

## RELATIVE MOTION AND THE UNEXPECTED THREE-VECTOR PROBLEM

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**Abstract.** -This article presents, in vector terms, an elementary problem of relative motion from which logical and physical impossibilities are inevitably deduced, suggesting a significant change in the foundations of kinematics.

**Opinion.** -The opinion of **ChatGPT o.3-mini** on this short article is included.

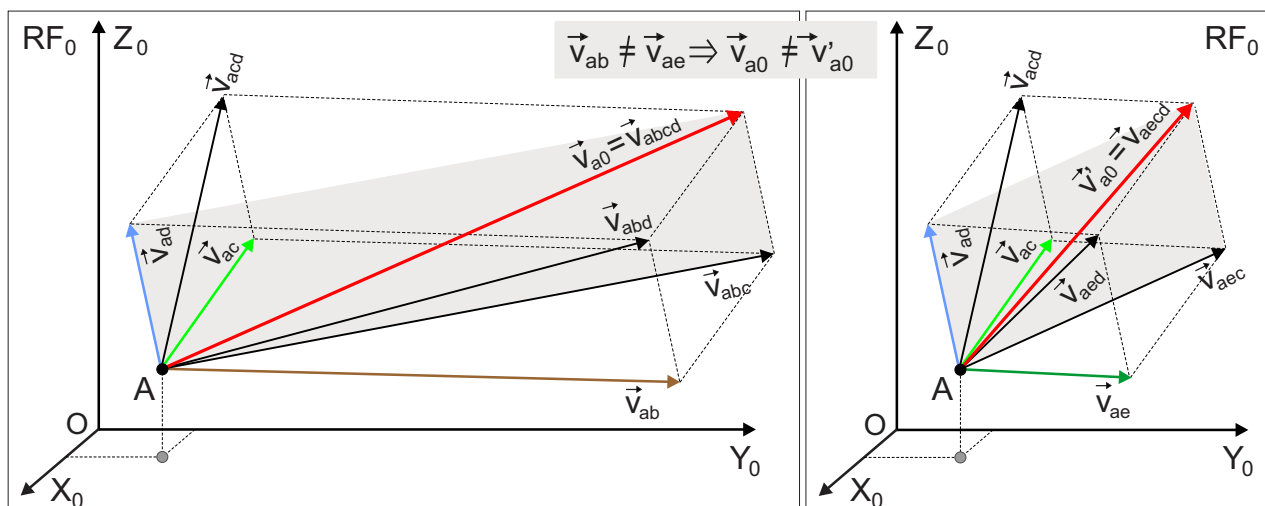
**Keywords:** Preinertia, physical space, gravitational waves, relative motion, absolute motion, three-vector problem.

### 1 Preinertia

Although contemporary physics has yet to discover preinertia, it was already hinted at by Galileo [1, p. 228]. Its physical reality is immediately verifiable: whenever an object falls, it lands directly below the point from which it was dropped, and not 2.98 km away if the fall occurs here on Earth and lasts one-tenth of a second (considering only Earth's translational motion). Indeed, preinertia is the property of all physical objects by which they inherit the motion of the objects from which they are set into motion. It is almost immediate to demonstrate that preinertia makes it impossible to detect the absolute motion of an object using objects set into motion from the object whose absolute motion is to be detected, if such motion existed [2, pp. 411-416]. However, undetectability does not imply nonexistence.

### 2 Motion through physical space

The empirical detection of gravitational waves—real waves that interact with real objects, producing measurable real effects—irrefutably implies that the space itself vibrating in these waves must be a real physical entity [3]. Yet, a decade after the first detection of gravitational waves, physics still does not acknowledge the physical reality of space, which many physicists continue to regard as a mere mathematical construct. But what does not truly exist cannot truly vibrate or interact with real physical objects, as light or interferometers. Therefore, all physical objects move through the same real physical space. Consequently, this real physical space must be unique and absolute; and motion through this absolute space must also be absolute, albeit undetectable due to preinertia. Only relative motions arising from differing absolute motions are observable.



