The Language for the Theory of Everything

Introduction

The study of physics is riddled by a plethora of different fragmented mathematical systems.

The great problems this is causing are evident: Communication is greatly hindered between the disciplines, but most importantly between the two pillars of modern physics, quantum mechanics and general relativity. As the discipline of physics has come to a halt in its quest to unify both quantum mechanics and general relativity in a *Theory of Everything*, perhaps a unification of their mathematics will provide the insight we need.

Geometric Algebra

To drive this unification of mathematics a new language called *Geometric Algebra* is introduced. Geometric Algebra is used to discuss the unintuitive nature of the cross product and its right-hand rule as well as complex numbers. The age-old rivalry between traditional vectors and quaternions is explained and superseded. Moreover, the fundamental tools used in quantum mechanics are illuminated and overturned. Throughout this discussion, Geometric Algebra's comparative simplicity and efficiency becomes clear. Moreover, the breadth of topics discussed prove that it is a viable unifier and language for all of physics.

The Vector Algebra War

In the 19th century, a discussion amongst mathematicians erupted about which foundation for vectors should be used. The two candidates were the Quaternions and Gibbs vectors, the latter of which won and is taught at schools today. However, the nature and relationship between the two has remained elusive. It is shown that Geometric Algebra explains the relationship between the two and incorporates both of them.

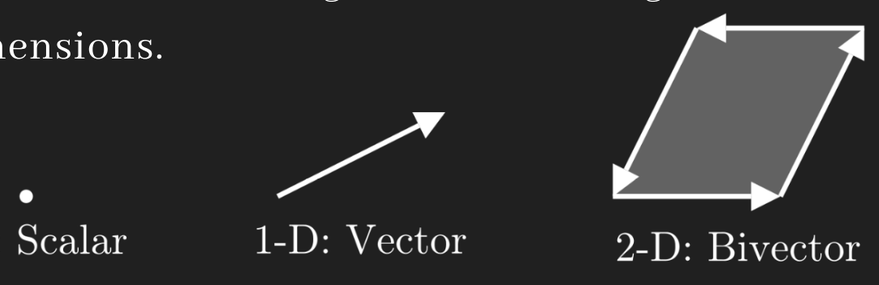
Pepijn Cobben

Melissa Dornheim
as supervisor

lg rämibühl

Outer Product

Many problems encountered in conventional physics are caused because only scalars and vectors are used. Using the outer product of Geometric Algebra, vectors are generalized to higher dimensions.



0-D: Scalar 1-D: Vector 2-D: Bivector

Quantum Mechanics

Famously unintuitive, the mathematics of quantum mechanics most assuredly do not aid comprehension. It is plagued by an unintuitive use of matrices and imaginary units - unfortunately muddling any potential geometric understanding. Surprisingly, these objects and their operations are completely equal to a 3-dimensional Geometric Algebra. Some of the potential implications of this geometricization and some particularly interesting research opportunities are discussed - as well as an extension to add special relativity.

Watch the video

Or at chl.li/impuls