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Photo: Nemanja Knežević, © Beyond Quantum Music

In October 2022 I was delighted to have the opportunity to present an audiovisual laser performance titled *Additive Duality* at CZKD in Belgrade, Serbia, as part of Beyond Quantum Music, an event organised by the Institute of Musicology SASA in partnership with Ars Electronica and funded by Creative Europe.

During the summer of 2020, due to the pandemic and a lack of paid work, I had been spending more time than I was usually afforded to explore digital synthesis techniques in much greater depth using the software Max. Around this time there was also another exciting strand developing on the visual side of my arts practice; having just invested in a laser projector at the beginning of 2020 after

years of saving up enough money and researching what was needed to explore this under-utilised medium. Playing with various sound synthesis methods,

combining and working through recorded sonic materials gathered over years of experimentation, I have repeatedly found myself returning to the unique and flexible character of pure, elemental sine waves – their unnatural behaviour, synthetic makeup, with no other harmonics present other than the fundamental frequency, appeals to me from the perspective of experimental sound design with the mindset of building sounds from their foundations. It just so happens that sine waves are also one of the most efficient methods for controlling lasers, as the smooth, flowing contours of the sine wave reduce harsh, angular jumps in the path of the travelling beam which can damage the high-speed mirrors that enable this movement.

When I first read the Beyond Quantum Music open call it seemed like an obvious opportunity to really dig into the audiovisual potential of sine waves and have a context with which to frame the work – a refreshing change of focus during that aimless period of the pandemic. Incorporating BQM's concept of the Quantum Synthesizer alongside a wholly additive synthesis palette, I first attempted to explore ideas of complementarity in the manner of Niels Bohr through an exploration of phase and beat frequency relationships. It was my intention to simultaneously extend the dimensionality of the sound waves, scaling down audible frequencies to drive a laser beam that would project the sound's visual counterpart in a physical space, akin to a 3D oscilloscope. In using sine waves as the basis for drawing patterns with a laser projector, it is not long before one arrives in the land of Lissajous figures. Harmonic structures emerge that resemble atomic nuclei, hinting at wormhole imagery and vacuum states.

Ideas and concepts concerning the quantum field are often difficult to grasp and daunting to the uninitiated – conversations surrounding quantum mechanics often make me feel out of my depth. However, being invited to creatively respond to some of the fundamental principles within quantum theory, it was exciting to interpret these ideas in a way analogous to my understanding of the harmonic relationships present in additive synthesis and laser-beam modulation, elucidating some of these core concepts through play and experimentation. The immediate experience of being able to hear and see the direct sound-laser translation (of what is essentially a study on vibration and wave relationships) inspired fresh perspectives in my own thinking and understanding of quantum theory and I would hope that this work inspires similar interpretations within an open audience.

In the time that has elapsed between my first contact with BQM, proposing Additive Duality in September 2020 and then performing the latest iteration of the work in Belgrade in October 2022, I have been fortunate enough to perform the piece in various states of progress to audiences throughout the UK – constantly trialling, testing, scrapping and reconfiguring the work almost obsessively. I have released two EPs of music during this period – Exigent Set

(2021) and Sinecures (2022), with the latter being more of a collection of these live materials reworked for release.

There are certain aesthetic decisions one might consider when presenting live audiovisual work with a laser. When translating studio mixed stereo audio (left, right) directly to laser (X, Y) the drawn image often resembles a restless squiggle, which in the context of Additive Duality, it makes sense as a visualisation of particle formation and chemical reactions – though honestly, Roger Hargreaves' Mr. Messy comes to mind. When inverting the process, translating traditional laser patterns to audio, these typically resemble droning low-frequency sawtooth waves with super wide stereo panning, depending on how they are played back. Most audiovisual laser performances that place an emphasis on audiovisual synchronicity belong to one of these two camps.

With my latest work (and going forward) I attempt to move beyond a simple direct translation in either direction and am considering novel methods of uniting the audio and visual elements in order to transcend both to form something greater than the sum of its parts – the sonic strengths of carefully composed audio alongside hypnotic, spectral laser light.

Photo: Matteo Favero @ IKLECTIK

