ICCA10

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10th International Conference on Clifford Algebras and their Applications in Mathematical Physics

Workshop

Conformal structures and conformal spin structures

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Presentation

According to a well-known happy thought of Albert Einstein, the theory of groups leads the theoretical physicist to a better understanding of the apparent confusion of things. The Galilean group governs classical mechanics. In special relativity, the first important group is the 10−dimensional inhomogeneous or extended Lorentz group, or Poincaré group, the semidirect product of the homogeneous Lorentz group by the group of the translations of the classical Minkowski space $E_{1,3}$. It is well known that the theory of special relativity was established by A. Einstein in 1905 on the basis of the formalism introduced by M. Faraday in his study of the electromagnetic field and of its fundamental laws and completed by J.C. Maxwell, about 1887, for its mathematical presentation. First, H. Bateman and E. Cunningham showed how the equations of the electromagnetic field are invariant not only for the Poincaré group but for a larger one : the conformal group $SO^+(2,4)$, which is the smallest semisimple group containing the Poincaré group and is the 15−dimensional maximal group of invariance of Maxwell equations. Elie Cartan himself studied the structure of $SO^+(2,4)$ and showed by an analysis of the roots that $SU(2,2)$ is a covering group. Many attempts have been made to build up a new theory of relativity, to construct a cosmology or to reveal classifications of elementary particles from a deep study of the conformal group. A very well known example is the twistor theory of Roger Penrose. The foundation stone of the twistor theory is the following mathematical fact : $Spin(2,4) \simeq SU(2,2)$ is a fourfold covering group of the connected component of the conformal group. More precisely, a twistor is simply a vector of the complex space $\mathbb{C}^4$provided with the standard pseudo-hermitian form of signature $(2,2)$ and the submanifold of the Grassmannian of complex planes of $\mathbb{C}^4$ constituted by totaly isotropic planes is identical to the conformal compactified space of $E_{1,3}$.

Now, it is known that mathematicians agree to call conformal group of a standard pseudo-Euclidean space $E_{p,q}$ provided with a quadratic form of signature (p,q), the projective group $PO(p+1,q+1)$.

Epistemologists will recognize that geometric algebras play an essential part in search of a try of unification of mathematics and moreover that conformal structures and conformal spin ones are foundation stones for the understanding of the universe.

We are pleased to invite all the colleagues, mathematicians, physicists and epistemologists studying conformal groups to participate in this workshop.

This is a non-exhaustive list of related topics :

Möbius geometry, standard classical conformal plane geometry, real projective quadrics, compactification of pseudo-Euclidean spaces, Lie geometry, real spin geometry and real conformal spin geometry, Cartan connections, Cartan conformal connections, Ehresmann connections, conformal Ehresmann connections, the theory of Yano,Vahlen matrices, twistor theory, conformal field theory, part played by conformal structures in the understanding of the universe,...

Registration : You can register for this workshop when you register online for ICCA10 at **http://icca10.ut.ee/.** Please **provide a title and an abstrac**t 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 e-mail. You will be contacted to confirm that your contribution fits into the framework of the workshop. Deadline is June 22, 2014.

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