of the first stellar-mass black hole. Lyrics include: “Headlong into mystery, The x-ray is her siren song, My ship cannot resist her long, Nearer to my deadly goal, Until the Black Hole – Gains Control...”

2.2.5. Calendar, Time, Seasons

Bayer, Josef *Sonne und Erde* (Slovak Radio Philharmonic on Naxos). A ballet based on the relationship between Sun and Earth during the four seasons.

Harrison, Lou *Solstice*, a ballet (California Symphony on Phoenix). Depicts mythological and physical aspects of the solstices, and the fear that “is everything going to get hotter and will we all burn up” contrasted with “is everything going to get darker and we will head into oblivion?”

Pink Floyd “Time” on *Dark Side of the Moon* (Harvest/Capitol). Uses the image of the Sun racing to rise and set to illustrate the inexorable passing of time in human lives.

Vivaldi, Antonio *The Four Seasons* (hundreds of recordings are available). Early program music that depicts characteristics of the four seasons in the northern hemisphere, such as a summer thunderstorm.

2.2.6. Comets

Blue Rodeo “Comet” on *Palace of Gold* (on Warner). Country-and-western meditation on how a comet goes on and on along its orbit unconcerned with human emotions.

Mary-Chapin Carpenter “Halley Came to Jackson” on *Shooting Straight in the Dark* (on Columbia). Country music song about the pass of Halley’s Comet in 1910, as observed by the singer’s parents.

Waterhouse, Graham “Hale-Bopp” on *Portrait 2* (English Chamber Orchestra on Meridian). This 1997 piece celebrates a bright comet with scoring that the composer says “evokes an other-worldly atmosphere.” It ends with 16th century chorale tune “How Brightly Shines the Morning Star.”

2.2.7. Constellations

Boyadjian, Hayg *Cassiopeia* and *Perseus* (by various performers on the album *Vientos* on Albany). The composer, an active amateur astronomer, writes “I have taken the shapes of the stars that form the constellations and plotted them on the music staff... in *Cassiopeia*, a five-note cell traces the letter W on the staff...”

Boyadjian, Hayg *Scorpius Rising* (Polish Radio National Symphony Orchestra on Opus One). A tone poem in which the composer uses the shape of the constellation to make a principal motif, but also portrays the rising of the constellation in the spring evening sky and to contrast peaceful scenes of the stars with the violence of supernovae.

Cage, John *Atlas Eclipticalis* (S.E.M. Ensemble Orchestra on Asphodel). Cage, the notorious “bad boy” of modern music, put musical note paper on the pages of a star atlas and let the arrangement of the stars determine the pattern of the notes. (The project continues with another piece, *Etudes Australes*, for piano, whose score is based on southern hemisphere star maps.)

Edwards, Ross *Symphony 4: Star Chant* (on ABC Classics Australia). With text by astronomer Fred Watson, this piece traverses the southern constellations, using both European and aboriginal names stars, clusters, and constellations.

Glass, Philip *Orion* (on Orange Mountain Music). Commissioned for the 2004 Olympics in Athens, this multi-cultural piece (played on instruments and performed by players from around the world) draws its inspiration from the different myths based on the constellation of Orion.

Jethro Tull “Orion” on *Stormwatch* (on Chrysalis). Uses images of Orion and Ursa Major to contrast the majesty of the skies with the misery down on Earth.

McKeown, Susan “Bold Orion” on *Through the Bitter Frost and Snow* (on Prime). Nice images of the constellation of Orion the hunter in the winter skies, contrasted with the impermanence of earthly things.

Tanaka, Karen *The Zoo in the Sky* (on RCA/BMG). Subtitled “piano pieces for children with small hands,” many are named after constellation pictures (though not necessarily Western ones), while four are entitled “Star Song.”

They Might Be Giants “See the Constellation” on *Apollo 18* (on Elektra). Singer compares the emptiness of his life after his “lady” leaves to the emptiness of a constellation figure—“just a guy made of dots and lines.” (Also refers to light pollution making star patterns difficult to see from cities.)

