



EMPAC

CONCERT
IN
WAVE FIELDS

In this concert, the audience will walk through “wave fields.” Wave Field Synthesis is a special way of creating sounds in space. The EMPAC Wave Field Synthesis system (EMPACwave) is a unique loudspeaker set-up with hundreds of speakers that was developed and built at Rensselaer over the past several years. While Wave Field Synthesis technology is not new, the design of EMPAC’s array is acknowledged by international experts to finally allow musicians to create music to the refined degree that has been promised by this theory of sound generation for over four decades.

Four works specifically composed for EMPACwave by Miya Masaoka, Bora Yoon, Nina Young, and Pamela Z premiered last August at Time:Spans festival but covid-protocol meant these new works could not be presented at EMPAC concurrently. Concert in Wave Fields is now presented for our campus community to experience the potential of EMPACwave’s 200+ speakers through the music of four acclaimed American compo-sers, none of which had previously had the opportunity to work with such an instrument.

The composers Miya Masaoka, Bora Yoon, Nina Young, and Pamela Z have created four very different pieces and their works inaugurate an ongoing program of commissions for EMPACwave at Rensselaer.

Concert in Wave Fields

Friday, March 4, 2022, 3PM
Studio 1—Goodman

Pamela Z

SONANT TOPOGRAPHY, 2021

Commissioned by EMPAC

Miya Masaoka

Seeking a Sense of Somethingness (Out of Nothingness), 2021

Commissioned by EMPAC

Nina C. Young

Phosphorescent Devotion, 2021

Commissioned by The Earle Brown Music Foundation
Charitable Trust

Bora Yoon

SPKR SPRKL, 2021

Commissioned by EMPAC

EMPACwave Design and construction: Todd Vos

Audio engineers: Todd Vos, Jeff Svatek, Stephen McLoughlin

Due to COVID restrictions at EMPAC, the compositions were premiered on August 12, 2021, in collaboration with the **Time:Spans** festival at the DiMenna Center for Classical Music, New York City. The concert was performed 13 times between August 12 and August 16.

The EMPAC commissions were curated by Dr. Anne Leilehua Lanzilotti.

Pamela Z

SONANT TOPOGRAPHY (2021)

In **SONANT TOPOGRAPHY**, a torrent of phrases, words, consonants, and phonemes spill into the room, scattering, stacking one upon the other, tumbling down, finding their way to remote pockets and corners, assembling, disassembling, reassembling, and distributing themselves, evenly and unevenly, throughout the space. Listeners will be bathed in a chorus of syllables and surrounded by chaotic and ordered structures built out of sounds from mouths. Ears will be filled with shifting constructions that morph in and out of the grammatical and sensible, as they expand and contract, come together, and fall apart.

—Pamela Z

Pamela Z is a composer/performer and media artist working with voice, live electronic processing, sampled sound, and video. A pioneer of live digital looping techniques, she processes her voice in real-time to create dense, complex sonic layers. Her solo works combine experimental extended vocal techniques, operatic bel canto, found objects, text, and sampled concrete sounds. She uses MAX MSP and Isadora software on a MacBook Pro along with custom MIDI controllers that allow her to manipulate sound and image with physical gestures. Her performances range in scale from small concerts in galleries to large-scale multi-media works in theaters and concert halls. In addition to her performances, she has a growing body of installation works using multi-channel sound and video.

