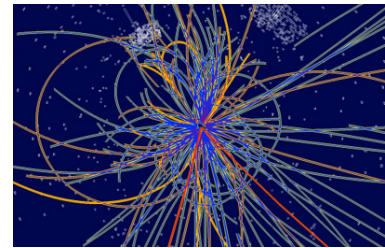




12th International Conference on Clifford Algebras and Their Applications in Mathematical Physics



Mini-symposium: Clifford Algebra and the Fundamental Forces of Nature 2

Dear Colleagues,

On behalf of the Scientific Committee of the 12th International Conference on Clifford Algebras and Their Applications in Mathematical Physics 2020 (ICCA12), we are pleased to invite you to visit Hefei (China) and to present some of your recent results.

We are organising a second mini-symposium on *Clifford Algebra and the Fundamental Forces of Nature (CAFFN2)* as a part of ICCA12, which will be held at University of Science and Technology of China, 3-7 August 2020.

■ **Background:** Clifford algebra, especially geometric algebra, and geometric calculus have been shown applicable to essentially all areas of physics and offer substantial advantages over conventional vector algebra and matrix formulations of physical problems, both in ease of solution and in improved physical insight. In his pioneering book, *Space-Time Algebra*, David Hestenes illustrated these assertions and set in motion detailed studies of both the Maxwell and Dirac equations using geometric algebra and geometric calculus. He wrote Maxwell's equations in terms of an electromagnetic 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. At this point, however, researchers have only scratched the surface in application to the Standard Model (SM) of particle physics and its gauge theory formulation.

Other progress has been made. In the 1990s, the Geometric Algebra Group at the University of Cambridge began using geometric algebra to reformulate the General Theory of Relativity into a gauge theory of gravity. This approach greatly facilitates the derivation of strong-field

gravitational effects and their physical interpretation. Gauge theory gravity (GTG) directly incorporates torsion and thus Dirac fields, and so points the way toward a unification of the fundamental forces of nature, given that all can now be formulated as gauge theories.

Scope and Topics: Topics of interest for this mini-symposium include applications of Clifford algebra and geometric calculus to the SM interactions (strong, electromagnetic and weak), to gravitation, and, especially, to combinations of these, either with respect to theoretical constructs or to the analysis of experimental data. Are there new approaches to second quantization? What fields might lead to dark matter or dark energy? What perspective is provided by GTG on the latest black hole imagery?

The predecessors of this mini-symposium were a workshop titled *Geometric Algebra and Calculus in the Standard Model of Particle Physics* held at ICCA10 in 2014 in Tartu, Estonia, and the first CAFFN mini-symposium at ICCA11 in 2017 in Ghent, Belgium. Several participants at the ICCA10 workshop suggested that gravitation be added to the scope, which proved successful at ICCA11.

We look forward to hearing your ideas for ICCA12.

■ **Registration** is via the official website of ICCA12 <http://www.smartchair.org/hp/ICCA2020/>. Please indicate during the registration process that your contribution is for the mini-symposium **CAFFN2**. Please submit the abstract (at most 1 page) for your talk following the instructions from the organisers of ICCA12, not later than June 4th 2020.

■ **Proceedings** of ICCA12, including this mini-symposium, will appear as a special issue of the journal *Adv. Appl. Clifford Algebras*, Springer-Birkhäuser. Manuscripts (max. 20 pages) will be subject to the usual refereeing process and are due Sunday, 6 December 2020.

If you have any questions, please contact us!

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