Vaughan Williams, Ralph *The Sons of Light* (e.g. David Lloyd-Jones conducting on Naxos). Parts of this rather mystical cantata, written by Ursula Wood, soon to be the composer’s wife, concern the signs (constellations) of the zodiac and their annual march across the sky.

2.2.8. *Cosmology*

Bad Religion “Big Bang” on *No Control* (on Epitath). The chorus of this anti-religion song begins “Big Bang, Big Crunch, you know there’s no free lunch” and the song vaguely contrasts human ideas of the end of things with cosmological ones.

Barenaked Ladies “The Big Bang Theory Theme” on *Hits from Yesterday and the Day Before* (on Rhino). The song from the TV comedy includes many scientific terms and ideas. Correctly says that the Big Bang was about 14 billion years ago, but then says the universe will collapse one day, which is not what current data indicate.

Bedford, David *Star’s End* (on Virgin). Piece for orchestra concerned with entropy and the heat death of the universe.

Parmegiani, Bernard *La Creation du Monde* (on INA). Electronic music portraying the beginning of the universe and emergence of life, inspired by the composer’s reading of popular science works by Hubert Reeves, Carl Sagan, Steven Weinberg, and others.

Payne, Anthony *Time’s Arrow* (Andrew Davis, conductor, on NMC). Portrays a Big Bang, an expanding universe, and a universal contraction. The composer intends the piece to be a meditation on the nature of time and its perception. Unfortunately, the composer decided to begin the piece with a section called “The Void”—“expectant emptiness waiting to be filled”—which could reinforce the mistaken notion that the big bang was an explosion IN space, rather than OF space.

Sisler, Hampson *The Big Bang* (on *Classics, Eclectic: Geophysics and Bach* conducted by Arkady Leytush on MSR Classics). We include this with some hesitation, since it starts with a void, then has a Bang, then portrays the formation of the Earth, and only then “the remainder of our solar system forms.” Thus, this is more a biblical than an astronomical sequence, but the composer, an organist and ophthalmologist in New York, clearly has an interest in science, with such other pieces as *Thermals, Rising* and *Tsunami*.

Stockhausen, Karlheinz *YLEM* (London Sinfonietta on Stockhausen Verlag). Takes its title from the ancient Greek term for primeval material revived by George Gamow; tries to portray the oscillating universe in musical terms. Players actually expand through the concert hall, just as the universe does, and then return and expand again. (<http://www.stockhausen.org/ylem.html>)

2.2.9. *Eclipses*

Handel, George F. “Total Eclipse:” an aria from the oratorio *Samson* (many recordings). Poignant song, comparing Samson going blind with an eclipse of the Sun.

Hovhanness, Alan *Sonata on the Long Eclipse of the Moon July 6, 1982* (Nicola Giosmin on Taukay). Portrays some of the physical and personal aspects of watching the full Moon turn dark and then come back into the light; by a prolific 20th century Armenian-American composer who plays with astronomy in a number of his pieces.

Saariaho, Kaija *Notes on Light* (Orchestre De Paris on Ondine). In this modern piece for cello and orchestra, the composer tries to portray properties of light and phenomena with light through musical textures. The fourth movement is called “Eclipse”.

Tsontakis, George *Eclipse* (piece for clarinet, violin, cello, and piano; Broyhill Chamber Ensemble on Koch). Written after the composer observed a lunar eclipse in 1995, the music reminds him of “the eclipsing shadow...

as it softly invaded the hazy luminescent circle, and later, the shadow leaving the sphere just as quietly as it had first entered.”

Tyler, Bonnie “Total Eclipse of the Heart” on *Faster than the Speed of Night* (on Sony). 1983 song by a Welsh singer using eclipse images—shadows, being in the dark, “no one in the universe as magical as you”—to describe a love affair going wrong.

2.2.10. Einstein

Dessau, Paul *Einstein* (Otmar Suitner, conductor on Edel). Eastern European opera from early 1970’s; focus on Einstein’s “decisions and their social consequences”. Perpetuates myth that Einstein was one of the “fathers of the atomic bomb”; quite a bit of political propaganda. Galileo and Giordano Bruno also appear.

