

Where Parallel Lines Converge

program notes

Where parallel lines converge is a sonic rendering of a composite image of the **Galactic Center**, or the center of our Milky Way galaxy, with data from NASA's Chandra, Hubble and Spitzer space telescopes. The piece is a tryptic, highlighting three astronomical objects or moments in the image: the X-ray binary, the arched filaments, and the supermassive black hole, **Sagittarius A***. The piece was conceived using the same principles as the original NASA Chandra data [sonifications](#), converting data to sound by matching different parameters of the image with musical parameters.

The following chart provides each image parameter and its musical equivalent:

Parameters of NASA image:	Parameters of music:
Wavelength/kind of light (X-ray, Infrared, Optical)	Timbre/Register <ul style="list-style-type: none"> ● X-ray: High register, pure/bright timbres ● Optical: Mid register ● Infrared: Low, darker/more discordant
Morphology/structure <ul style="list-style-type: none"> ● Diffuse ● Point-like 	Resonance <ul style="list-style-type: none"> ● Pixels=attacks ● Clouds=longer resonances Movement of sound <ul style="list-style-type: none"> ● Static vs. active
Image intensity/brightness	Dynamic <ul style="list-style-type: none"> ● Brighter=louder ● Dimmer=softer Note→Noise spectrum <ul style="list-style-type: none"> ● Brighter=purer note ● Dimmer=more noise
Density of image features	Consonance→Dissonance <ul style="list-style-type: none"> ● As the features get denser the notes do too Sparsity vs. Density of sound

I approached the form from a different perspective than the original sonifications: rather than scanning the image horizontally and treating the x-axis as time, I instead focused on small sections of the image creating short vignettes corresponding with these occurrences. I also approached the piece as if I was writing a film score to accompany the image. Because the Galactic Center image was so full of information, of material, I wanted to draw the listener's attention to smaller events within the greater data set. Since each vignette is only a minute long, I decided to focus on capturing the feeling of the image rather than on trying to depict every detail of the data. I approached the three-minute piece as a study for a longer track, where each small vignette can be viewed as a preview of one movement.

X-Ray Binary:

This section is characterized by contrast. I was fascinated by how the darkness and the infrared light surround this extremely bright X-ray center from Chandra, so I wanted to emphasize this contrast in the image by using both the lowest and the highest possible sounds with the given instrumentation. The piece begins with white noise, characterizing empty space. Gradually, low bass clarinet and cello chords are layered in, representing the clouds of low spectrum infrared light surrounding the X-ray binary. Muted attacks such as plucked piano strings, cello pizzicatos, and flute tongue rams depicting dim stars that are only visible in the infrared spectrum. As we zoom in towards the center of the X-ray binary, higher notes in the flute and violin come through, and the chords grow brighter, culminating in the highest and purest tones on each instrument.

Arched Filaments:

This section is the sparsest and softest. In order to depict these delicate and wispy structures, I used the unique and shimmery texture of harmonic glissandos in the violin and cello. The combination of the clarinet, flute and glockenspiel, the piano harmonics, and arco vibraphone represent the many stars of varying brightness that surround the arched filaments. In this part of the image some of the stars are brighter and pop out of the texture, while others are more obscured, so I tried to achieve this effect by creating an underlying texture from which some pure bright tones pop out.

Supermassive Black Hole Sagittarius A*:

In contrast to the unmetred and free section before it, this section focuses on repetitive, metered gestures that overlap and build, generating a sensation of spiraling toward an epicenter. The two main textures are high staccato sixteenth notes in the glockenspiel, piano, marimba and crotales accompanied by an undertexture of swelling chords in the violin, cello, flute, and clarinet. At first

the sixteenth note gestures occur one at a time, but gradually they overlap and multiply, depicting the way the stars grow more densely populated toward the supermassive black hole Sagittarius A*.