

CU Physics Department Colloquium

Monday, March 28, 2011 4:10 PM 428 Pupin Hall

Space-Time, Quantum Mechanics and Scattering Amplitudes

Scattering amplitudes in gauge theories and gravity have extraordinary properties that are completely invisible in the textbook formulation of quantum field theory using Feynman diagrams. In this usual approach, space-time locality and quantum-mechanical unitarity are made manifest at the cost of introducing huge gauge redundancies in our description of physics. As a consequence, apart from the very simplest processes, Feynman diagram calculations are enormously complicated, while the final results turn out to be amazingly simple, exhibiting hidden infinite-dimensional symmetries. This strongly suggests the existence of a new formulation of quantum field theory where locality and unitarity are derived concepts, while other physical principles are made more manifest. The past few years have seen rapid advances towards uncovering this new picture, especially for the maximally supersymmetric gauge theory in four dimensions. These developments have interwoven and exposed connections between a remarkable collection of ideas from string theory, twistor theory and integrable systems, as well as a number of new mathematical structures in algebraic geometry. In this talk I will review the current state of this subject and describe a number of ongoing directions of research.



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Hosted by Alberto Nicolis