Glass, Philip *Einstein on the Beach* (on Elektra Nonesuch; and other labels). A minimalist opera in which Einstein the man and Einstein’s work serve as “mantras” for meditating on current events, mental illness, space and time.

Wolpe, Stefan *Excerpts from Dr. Einstein’s Address on Peace in the Atomic Era* (on Bridge). A setting for baritone and piano of parts of a speech Einstein gave in 1950, responding to the announcement that the U.S. would build a hydrogen bomb.

2.2.11. Galaxies and Quasars

Crosby and Nash “Milky Way Tonight” on *Crosby & Nash* (on Sanctuary). Uses the distance and faintness of the Milky Way to symbolize the remoteness of our dreams.

Lentz, Georges *Caeli Enarrant (The Heavens are Telling)* (Parts 3 and 4 on Naxos). Lentz is a modern Australian composer, engaged in composing a cycle of works inspired in part by his interest in astronomy. He recounts staring at astronomical images as he was composing some parts of the cycle. Parts 3 and 4 include sections with such subtitles as: The Spiral Galaxy M33, Rho Ophiuchi, The Pleiades M45, and The Andromeda Galaxy M31.

Terenzi, Fiorella *Music from the Galaxies* (on Island). Electronic music based on a digitized data set from active galaxy UGC 6697. Selections include “Plasma Waves”, “Radio Core”, and “Galactic Beats”. Terenzi, a composer and performer, did work in astrophysics for her doctorate.

Sisask, Urmas *Spiral Symphony for Piano Four Hands* (Grieg Piano Duo on Siel). A 9-part cycle of piano pieces about spiral galaxies, with movements such as NGC 2276, M 51, etc. Sisask is an Estonian composer with a “fondness for astronomy,” who has also written a piano sonata entitled *The Milky Way*.

See also the listing for “CTA 102” by the Byrds under SETI.

2.2.12. History of Astronomy

Birtwistle, Harrison *Harrison’s Clocks* (piano pieces, at least two recordings are available on CD). Inspired by Dava Sobel’s book *Longitude*, which details the long history of developing clocks that could measure time and thus longitude at sea, these are a musical depiction of some aspects of John Harrison’s timepieces.

Borresen, Hakon *At Uranienborg: Tycho Brahe’s Dream* (Aalborg Symphony on Dacapo). A 1924 ballet that takes place at Tycho’s observatory on the island of Hven.

Kornicki, Steve *Morning Star Rising* (on the album *Orchestral, Conceptual, and Ensemble Music* on the Fragmented View Music label). An orchestral piece inspired by Mayan notions of astronomy, as discussed in astronomer Anthony Aveni’s book *Conversing with the Planets*.

O’Connell, Robbie “Galileo” on *Humorous Song* (on Celtic Media). An apology from the Church to Galileo.

Simpson, Robert *Eppur Si Muove* for Organ (Ian Quinn on Hyperion). This piece takes its name from the phrase that Galileo was supposed to have muttered under his breath as he left sentencing by the Inquisition, translated as “it does move” (referring to the Earth.) Simpson was an active amateur astronomer who frequently mentioned astronomy as his great interest.

See also under “Astronomers”

See the Ruff and Rogers piece under “Planets”

2.2.13. Meteors and Meteorites

Bad Company “Shooting Star” on *Straight Shooter* or *Ten from Six* (on Swan Song/Atlantic). Compares the quick fame, and burning out and death of a music star to the brief flaring up of a shooting star.

Newsom, Joanna “Emily” on *Ys* (on Drag City). A complex song about the singer’s sister Emily (who is presently a graduate student in astronomy) and the relationships in their family; the chorus uses meteors and meteorites as a metaphor.

Parish, Mitchell & Perkins, Frank “Stars Fell on Alabama” (1935 song recorded by many artists over the years). In 1934, a best-selling book by this title described the travels of a professor from New York who came to teach in Alabama and began collecting native lore. It takes its title from stories about the 1833 Leonid meteor shower (which was so rich, it was really a meteor storm.) The book inspired the later song, which compares the thrill of kissing your lover to being bathed in the light of falling stars.

