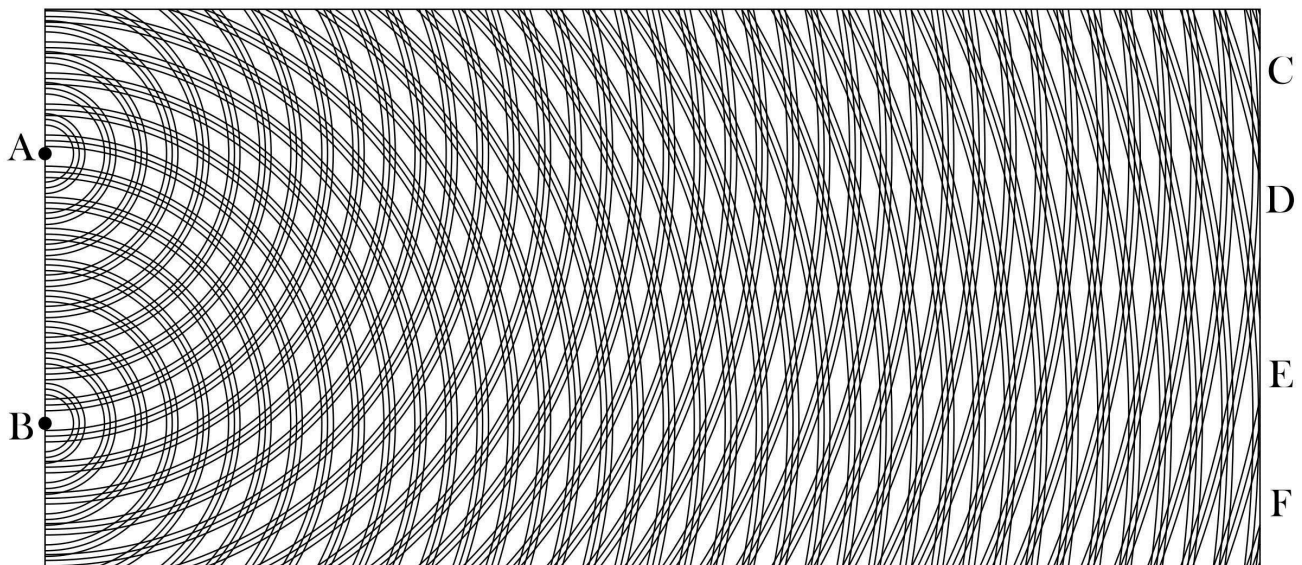


Flow

Nokuthula Endo Ngwenyama

Come in and out of silence,
Tone swirling in the balance.
Nothing, then everything
waving into space.

Then Light.
And after a longer while
Air.
And now sixteen strings manually animated,
Vibrating through time.



Sketch made by [Thomas Young](#) to illustrate the two-slit diffraction of light. Narrow slits at A and B act as sources, and waves interfering in various phases are shown at C, D, E, and F. Presented to the Royal Society in 1803.

The moment Ms. Harumi Rhodes of the celebrated Takács Quartet reached out about writing a piece for the group I was surprised, greatly honored and fearful. The string quartet is considered a ‘perfect’ ensemble. It inspires delicacy, sensitivity and adventure. The core range is smaller than that of the piano, yet its timbre allows for beautiful interplay.

Harumi then requested the quartet be about anything in the natural world on behalf of lead commissioner Cal Performances. Fortunately patterns in music and science pair well, so that brought relief.

I researched a wide array of subjects for over a year. Topics included the life cycle, carbon reclamation, environmental protection, animal communication, starling murmurations, our last universal common ancestor (LUCA), black hole collisions and the sub-atomic realm. I listened and re-listened to the silky recordings of the Takács Quartet with gusto, especially savoring their performances of Johannes Brahms, Samuel Coleridge-Taylor and Florence Price. Systems layered upon other systems revealed a common flow to existence tying us to the initial outburst of energy and matter at the birth of our universe.

We flow through life. Conversely, the flow of existence is temporarily housed in us each generation. Everything in nature flows and develops through time. Flow can be expressed mathematically, psychologically, physically, visually and, now, via string quartet.

