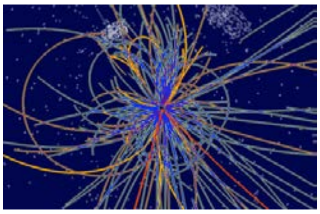

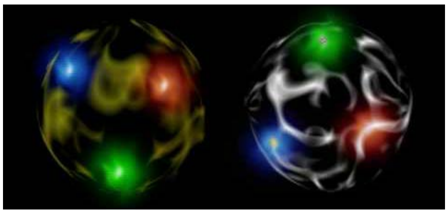

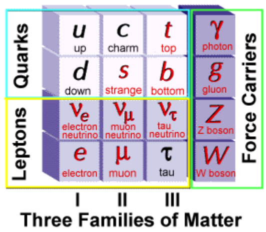

Workshop: Geometric Algebra and Calculus in the Standard Model of Particle Physics

Can geometric algebra (GA) and geometric calculus (GC) offer insights regarding the elementary particles and fields of the Standard Model (SM)? The purpose of this workshop is to examine the foundations of the SM as formulated in GA/GC and to find ways to better understand the physics of the SM and, possibly, physics beyond the SM.

Background: The SM is successful in describing the interactions of elementary fermions and bosons and in predicting the existence and properties of the recently discovered Higgs boson. Nevertheless, the SM has shortcomings indicating the need for new physical insight and theories, *e.g.*:

1. The model is based on nearly a score of parameters whose values are determined by experimental measurement rather than by theoretical understanding.
2. The quark sector of the SM is well described by SU(3) but lacks any reason why or any physical rationale for the fractional electric charge of quarks relative to the electron.
3. There is no explanation for the existence of three flavors (families or generations) of fermions or for the relative masses of the fermions.
4. The three flavors of neutrinos are assumed massless in the SM but are known by experiment to have non-zero (though small) masses.
5. The fields/particles of the SM make up only about 5% of the cosmological energy density in our universe. The SM offers few clues about dark matter (~25%) or dark energy (~70%).

As an initial application of GA/GC to the SM, David Hestenes wrote Maxwell's equations in terms of an electric/magnetic bivector field in space-time algebra (STA). Similarly, he formulated the Dirac equation in STA with the electron field expressed as an even-grade, geometric spinor not requiring imaginary numbers. Others have extended this work into many aspects of quantum mechanics and field theory.

Description: Contributions are invited on current work ranging from the basic principles of electrodynamics to advanced concepts in field theory, quantization, and supersymmetry.

What can GA/GC achieve in elementary particle physics that cannot already be done with gauge theory, Feynman path integrals, and the associated methods of the SM?

The weak interactions of elementary particles follow SU(2) symmetry. How can the formulation of the Maxwell and Dirac equations with GA/GC be extended to include weak interactions?

How can such work be extended to all of the fields of the SM?

Can we develop a much more streamlined formulation of the SM Lagrangian?

Is there a role to be played in the SM by the incorporation of extra spatial dimensions?

Can GA/GC improve our understanding of quantum mechanical entanglement?

What clues can GA/GC provide about the nature of dark matter and dark energy?

Other topics related to the SM are welcome.

Proceedings: We will follow the lead of the ICCA10 Conference Organizers on the process for publishing workshop contributions.

Registration: You can register for this workshop when you register online for ICCA10 at http://icca10.ut.ee/. Please provide a title and an abstract for your presentation in the space provided there. If you have already registered and wish to participate in this workshop, please contact the workshop organizer by email. You will be contacted to confirm that your contribution fits into the framework of the workshop. Deadline is June 22, 2014.

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