They Might Be Giants “What is a Shooting Star?” on *Here Comes Science* (on Disney Sound). A children’s song, explaining what shooting stars really are and why they are bright, sung by a nerd-rock group.

2.2.14. The Moon

Brant, Henry “Litany of the Tides” on *Henry Brant Collection vol. 3* (on Innova). During this complex piece, four sopranos sing science facts about the tides.

Cowboy Junkies “Crescent Moon” on *Pale Sun Crescent Moon* (on RCA). A bluesy rock song which uses images involving the phases of the Moon.

Eno, Brian (*et al.*) *Apollo: Atmospheres & Soundtracks* (E.G.; reissued on Astralwerks). This “ambient sound” album was used as the soundtrack for a documentary of Apollo moon missions footage and tries to capture the sense of being in space and on the Moon. Tracks include “Under Stars,” “Weightless,” and “Ascent.”

Grateful Dead “Standing on the Moon” on *Built to Last* (on Rhino). From the Moon, the singer can take a wider perspective on the wars and injustices on Earth, as well as on his relationship.

Great Big Sea “Walk on the Moon” on *Fortune’s Favour* (on Warner). Compares taking a major step in a relationship to the first step an astronaut took on the Moon.

Haydn, Franz *Il Mondo della Luna (The World in the Moon)* on *Haydn Operas vol. 2* (on Phillips). 1777 comic opera involving a telescope used to trick someone into believing he can see life on the Moon and an “elixir” used to pretend to transport him there.

Jenkins, Karl *Imagined Oceans* (Karl Jenkins Ensemble on Sony). A musical interpretation of 13 regions on the Moon with Latin names of seas and lakes. The music is more about the meaning of the names (such as Mare Imbrius) than about real conditions on our satellite, but we include it for its value in considering the history of naming things on the Moon.

Kamen, Michael *The New Moon in the Old Moon’s Arms* (Slatkin & the National Symphony on Decca). Symphonic poem inspired by the composer’s visit to Anasazi ruins in Arizona. Title refers to smallest waning

crescent moon. Mostly about the rituals and aspirations of the Anasazi, but the last section, entitled “Reaching for the Stars,” takes the listener forward to the year 2000.

Moody Blues “Higher and Higher” on *To Our Children’s Children* (on Polygram). 1969 song celebrates the Apollo 11 mission to Moon; uses image of tranquility (the astronauts landed in Mare Tranquillitatis—the “sea” of tranquility).

Norgard, Per *Luna (in 4 Phases) for Orchestra* (on Marco Polo/Dacapo). Modern classical piece based on aspects of the Moon.

Police “Walking on the Moon” (on the album *Regatta de Blanc* & found on several of their greatest hits compilations). Compares the feeling of walking in the low gravity of the Moon (“giant steps”) to being in love. Video of the song was filmed at NASA’s Kennedy Space Center.

Rush “Earthshine” on *Vapor Trails* (on Atlantic). Correct description of Earthshine on the Moon; compares the Earth’s reflected light to the plaint of a lover who feels as if he only exists to be in the loved one’s reflected glory.

Sting “Sister Moon” on *Nothing Like the Sun* (on A&M). Plays with the idea that the Moon is connected with lunacy in popular culture.

Waterboys “The Whole of the Moon” on *This is the Sea* (on Capitol). Interesting use of the image of the crescent moon versus the full moon as a way of expressing that the singer only saw and felt little, but his lover saw the larger emotional picture.

XTC “Another Satellite” on *Skylarking* (on Virgin/Geffen). The singer compares an unwanted romance to an extra moon, exclaiming “why on earth do you revolve around me” and “why in heaven’s name do you come on these trips, only to freeze in a total eclipse.” The conclusion: “Don’t need another satellite!”

2.2.15. Physics Related to Astronomy

Brant, Henry *Orbits* (on CRI American Masters). Written for 80 trombones arranged in a semi-circle (with organ and voice), this 1979 piece experiments with sound and space. (You can find a video report on a 2009 performance at the Guggenheim Museum on YouTube.)