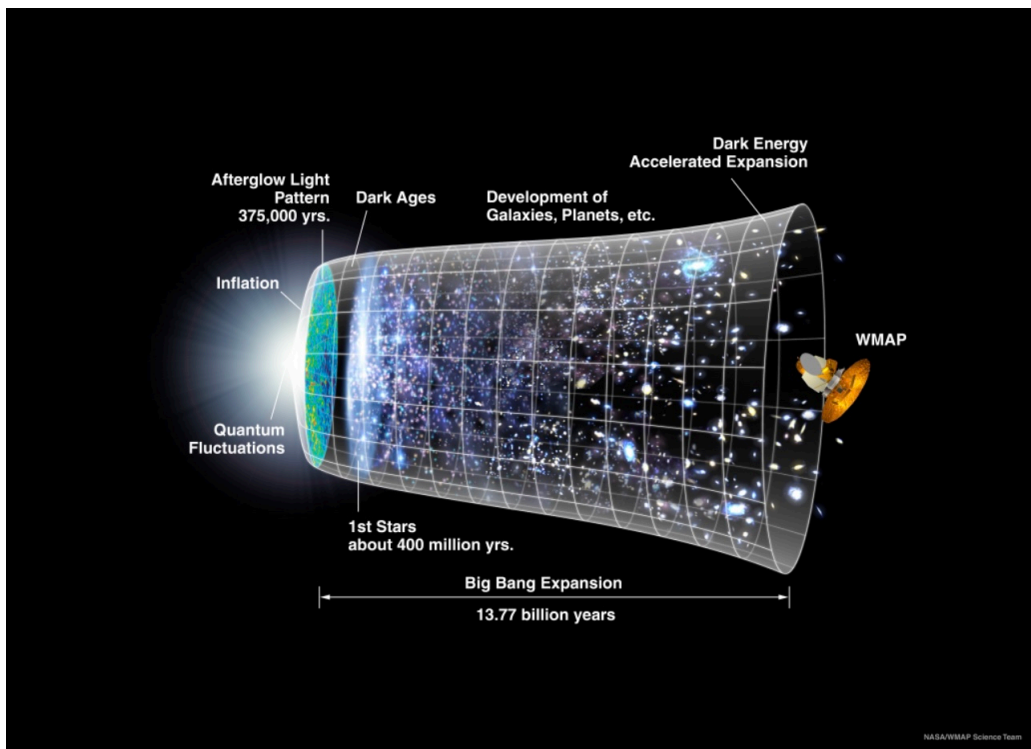
‘Prana’ in Sanskrit fits this concept. ‘Pra’ means ‘first’ and ‘na’ means energy. It is infinite and all-pervasive through animate and inanimate realms. The quartet is asked to connect through ‘Pranayama,’ where ‘ayama’ is the expansion of ‘Prana’ and

practiced through breath control. The quartet also connects with initial energy through the concept of Om ॐ, which is synonymous with ‘Pranava’ meaning “foresound” and ‘Onkara,’ meaning “Om maker:” the first source of sound and act of creation. ॐ in the string quartet mostly appears on an upbeat as a widely vibrated pizzicato glissando in the cello imitating rhythmic placement of the gong in Balinese Gamelan. That, in turn, imitates the creative vibrational energy in, of and beyond our universe.

Energy spreads as our universe expands. Its ‘pitch’ lowers, as can be heard on physicist John G. Cramer’s April 14, 2013 audio representation of the ‘Big Bang’ based on the European Space Agency (ESA) Planck Mission’s analysis of cosmic microwave background (CMB) radiation. That 100 seconds is the general overarching form to the quartet ‘Flow.’ Cramer’s audio file is based on temperature fluctuations and scaled upward by $\sim 10^{26}$ to match the response of the human ear. It begins with a quiet glissando from a high pitch, spikes into a raucous outburst, then ripples and tails into an ever-lowering dissipating bass decrescendo.