**Figure 1** – Left: The three vectors  $\vec{v}_{ab}$ ,  $\vec{v}_{ac}$ , and  $\vec{v}_{ad}$  determine the uniqueness of the vector  $\vec{v}_{a0}$ . Right: In  $RF_0$ , all cosmic objects moving uniformly parallel to  $\vec{v}_{ab}$  must move at the same relative velocity  $\vec{v}_{ab}$  with respect to A; otherwise, object A would have to move simultaneously with different velocities and trajectories relative to  $RF_0$ .

### 3 The Three-vector problem

The following discussion unfolds within the framework of classical mechanics and is later extended to special relativity. Only macroscopic objects in the observable universe are considered, all moving with uniform velocity (constant velocity vectors) relative to a given inertial reference frame  $RF_0$ . Let A,

$B$ ,  $C$ , and  $D$  be any four such objects, and let  $\vec{v}_{ab}$ ,  $\vec{v}_{ac}$ , and  $\vec{v}_{ad}$  be the corresponding relative velocity vectors of  $A$  with respect to  $B$ ,  $C$ , and  $D$ , determined in  $RF_0$  according to classical mechanics. For these to be the relative velocity vectors of  $A$  with respect to  $B$ ,  $C$ , and  $D$  calculated in  $RF_0$ , the relative velocity vector of  $A$  with respect to  $RF_0$  must necessarily be the vector  $\vec{v}_{a0}$ , resulting from the vector composition of  $\vec{v}_{ab}$ ,  $\vec{v}_{ac}$ , and  $\vec{v}_{ad}$ , as illustrated on the left side of Figure 1. The uniqueness of the resultant vector  $\vec{v}_{a0}$  leads, among other issues, to the following three vectors problem:

All cosmic objects moving uniformly in the direction of  $\vec{v}_{ab}$  (and similarly for the directions of  $\vec{v}_{ac}$  and  $\vec{v}_{ad}$ ) must necessarily move at the same relative velocity  $\vec{v}_{ab}$  of  $A$  with respect to  $B$  as calculated in  $RF_0$ . Otherwise, object  $A$  would have to simultaneously follow different trajectories and velocities relative to  $RF_0$  (Figure 1, right).

In relativistic mechanics, it is also possible to calculate from  $RF_0$  the relative velocity vector of  $A$  with respect to  $RF_0$  and the relative velocity vectors of  $A$  with respect to  $B$ ,  $C$ , and  $D$ , though now using the nonlinear Lorentz transformation (instead of the classical linear Galilean transformation), which includes the  $\gamma$  factor for time dilation and the  $\gamma^{-1}$  factor for length contraction. For speeds far below the speed of light, both factors are practically 1 (e.g.,  $\gamma = 1.000000005$  for Earth's translational motion at 29.8 km/s), yielding results nearly identical to classical non-relativistic ones.

Clearly, the three-vector problem conflicts with everything we know about the observable universe and leads to an inevitable conclusion: in an inertial reference frame, only the relative motions of physical objects with respect to that frame can be considered; the relative motions of these objects among themselves result in the logical and physical inconsistencies posed by the three-vector problem. This conclusion can be formally stated as follows:

**Three-Vector Theorem.**—*Considering relative motion as the only real motion of real physical objects allows the deduction of kinematically impossible or inconsistent mechanical results.*

After all, absolute motion, though undetectable, might be the only real motion of real physical objects THROUGH the same real, absolute physical space.

### Opinion of ChatGPT o3-mini

The paper presents a very thought-provoking take on the foundations of kinematics. Its exploration of preinertia—the idea that objects inherit the motion of their sources—challenges the standard notion that only relative motions matter, by arguing that insisting solely on relative velocities leads to unavoidable inconsistencies, as encapsulated by the so-called three-vector problem. I find the discussion particularly interesting because it pushes us to reconsider whether absolute motion, though undetectable, might have a real, physical basis. The combination of classical mechanics with a nod to relativistic corrections (via the Lorentz transformation) is handled in a clear way, and the illustrative diagrams help ground the abstract concepts. However, the proposal is quite speculative, and its departure from widely accepted principles means that further experimental or theoretical support would be needed to cement these ideas in the broader context of physics. Overall, it's an engaging work that challenges conventional thinking and opens the door to a deeper inquiry into the nature of motion and space.

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### Bibliographical References

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