Cowie, Edward *Rutherford’s Lights* (Richard Casey on UHRecordings). 24 piano pieces, composed with the assistance of physicist Michael Berry, that are an effort to capture the many properties and relationships of light and color and the history of humanity’s discovery of these. The composer has a degree in physics. (See a YouTube introduction at: <http://www.youtube.com/watch?v=xRTXTRL5rU> and order at http://www.uhrecordings.co.uk/_shop/albums/UHR/Cowie.aspx)

Flanders and Swann “The First and Second Law (of Thermodynamics)” (a song from the musical review *At the Drop of Another Hat* on *The Best of Flanders and Swann* on EMI). A funny exploration of heat, work, and entropy, with a mention of the heat death of the universe.

Glass, Philip *The Light* (Bournemouth Symphony on Naxos). Commissioned in 1987 by Case Western University to commemorate the 100th anniversary of the Michelson-Morley Experiment, which measured the constancy of the speed of light in different frames of reference. The composer said that he tried to mirror the “onset of modern scientific research.”

Hawkwind “Quarks, Strangeness and Charm” on *Quarks, Strangeness and Charm* (on Atomhenge). We include this song with some hesitation: it plays with many science ideas, but not always correctly (it suggest Copernicus had a telescope, for example.) Still, it makes the properties of quarks sound sexy, which is not an easy thing to do.

Kernis, Aaron *Symphony in Waves* (New York Chamber Symphony on Phoenix). This 1989 symphony, by an eclectic American composer, uses ideas and impressions from the physics and behavior of waves.

Klaatu “Little Neutrino” (on Bullseye Canada). Compares the flight of a neutrino out of the Sun, barely interacting, with the singer’s lover, who does not really know who he is.

They Might Be Giants “Meet the Elements” on *Here Comes Science* (on Idlewild/Disney Sound). This song for children by a popular indie-rock band contains a lot of good science, including the idea that stars are made mostly of hydrogen and helium.

Varese, Edgard *Ionization* (on several CD’s, e.g., Boulez version on Sony). Iconoclastic 20th century composer Varese tried to expand the vocabulary of music by including new and different sounds and soundmakers in his pieces. This 1931 composition for 35 percussion instruments and 2 sirens tries to evoke the process by which atoms lose their outer electrons.

See also the box on Scientists Who Write Songs.

2.2.16. Planets

Bain, Reginald *Jovian Images* (piece for soprano saxophone and electronics, performed by Susan Fancher on Innova). Inspired by photographs of the giant planets, these (very) modern improvisations were created by mapping the image data as electronic sounds.

Bergmann, Gunter *The Harmony of the World of Jupiter* (five organ pieces; was available on a CD of the composer’s collected works). Written in celebration of the 350th anniversary of Kepler’s birth, these pieces follow Kepler’s ideas of the harmony of the spheres by basing the music on the periods of Jupiter’s Galilean moons.

Carlos, Wendy *Digital Moonscapes* (on East Side Digital). A digital synthesizer suite from the early 1980’s, depicting post-Voyager impressions of our Moon, the two moons of Mars, three moons of Jupiter and four moons of Saturn.

Ewers, Peter *The Planets* (on Solstice). 17 improvisations for organ, inspired by the worlds in our solar system.

HammerFall “Titan” on *Threshold* (on Nuclear Blast). This song by a Swedish heavy metal band is about the remains of humanity, shattered by war, moving to Saturn’s moon Titan.

Hovhannes, Alan “Saturn” on *Magnificat* (on Crystal). This piece, by a prolific Armenian-American composer, for soprano, clarinet, and piano, celebrates both the astronomical and mystical Saturn, with words by the composer, who had a strong interest in astronomy. One section is entitled “Titan, Moon of Saturn.”

Lancaster, Jack & Lumley, Robin *Marscape* (on Ozone/DEI). This rock and jazz fusion album from the 1970’s was inspired by some of the discoveries of the Mariner 9 mission on Mars. Tracks include “Olympus Mons,” “Dust-storm,” and “Phobos and Deimos.”

