Simple Question

Start with the simplest question.

What is the least structure that must exist for anything to exist at all—and for that existence to be observable?

Most physical theories begin by filling the universe with ingredients: particles, fields, coordinates, operators. This framework starts one step earlier. Before any object, field, or coordinate system can exist, there must first be a distinction between what exists and what does not.

That distinction is a boundary.

What begins here as a simple conceptual observation does not remain philosophy for long. The same requirement appears again from two independent directions. Physics demands gradients in order for structure to form, and the mathematics of boundary propagation later shows that perfectly uniform expansion cannot produce persistent structure at all. The conceptual insight, the physical requirement, and the mathematical result all converge on the same conclusion: existence requires boundaries that propagate through a non-uniform geometry.

The void as primitive boundary

Physics already encounters boundaries whenever its descriptions reach their limits. Horizons separate observable regions from inaccessible ones. Cosmological models acknowledge domains beyond which coordinates and fields cease to provide meaningful descriptions.

The point is simple: boundaries naturally appear whenever we try to define where something exists and where it does not.

Once that idea is accepted, the next step follows naturally. If boundaries can exist at large scales, there is no clear reason they cannot also exist locally. A boundary is simply the place where something exists on one side and not on the other.

This motivates the void postulate:

Void Postulate (informal). Space may contain finite holes whose boundaries carry the geometric and dynamical structure associated with their motion.

A void is not a new substance. It is simply the absence of space itself, bounded by a surface that can move. The only structure it possesses is the structure of that boundary.

Where many models treat boundaries as rare or exceptional situations, the minimal statement of existence treats them as basic structural elements.

Energy and mass as boundary dynamics

Once local void boundaries are admitted, the next question is how they move.

The most conservative assignment is that they propagate at a single invariant speed—the same invariant speed already associated with light. Nothing new is introduced here; the boundary simply moves at the only universal speed already known.

In the pre-mathematical picture, a void is a propagating absence. As the boundary advances it opens space at its leading edge and closes it behind. Energy then appears in the simplest possible way: it is the continued propagation of such boundaries through space.

When a propagating void moves through a perfectly homogeneous region, its motion is free and structureless. Nothing interrupts it.

But if the boundary encounters gradients in geometry, its trajectory can bend back on itself. Under suitable conditions those folds stabilize into loops that obscure regions of space and obstruct further propagation.

Those stable obstructions behave exactly like what physics calls mass.

In this sense, mass is not fundamental. It is energy—a propagating boundary—trapped by geometric gradients.

This reverses the usual hierarchy. Instead of matter and energy shaping geometry, geometry and boundary structure come first, while energy and mass appear as particular patterns of boundary motion.

Why a perfectly uniform beginning cannot produce structure

A completely uniform universe cannot produce persistent structure.

If space began perfectly homogeneous—with no curvature differences and no gradients of any kind—then propagating boundaries would never encounter anything capable of bending their paths back on themselves. They would simply continue outward forever.

Energy would exist, but nothing would ever stabilize. No loops. No trapping. No lasting structures.

The existence of matter therefore implies that geometric gradients must already be present before matter forms.

Cosmology already hints at this requirement. Many early-universe models invoke a pre-Big-Bang stage or primordial structure in order to explain why the observable universe is not perfectly uniform. In those models the requirement appears as an abstract condition: some earlier event must leave behind the gradients that later allow structure to form. Modern cosmology reaches a similar conclusion from observation. Quantum fluctuations and inflationary perturbations are often invoked to explain how those irregularities appeared.

In the VMS framework this requirement becomes concrete. The mathematics of boundary propagation shows that a perfectly uniform beginning cannot produce persistent structure at all. Gradients must exist first. What appears in cosmology as a speculative pre-Big-Bang condition therefore reappears here as a direct mathematical requirement of the boundary dynamics.

This connection was not discovered only after the mathematics was completed. The need for such gradients was already apparent at the conceptual level: if everything expands perfectly uniformly, with nothing to interrupt or bend that motion, then nothing could ever become distinguishable. Any disturbance would disperse before it could define itself as anything at all. In such a state, existence would never stabilize into anything observable; everything would simply propagate outward in uniform fashion and fade away.

The mathematics simply confirms that intuition. The boundary dynamics show that uniform propagation cannot produce persistent structure. Gradients must exist first. What first appeared as a conceptual requirement for existence itself emerges in the formal framework as a necessary condition of the boundary dynamics imposed by observation itself.

From idea to mathematics

The picture described above: boundaries, propagation, geometric & mathematical requirements. It's not a metaphor. The following lemma shows that two kinematic conditions already present in standard physics, combined with the requirement that observers are finite and invariant, uniquely force Lorentz structure. No metric, invariant interval, or symmetry group is assumed. The geometry alone is sufficient if nothing else is assumed.