

# Web diagrams: a combinatorial construct combining graphs and permutations

Mark Dukes  
UCD

**Abstract:** In this talk I will present and discuss different aspects of a new combinatorial structure that we have termed a “web diagram”. These structures were introduced in a series of recent papers and the motivation comes from particle physics where the diagrams arise as particular types of Feynman diagrams describing scattering amplitudes in non-Abelian gauge theories. A web diagram is a generalization of a graph in that it is built on an underlying simple graph. Instead of ordinary vertices the diagrams have pegs, and edges incident to a peg have different heights on that peg.

The “web world” of a web diagram is the set of all web diagrams that result from permuting the order in which endpoints of edges appear on a peg. To every web world there is the web-colouring matrix. The rows and columns of this matrix are indexed by the constituent web diagrams and the entries are generating functions detailing the colourings that can transform the row diagram into the column diagram. While the original reason for studying these comes from physics, there are many interesting combinatorial questions to be answered.