

MatterSpaceTime (MST) Theory

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Major advances in theoretical physics have come from redefining frame of reference, space and time. Cartesian coordinates enabled development of calculus and classical physics. Integration of space and time into spacetime explains various special relativity phenomena. Curvature of spacetime ushered in General Relativity and Big Bang Cosmology.

A logical question: why stop at the curvature of spacetime fabric? If spacetime can curve, can the fabric have lumps(or bumps, blisters or bubbles; whichever suits your imagination)? Do these lumps require a locality(piece or part) of spacetime of higher dimensionality than the surrounding? Can these lumps be matter which is localized energy? With these intuitions, matter can be integrated with spacetime. Such **integrated mixed dimensional fabric** is called MatterSpaceTime(abbreviated as MST) here. This helps to intuitively understand important unresolved questions. Such explanations are collated as MatterSpaceTime(MST) theory.

String theory needs the existence of extra dimensional spaces in its search for a theory of everything. According to String theory we don't see extra dimensions because they are compactified. MST helps us to visualize extra dimensions as locally created dimensions **without the need of compactification**. According to MST theory, extra dimensions are created only in the area where matter particles in spacetime are present. MST theory is **background independent** like loop quantum gravity.

As energy concentrates together in a small area, spacetime lumps appear resulting in matter particles. Extra dimensions are created in the lumpy areas as these quantum particles are getting created from the localized energy. In General Relativity curvature can vary from place to place(or point to point). Similarly in MST, **dimensionality can vary across SpaceTime fabric**. So instead of "matter being in SpaceTime" as in String Theory/General Relativity, we have matter integral part of MatterSpaceTime; This view is more unifying.

We have various dualities; In physics, Gravity and Quantum Mechanics need theories of quantum gravity. In philosophy, materialism and idealism are conflicting viewpoints. MatterSpaceTime can be the starting point to unify these dualities. It is interesting to visualize how these dualities can emerge from the natural division of MatterSpaceTime.

Math of mixed dimensions and AI/ML applications

Alternate parallel postulates led to geometries other than Euclidean(Non-Euclidean etc) Geometry. In MST, these geometries can be further generalized to have a mixed number of dimensions: different regions of the geometry having different numbers of dimensions. Mixed number of dimensions conform to the euclidean postulates(excluding parallel postulate) like non-euclidean geometry. Such a **mixed dimensional topological manifold is practically useful** also to optimize machine learning algorithms such as Stochastic Gradient Descent(SGD) in case of **sparse, high-dimensional** and **large** datasets.

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Quantum Mechanics(QM)

Each smallest component/part of MatterSpaceTime is a Quantum System has all the properties from which classical physics, logic & mathematical patterns emerge just like every cell has DNA. Only restriction on a quantum system is resulting from the freedom of other components of the universe. **All physics/math laws emerge** from such 'sociology' of the components. Each Quantum System(even smallest) has **its own 'clock'** which is independent from observers' reference frame time. This independence explains the **randomness** of wavefunction collapse. If the environment consisting of other components does not dictate(as in wavefunction collapse) a specific state for a property, the particular property will be in **quantum superposition** of the possible states. Block theory of time with the ability of the lumps(matter particles) in MatterSpaceTime travel back and forth in the cosmological time can explain the superluminal correlations in the Bell pair **entanglement**. Each Quantum System has its own dimensions of freedom consistent with **normed division algebra** as it tries to divide itself. **This explains the facts: complex numbers** are required in QM; Using **quaternions** Maxwell's equations reduce to a single equation and ongoing research to understand standard model(SM) using **octonions**.

How do the above dimensions of neighboring quantum systems align? These alignment emerge from the fact that these components arise from division of existing components. If you follow all the splits, all the components originate from a single component of very high dimensionality naturally following **Cayley–Dickson construction**(sort of generalization of normed division algebra: power-associative algebra).

Cosmology

General theory of relativity and Big Bang cosmology support the block theory of time. We can imagine the universe as a river in spacetime which has big-bang as origin. Arrow of time can be explained by saying classical objects are 'going with the cosmological time flow'. Such a river is expanding, leading to the 'Expansion of the Universe'. If one imagines such a river will expand further to minimal dimensionality(thinning out of the MatterSpaceTime fabric) and then start contracting(reducing entropy) leading to a **minimal entropy Big-Crunch** which can be the black hole **precursor to the Big Bang** (white hole). This **super black hole white hole pair** is packed via Cayley–Dickson construction in a very high dimensionality. When such humongous dimensionality is unpacked, it leads to the **inflation epoch** of the big bang and leads to the observable universe where the matter particles seem separate from spacetime.

Philosophy: Materialism vs Idealism

MatterSpaceTime has the property of 'forms emergence' and can be the substrate of any form(geometrical or event/process like) which is achievable by dividing itself naturally. Ideas (including more complex form:**consciousness**) emerge from this most fundamental form and matter emerges from this most fundamental substance **resolving** the chicken & egg type question : which is more fundamental between Materialism and idealism? Materialism and idealism both are emerging out of the **single entity both qualitatively and quantitatively**:

MatterSpaceTime.