Structures in Local Quantum Field Theories

Les Houches

June 04-15 2018

In recent years we have seen many new insights into the mathematical structure of renormalizable quantum field theories. Such theories still form the core of theoretical physics underwritten either by their ability to predict the outcome of physics experiments, or by their hidden simplicity when augmented by sufficient supersmmetry, which allows them to be recasted often in the framework of integrable models.

Progress is made on various fronts: through understanding the mathematical structure of renormalization and the renormalization group, through an understanding of the algebro-geometric and number-theoretic prop- erties of amplitudes, through the connection of gauge and gravity amplitudes to tropical geometry and geometric group theory, through advances in understanding non-perturbative physics through Dyson Schwinger equations, through the definition of integrable as well as non-commutative field models which allow for all orders results.

One focus of the workshop will be to understand how the structure of a non-conformal and non super-symmetric gauge theory connects to free or conformal integrable models.

Another focus will be on the relation the analytic structure of amplitudes and the combinatorics of graph complexes and the structure of *Outer Space* as studied by Vogtmann and collaborators.

To illuminate such questions we are organizing a two-week workshop and summer school in Les Houches. Similar workshops were successfully held in 2010 and 2014.

As speakers we expect experts in all these developments: Francis Brown (Oxford), Spencer Bloch (Chicago), Lance Dixon (Stanford), James Drummond (Southampton), John Gracey (Liverpool), Ralph Kaufmann (Purdue), Dirk Kreimer (Berlin), Lorenzo Magnea (Torino), Vasily Pestun (IHES), Walter van Suijlekom (Ni- jmegen), Karen Vogtmann (Warwick), Raimar Wulkenhaar (Muenster), Karen Yeats (Waterloo) amongst others. In addition, motivated by our experiences last time, we will include a young speakers symposium.