Miya Masaoka

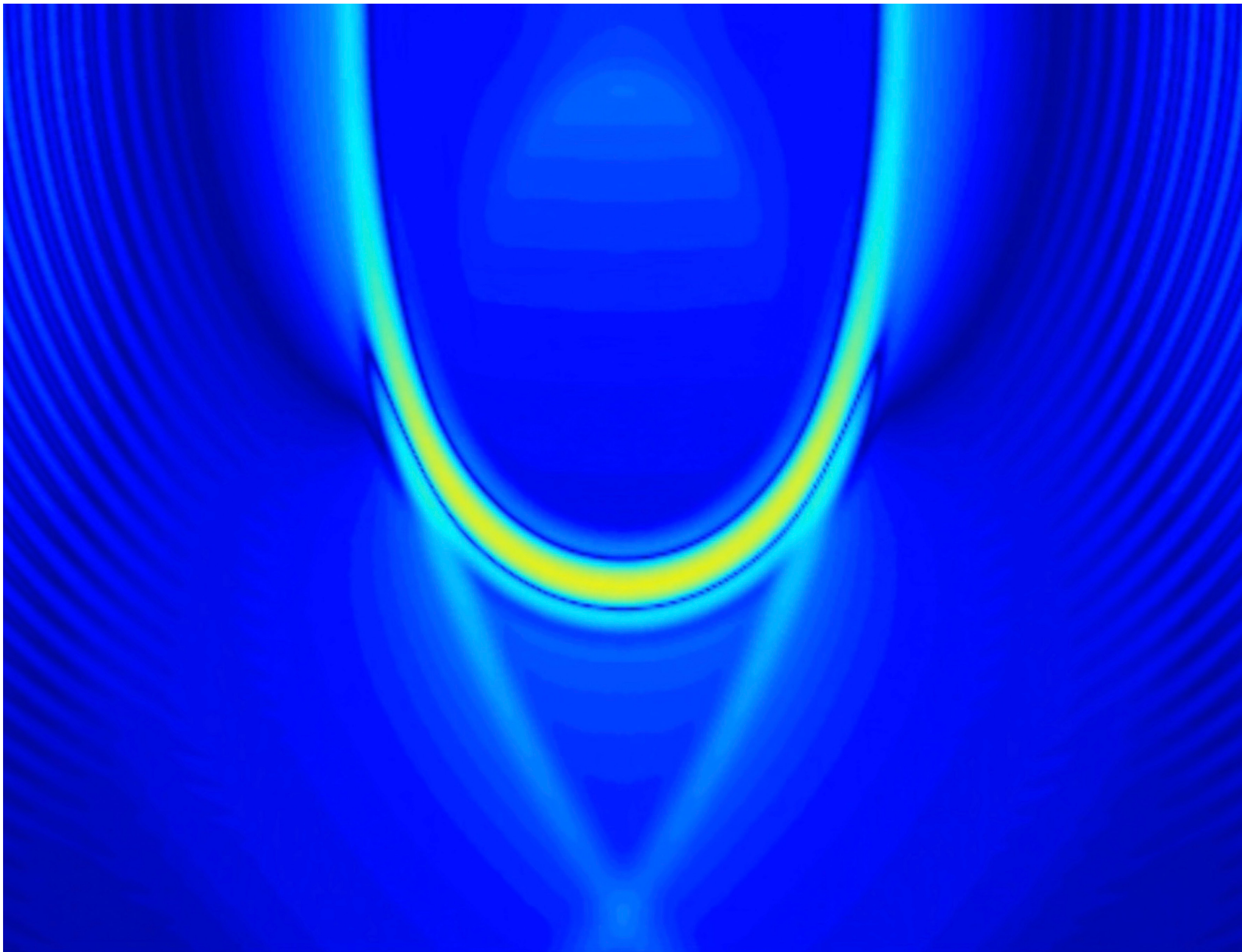
Seeking a Sense of Somethingness (Out of Nothingness) (2021)

We know nothing, we are familiar with nothingness, but what about something? Can you feel something, are you seeking something?

Exploring *opacity* and *transparency* with Wave Field Synthesis, this is a situational composition based on the inimitable sounds of bassoonist Clifton Joey Guidry III mixed with field, water, and outer-space recordings along with analog synthesizers. This piece is dedicated to the late David Wessel, who first introduced me to vicissitudes of Wave Field Synthesis years ago.

—Miya Masaoka

Miya Masaoka is a composer, sound artist, and musician based in New York City. Classically trained, her work operates at the intersection of spatialized sound, frequency, and perception, performance, social and historical references. Whether recording inside physical objects or inside a plant or the human body, within architecturally resonant spaces or outdoor resonant canyons, she creates incongruities that feed the paradox of the contemporary condition. In 2018, she joined the Columbia University Visual Arts Department as an Associate Professor, where she is the director of the Sound Art Program, a joint program with the Computer Music Center.



Nina C. Young
Phosphorescent Devotion (2021)

In a 2006 paper published by MIT Press, Barry Blesser defines aural architecture as “that aspect of real and virtual space that produces an emotional, behavioral, and visceral response in inhabitants. A space can produce feelings of intimacy, anxiety, isolation, connectedness, warmth, as well as a mystical sense of spirituality. Such responses parallel those of visual architecture, except that the space is experienced by listening rather than seeing.”

Wave Field Synthesis offers a unique opportunity to create aural architectures using audio holograms that you can explore, physically, without relying on the ‘sweet’ spot of many spatial audio systems. You can immerse yourself in an ephemeral, morphing, virtual architecture with the agency to sculpt your own experience and personal ritual. My new work is loosely inspired by the light and color combinations of James Turrell. In this new exploratory sonic composition, I send out ‘regions’ of synthesized tones. The visitor moves through the space, creating their own temporal envelopes as they travel through different ‘melodic’ sequences. The positioning of the materials drifts across the array and morphs, mixing to create a more complex experience. Cashed between the regions of synthetic tones are snippets of acoustic memories—instruments, voices, field recordings—frozen in invisible space. You can stop to listen, or simply let them pass by as a whisper of something that you may recognize.

