

## QUANTUM MUSIC PROJECT APPLICATION

Physics posits two things cannot occupy the same space at the same time. Ask any choreographer and you will obtain the same answer. But if you question a musician, you will hear something quite different. Two musicians cannot, but two **notes *can*** occupy an identical spacetime continuum. In this specific way music acts like a form of quantum mechanics by occupying multiple dimensions as posited by string theory postulates. At the vibratory level there is an interaction of vibratory fields that produce overtones of the dominant tone so all notes that interact have to occupy the same space at the same time. When notes interact closely they produce beats, enrichen the timbre, produce physical results of their interaction. So music defines a pointlike omicron of insertion that simultaneously defies Newtonian physics, clarifies the classical mind, and invades string theory. Just ask any musician and they will say they have musically entered a private space when they play with any other musician on the same piece. This applies to all written music, improvised music, folk music, and spiritual, profane, rock—all kinds of interactive musics. The notes interact and occupy the same space at the same time.

String theory takes the position that superposition may be related to the entanglement of particles in a world beyond spacetime. The word spacetime might also be relativized by reversing the usual order to create the word timespace, that area within which something happens in time. Time being a dimension, timespace includes everything so entangled particles interact in timespace. Many entangled particles interacting outside of spacetime do not yet exist because of superposition. They have yet to collapse into spacetime. Let us refer to entangled, superpositioned particles as occupying timespace. They are superpositioned and therefore occupy the same space at the same time. Dropping out of timespace, superpositioned quantum particles collapse into spacetime and cannot then act according to timespace. So in timespace, superpositioned entangled particles are different from spacetime collapsed wave particles, or wavicles to be precise. Wavicles are the spacetime rendition of superpositioned quantum particles. How do they interact besides collapsing?

Vibrations may offer a clue. Consider two musicians playing with one another. They might be able to pass through one another—give them enough time. But the odds are against it. But the music they play fills timespace. Playing together entangles vibratory schemae. A tone is produced which has harmonics—it is the same tone with multiple waves vibrating at various frequencies. This effect can be heard as if the air is filled with simultaneously occurring particles occupying timespace.

Good music comes from another place. It takes us to another place. That place is called different things so I cannot name it in a specific way. Mathematical formulae which describe imaginary numbers so as to describe superpositioned quantum particles may also describe good music—if the musicians are playing together!

The Bose-Einstein Condensate (BEC) is located at the lowest temperature in the Universe. At temperatures close to absolute zero wavelengths of atoms become large enough to form overlapping waves of individual atoms that act as individual systems on higher temperatures. In other words, all atoms descend to an identical, lowest possible energy state, overlap their waves and become one quantum system. It is this state of matter, in which groups consisting of millions of atoms, which is a specific quantity of matter, begin to act as a single quantum system (and) opens the possibility of establishing direct bonds between acoustic and quantum mechanics systems (Lee, Huang and Yang 1957). (Novkovic, Peljevic, and Malinovic. 2018)

Furthermore, intergalactic space, at temperatures of 3-4 K, the coldest area outside the laboratory known to man, is at the temperature that BEC exists. I would suggest that interstellar space might be composed of Bose-Einstein Condensate and that the universe is vibrating as one quantum structure.

Our project consists of a worked out basic and purely abstract pitch structure that allows a lot of space for improvisation along with electronics that are derived from or contain the pitch structure, i.e. the pitch structure is embedded in the sounds. The performers will elaborate the pitch structure according to their own (collective and individual) ears and the kind of musical gestures will be roughly controlled by the kinds of and pacing of the electronic sounds, including, especially, their spatialization. Maybe the performers could be scattered around the hall as well, or could even walk around the hall and play from different positions. Or if you want to get really funky, attach one of those Peter Pan harnesses to the more adventurous of the players and literally fly them around the hall (did you ever see the Peter Pan musical when you were a kid? really fun).

A technical comment: you make beats with micro-intervals, minor 9ths are already nice and solid (my favorite interval). Take any old sound and play it with itself frequency shifted up 3 or 4 Hz and you'll get 3 or 4 beats a second, i.e. interference patterns that make beats. This can be useful if you change these frequencies during performance, always by micro-tuning.

The overarching concept of quantum music creates a new architecture of stimulus and response in which the quantum nature of sound is played by the musicians in timespace. The induction of position is made by the electronic musical structure which suggests tonal centers within which improvisation occurs. The resultant hybrid induces sound which resonates throughout the universe as a function of the Bose-Einstein Condensate—audible to the human ear as music. Similar to free jazz, the electronics produce changes, the musicians play the changes, and we are uplifted to another mind altering space neither in spacetime nor in timespace but in BEC-entanglement.