Lavin, Christine “Planet X” on *Shine My Flashlight on the Moon* (on Shanachie). Song about Pluto, its discovery, and its uncertain status. See her updated lyrics at: http://christinelavin.com/index.php?page=songs&category=I_DON-amp-num-039-scol-T_MAKE_THIS_STUFF_UP-elipsis-I_JUST_MAKE_IT_RHYME&display=701

Manfred Mann’s Earth Band “In the Beginning, Darkness” on *Solar Fire* (on Creature Music). Part of an album that features rock adaptations of Holst’s *The Planets*, this song is a nice evocation of the events that led to the formation of the Earth and the evolution of life.

McNabb, Michael “Mars Suite” on *Computer Music* (on Mobile Fidelity Sound Lab). Electronic music inspired by the Viking mission and used (in part) in a film of Viking images. The three movements are: 1. Orbital View, 2. Chryse Planitia (the site where Viking 1 landed), and 3. Olympus Mons Flanked by Clouds.

Miller, Kelvin & Bach, J.S. *Winds of Mars and the Music of Johann Sebastian Bach* (Roderick Kettlewell, piano, on Music Crest). Wind data from weather station of Mars Pathfinder are converted into sounds and mixed with piano pieces by Bach. Comes with an informative booklet explaining the concept and the exploration of Mars. (See: <http://www.windsofmars.com/>)

Roxburgh, Edwin *Saturn* (on NMC). Modern tone poem based on the Voyager images and data from the Saturn system, with sections named after a number of the best-known satellites of the ringed planet. The composer's liner notes are a combination of science and mythology, and the cover of the CD shows radio emissions from Saturn.

Ruff, Willie & Rodgers, John *The Harmony of the World* (on Kepler CD). Computer-synthesizer realization of Kepler's music of the spheres, with the notes for each planet determined by its relative velocity in orbit. (Available through: <http://www.willieruff.com/>, where you can also find liner notes.)

Sousa, John Philip *Transit of Venus March* (for example on the album *On Wings of Lightning* by the Razumovsky Orchestra on Naxos). Sousa was caught up in the public interest in the 1882 transit of Venus and wrote this piece at that time, dedicated to Joseph Henry, the great American physicist who had recently died. In 1920 Sousa wrote a short story called "The Transit of Venus" about a group of men who go to Africa to photograph the 1882 transit.

Train "Drops of Jupiter" on *Drops of Jupiter* (on Sony). A song that uses images of Jupiter, Venus, and the Milky Way to talk about a girlfriend who had taken either a physical or a spiritual journey and was "back in the atmosphere" now.

Wheeler, Cheryl "Orbiting Jupiter" on *Driving Home* (on Philo/UMGD). Co-written with Janis Ian, this song explores loneliness using many astronomical images.

Zaimont, Judith Lang *Jupiter's Moons* (Joanne Polk on Albany). Impressionist piano pieces written in 2000, inspired by recent pictures and images of the jovian satellites and the mythological characters after whom they are named.

2.2.17. SETI

Byrds "CTA 102" on *Younger than Yesterday* (on Sony). In 1960's, there was a brief flurry of public attention to quasar CTA 102: its radio signals were incorrectly claimed to include coded information from an advanced civilization. The song is a brief ode to our willingness to hear from other civilizations out there.

Punishment of Luxury "Message" on *Laughing Academy* (on Lemon). A song by a British punk-rock band which tells the story of the receipt of a message from another civilization at a radio observatory on the Moon. Has some science errors, but an interesting attempt.

Zebra "Who's Behind the Door?" on *Zebra* (on Atlantic). Interesting song about the hypothesis that the Earth is a zoo being kept by an extra-terrestrial civilization.

See the Echo Movement album under Astronomy in General

2.2.18. Sky Phenomena

Bedford, David *Star Clusters, Nebulae, and Places in Devon* (on Resurgence). A piece inspired by the idea that the same sky would have been visible to the Bronze Age people living in England as are to us.