—Nina C. Young

Composer and sonic artist Nina C. Young creates works, ranging from concert pieces to interactive installations, that explore aural architectures, resonance, and ephemera. She dialogues with natural acoustic environments, instrumental performance techniques, and digital signal processing. Nina is a professor at USC’s Thornton School of Music. She was on the faculty of Rensselaer’s Department of the Arts from 2016 until 2018. She started working with EMPAC-wave in 2020 just before the COVID pandemic. Nina will be back this April to complete and premiere her new work at EMPAC.

Bora Yoon
SPKR SPRKL (2021)

SPKR SPRKL is a work-in-progress excerpt that explores the paradoxical tension between inner resonant body space and outer acoustic/architectural space. Using the Wave Field Synthesis Array to explore the scalar extremities of sound, **SPKR SPRKL** journeys through jagged rhythmic sequences akin to synapses of neurons firing and fireworks, and the visceral texture and whisper of strings, voices, and objects, to explore how these sound scales may be able to form layered simultaneous realities.

—Bora Yoon

Korean-American composer, vocalist, and multi-instrumentalist Bora Yoon is an interdisciplinary artist who conjures audiovisual soundscapes using digital devices, voice and found objects and instruments from a variety of cultures and historical centuries – to formulate an audiovisual storytelling through music, movement, and sound.

Bora was in residency at EMPAC this January to work on the larger work including the EMPACwave with interactive performance with live video and sound projection. She will be back for two more residencies and will premiere the work at EMPAC in early 2023.

The EMPAC High-Resolution Modular Loudspeaker Array for Wave Field Synthesis

A long box with over 240 small loudspeakers is positioned along the wall. The box serves simultaneously as stage and as instrument for the pieces created for this event. The composers worked with this instrument exploring its potential for their music.

This instrument creates sounds quite differently to other loudspeaker systems. It has an unwieldy name: The EMPAC High-Resolution Modular Loudspeaker Array for Wave Field Synthesis or EMPACwave.

Everyone has experienced the following situation: You are listening to music over a stereo system with a left and a right loudspeaker. There is an area where you hear the full panorama of the music, from left through the center to the right, as if there was a stage. When you move your chair to the very left or very right, most of the music comes from the speaker closest to you. The same in a lecture hall where a human speaker is amplified with left and right loudspeakers on both sides of the stage. If the podium with the speaker is to the left on the stage and you sit to the right in the audience, you will hear their voice coming out of the right loudspeaker rather than from where they stands. Or you sit in a movie theater with surround sound on the furthest left seat of a row. The surround sound effects will come for you mostly from the left.

The listening experience is different when you are in a concert hall with a small ensemble playing acoustic instruments. Independent of where you sit, you hear the clarinet seated on the right, the singer in the center, and the oboe to the left — always from where they are onstage. You move around in the hall and the sound of the instruments always comes to you from where the players sit. And if a player sits towards the back of stage left, you hear them playing from back there.

Wave Field Synthesis is a specific technology that allows us to create such a sound stage. You hear the sounds coming from their specific location, where the composer or sound engineer placed them,

independent of where you are in the room. The system creates a physically correct wave field for each sound. And if a sound moves from left to right, anyone in the auditorium will hear that movement. The sounds are spatialized and placed in space to be experienced independent of whether you are more to the right, in the center, or more to the left. Wave Field Synthesis creates this 'natural' way of localizing sound, allowing for a greater transparency of the sound stage. A composer can work with sound in space very precisely and can be assured that everyone can hear it as intended.

The theory and technical implementation for Wave Field Synthesis was developed in the late 1980s. Quite a few loudspeaker systems have been developed to take advantage of this theory. The quality of such systems depends on the diameter of the loudspeakers. The smaller the speakers, the better and sharper the sound localization; the larger the diameter, the fuzzier and more out of focus the spatial perception for our human ears. We developed this system at EMPAC at Rensselaer Polytechnic Institute for highly flexible artistic use, which allows the placement of modules anywhere in a space, not only in a line but overhead or in a circle. For this event, we use a straight line of speakers. The system requires a large amount of computing power to calculate the wave field of each sound since the creation of each sound involves many, many loudspeakers at the same time. It is not one loudspeaker for one sound rather they all are engaged for each individual sound.

Listening to the music does not require an understanding of the system.

—Johannes Goebel

A technical description can be found at <https://empac.rpi.edu/program/research/wave-field-synthesis> with the link to a detailed conference paper at the bottom of this page.

SPRING 2022

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