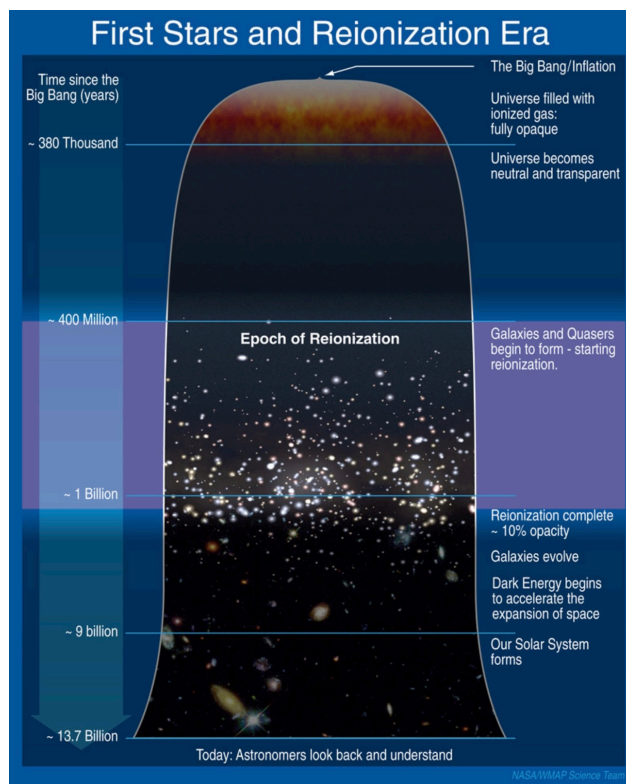
Audio by John G. Cramer, University of Washington, April 14, 2013; in Cosmoknowledge, June 7, 2019



Courtesy of NASA WMAP Science Team

‘Flow’ starts like gas seeping from an infinitely full balloon about to pop. Then, as matter inflates space, climactic material is presented almost immediately before abruptly burning out for the universal dark ages.

Cooling during the epoch of reionization allow H (Hydrogen - represented by the note B) - and He (Helium - represented by notes BE) to stabilize. There is light, then stars and galaxies form.

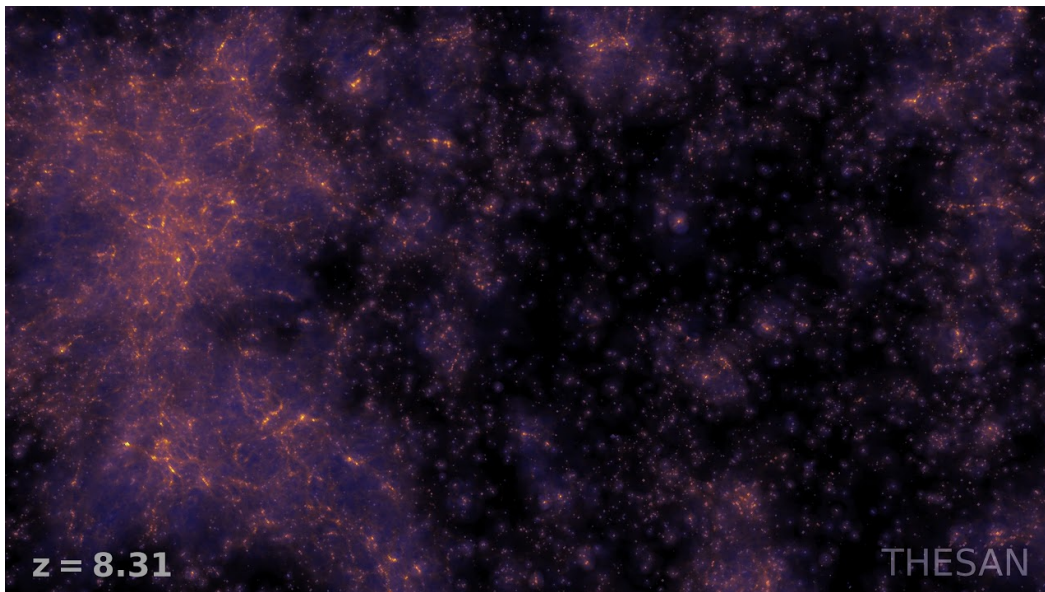


Courtesy of NASA WMAP Science Team

We, at 62% Hydrogen (10% of our mass), are ancient dust from our universe's creation 13.7 billion years ago. Our atomic selves can be traced to this epoch of reionization 400 million through a little over 1 billion years after the 'Big Bang.'