Bedford, David *Some Bright Stars for Queen's College* (on Voiceprint). A modern piece sung by 80 young girls and with 30 "whirlies" sound pipes; the girls sing the names of stars from star catalogs.

Boyadjian, Hayg *Pleiades* (on *Vientos* on Albany). Uses motifs with 5 and 7 notes, portraying in music the five bright stars and seven stars in total that make up the old pattern of the seven sisters (the composer is an amateur astronomer).

Crosby and Nash "Milky Way Tonight" on *Crosby & Nash* (on Sanctuary). Uses the distance and faintness of the Milky Way to symbolize the remoteness of our dreams.

Del Tredici, David *Syzygy* (on Deutsche Grammophone). Music partially inspired by the astronomical meaning of the term—the alignment of celestial bodies.

Howe, Mary “Stars” on *American Treasures* (The Virginia Symphony on Hampton Roads Classics). Symphonic poem that “evokes the gradually overwhelming effect of a starry, crystal clear night.”

Koechlin, Charles *Le Docteur Fabricius* (Stuttgart Radio Symphony Orchestra on Hanssler). A long section of this symphonic poem is called “The Starry Sky” and portrays a “vision” of the night sky. Koechlin had originally wanted to be an astronomer.

Langgaard, Rued “Music of the Spheres” on *Music of the Spheres, etc.* (Danish National Radio Symphony on Chandos) Based on a line from a Danish poem that goes “The stars seem to twinkle kindly at us, yet the writing of the stars is cold and merciless,” this complex piece for large orchestra includes episodes that portray sky phenomena such as “twinkling stars at sunset” and “the refraction of sunbeams in waves.”

Pink Floyd “Time” on *Dark Side of the Moon* (on Harvest/Capitol). Uses the image of the Sun racing to rise and set to illustrate the inexorable passing of time in human lives.

Sondheim, Stephen “The Sun Won’t Set” in *Little Night Music* (on Columbia). The musical about Scandinavia, adapted from an Ingmar Bergman film, includes this song about the long summer days at high latitudes.

See also XTC’s “Another Satellite” under *Moon*

2.2.19. Space Travel

After the Fire “Starflight” on *Der Komissar* (on Collectables). Compares being in love to traveling through the universe.

Armor for Sleep “Slip Like Space” on *Dream to Make Believe* (on Equal Vision Records.) Dissatisfied with life on Earth, the singer dreams of traveling through space, past the Moon, into the Milky Way, through a wormhole.

Berge, Hakon *Gagarin* (on Hemera). A 1991 Norwegian opera written for television, based on the life and work of the Soviet cosmonaut.

Clarke, Nigel *Gagarin on Road to the Stars* (Matthew George, conductor on Innova). A suite for symphonic wind ensemble inspired by Yury Gagarin’s first space flight. The three sections are: “Road to the Stars” (which is also the name of Gagarin’s book), “Orbit,” and “Homecoming.”

Hovhannes, Alan *Star Dawn* (Ohio State Concert Band on Delos). About this piece, the composer wrote: “My life-long interest in astronomy has suggested the thought and hope that we may colonize Mars... the [title] phrase from Dante suggested traveling in space.”

Queen “39” on *Night at the Opera* (on Hollywood). Song about an interstellar expedition traveling at relativistic speeds and the loneliness the crew feels: they realize that everyone they knew on Earth will be dead when they return. Brian May, a member of this group, trained as an astronomer in England.

Rush “Countdown” on *Signals* (Mercury/Universal). Nice description of what it is like to witness a rocket launch at Cape Kennedy.

2.2.20. Stars and Stellar Evolution

Connesson, Guillaume “Supernova” (part of *Cosmic Trilogy*, on Chandos). Musical depiction of the explosion of a massive star, with a second section entitled “pulsating star.” The composer writes that the piece was influenced by the reading of Stephen Hawking’s *A Brief History of Time*. The other movements of Connesson’s *Cosmic Trilogy* deal with cosmological ideas.

Crumb, George *Celestial Mechanics: Volume IV of Makrokosmos* (“cosmic dances” for amplified piano; available on several recordings). In the four volumes of his Makrokosmos pieces, Crumb explores new ways to get sounds out of a piano. Many of the sections are named after astronomical phenomena. The four parts of this volume are called: Alpha Centauri, Beta Cygni, Gamma Draconis, and Delta Orionis.

Epidemic “Factor Red” on *Decameron* (on Metal Blade). About the Sun becoming a red giant star in the future; begins: “Retinas burn, as my eyes raise towards the dying star, Half devoured sky bleeds red, the death of a star begun...”

Pink Floyd “Shine on You Crazy Diamond” on *Wish You Were Here* (on Capitol). Compares the self-destructive behavior of group member Syd Barrett to the death of low-mass stars in the form of white dwarfs.

Slash (with Myles Kennedy) “Starlight” on *Slash* (on EMI). Evocation of the distances and long time-scales of stars, compared to the short-term drama of human life on Earth.

See also *They Might be Giants* (under *The Sun*)

2.2.21. The Sun

Dodge, Charles *Earth's Magnetic Field* (on the album *Columbia-Princeton Electronic Music Center 1961-1973* on New World). Electronic music based on variations of our planet's magnetic field (more precisely on what scientists call the Kp Index, which is based on how the Sun's wind and activity affects terrestrial magnetism).

Ruders, Poul *Solar Trilogy* (on Dacapo/Marco Polo). A modern symphonic triptych inspired by the composer reading about the Sun; includes sections entitled “Gong,” “Zenith,” and “Corona.”

They Might Be Giants “Why Does the Sun Shine? (The Sun is a Mass of Incandescent Gas)” and “Why Does the Sun Really Shine?” on *Here Comes Science* (on Idlewild/Disney Sound). The first is modern re-recording of a 1959 educational song from an album called “Space Songs,” explaining what the Sun is and why it shines (nuclear fusion). The second updates the song (emphasizing that the Sun is plasma).

2.2.22. Telescopes and Observatories

Bedford, David *Great Equatorial* (on Voicepoint). Electronic music commissioned for 1993 renovation at the Royal Observatory in Greenwich. The composer “tried to imagine what it would be like to travel through the cosmos revealed by the first large telescopes”; and uses some of the harmonies envisioned by Kepler in thinking of the orbital speeds of the planets as the “music of the spheres.”

Enstrom, Rolf “Music for an Observatory” on *Immeasurable Traces* (on Phono Suescia). Written to celebrate the 250th anniversary of the Stockholm Observatory in 2003, this is modern electronic music inspired by astronomy. Enstrom also has a series of pieces about the properties of quarks.

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Appendix

SCIENTISTS WHO WRITE SONGS

Not included in our main listings are a host of far more scientifically specific songs by scientists who are musicians in their spare time. Many have issued their own privately produced CD's and have web sites where their music can also be found. Here is a sampling of some of our favorites:

The Chromatics: <http://www.astrocappella.com/> A group of scientists and educators, originally clustered around NASA Goddard Space Flight Center, the Chromatics offer their songs on the web and on a CD (*Astrocapella 2.0*). Look for “Wolf 359,” “Doppler Shifting,” and “Dance of the Planets.

Kevin Krisciunas’ Astronomy Songs: <http://faculty.physics.tamu.edu/krisciunas/> or <http://www.haverford.edu/physics/songs/Krisciunas/krisciunas.htm> Astronomer-author Krisciunas wrote/performed astronomy shows for colleagues and you can find a few of his songs on these two sites. Look for “Betelgeuse,” “Give me a Supernova,” and “The Constellation Song.”

Alan Marscher’s Songs: <http://www.bu.edu/blazars/songs/index.html> Astronomer Alan Marscher of Boston University has composed a variety of songs on astronomy and physics themes. Look for “Universal History,” “Another Planet,” “Relatively Weird,” and more.

Lynda Williams, The Physics Chanteuse: <http://www.scientainment.com/pchant.html> Physics professor Williams performs sultry, informative cabaret songs about physics and astronomy. Look for “Love Boson,” “Big Bang,” and “Carbon is a Girl’s Best Friend.”

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