The Prelude examines 'B'ing/'BE'ing melodically and harmonically through moments of pranayama. It ends with a trailing ॐ .

The Lento brings further cooling and space in chorale around an octave B-centric pedal. Prelude motifs are given room to develop. The bass line further descends and expands. Microtone slow glissandi hold the group together.



Internal 3D view of the gas density evolution in Thesan-1 from Thesan Simulations, November 4, 2021

Quark Scherzo explores our fundamentally playful selves vibrating here, there - and where? Our sub-atomic realm giddily waltzes up (u) and down (d) while we embrace ideas solidity and ego. The opening cello mimics quark motion for ${}^2\text{H} = 2$ protons + 1 neutron = uud uud ddu = ddu uud uud. Later, it's He-4 = 2

protons + 2 neutrons = uud uud uud + ddu ddu = uud uud
ddu ddu udu duu. The trio, whose only claim to three are triplets
 in the cello line, provides no break for anyone and instead
 intones a ballade. The movement ends in virtuosic flurry.

The Finale settles into a stylized recitative where three lower
 strings solo before coming together to feature a soaring treble
 voice. Flowing triplets turn into a Classical Indian Dadra Tal (even
 six beat) rhythm in the bass line while upper strings bow their
 bouts simulating Cosmic Microwave Background (CMB)
 radiation. Upper strings join in ♩ via pizzicati glissandi. There is
 a return to the Prelude opening, then a slingshot into the ecstatic
 joy of starling murmurations photographed and reported by
 Søren Solkær in the New York Times Travel column 'The World
 Through a Lens' from April 4, 2022.

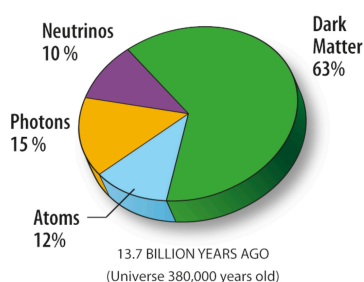
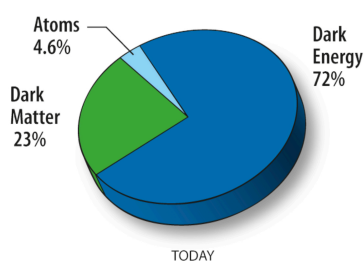


DW Euromaxx, March 26, 2021

Lower strings continue unrelenting while violin lines blissfully
 chase one other, turning, merging and enjoying. They eventually
 land, the sky calms through long D overtone glissando and a
 retreating tremolo reveals:

Enjoy and go with the flow, we only know what we know.

Heartfelt thanks to Harumi Rhodes and the entire Takács Quartet for asking a Divinity School graduate to write this. Thanks also to lead commissioner Cal Performances and supporters University Musical Society (Ann Arbor, MI), Shriver Hall Concerts (Baltimore, MD), 92nd Street 'Y' (New York, NY), Philadelphia Chamber Music Society (PA), Friends of Chamber Music (Portland, OR), BroadStage (Santa Monica, CA), Boston Celebrity Series (MA) and Capital Region Classical (Schenectady, NY) for supporting this sonic exploration while broadening my yoga practice, a necessity for this all-encompassing challenge. Thanks additionally to musicians Dewa Putu Berata (director of Çudamani), I Wayan Arya Misha and Dewa Ogen for the opportunity to share and learn about different layers of instrumentation in Balinese Gamelan.



Knowing our natural history gives insight into our role as 4.6% atomic matter in the universe. We are the anomaly. Life and agency ('Atma' - soul in Sanskrit) allow the universe to be observed from our sliver of pie. We're humor passing time, blinks to be cherished. There are no limits coming together in love and gratitude. We are connected in appreciation to true nature, there is no "us" or "them." Flow in peace. ॐ

Courtesy of NASA WMAP

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