# LMS Computer Science Colloquium – speakers, titles and abstracts

**Christian Konrad (University of Bristol)**
***Streaming Algorithms, Communication Complexity, and the Maximum Matching Problem***

This talk explores the connections between Streaming Algorithms and Communication Complexity, using the Maximum Matching problem as a key example.

Streaming algorithms for graph problems process sequences of edge insertions and deletions that make up a graph while using a memory that is much smaller than the graph itself. Communication Complexity examines the number of bits that multiple parties must exchange to solve a given problem. These two fields are closely linked, as lower bounds in communication complexity imply lower bounds on the space requirements of streaming algorithms. In this talk, we will delve into this connection through the lens of the Maximum Matching problem, tracing how this relationship has been leveraged from the earliest works on streaming algorithms for matchings in 2004 to the present.

**Peter Kiss (University of Warwick)**
***$(1+\epsilon)$-Approximate Sub-Linear and Dynamic Matching***

We show a fully dynamic algorithm for maintaining $(1+\epsilon)$-approximate size of maximum matching of the graph with $n$ vertices and $m$ edges using $m^{0.5-\Omega_{\epsilon}(1)}$ update time. This is the first polynomial improvement over the long-standing $O(n)$ update time, which can be trivially obtained by periodic recomputation. Thus, we resolve the value version of a major open question of the dynamic graph algorithms literature.

Our key technical component is the first sublinear algorithm for $(1,\epsilon n)$-approximate maximum matching with sublinear running time on dense graphs.

All previous algorithms suffered a multiplicative approximation factor of at least $1.499$ or assumed that the graph has a very small maximum degree.

**Peter Davies-Peck (University of Durham)**
***The Distributed Lovász Local Lemma***

The Lovász Local Lemma (LLL) is a fundamental result in probability theory, used to prove the existence of mathematical objects via the probabilistic method, with applications in many areas including routing and scheduling, hash functions, and integer programming. Relatively recently, the LLL has also been shown to have a central role in the complexity theory of distributed algorithms, in which in problems must be solved collaboratively by processors represented as nodes in a communication graph. Distributed algorithms for the constructive LLL can act as meta-algorithms to solve a range of other distributed graph problems.

In this talk, we will survey the background of the distributed LLL, and discuss some recent advances in distributed LLL algorithms and their implications.

**Sagnik Mukhopadhyay (University of Birmingham)**
***Unified Algorithm Design in Modern Computational Models***

I will discuss recent advances in the design of cross-paradigm algorithms, which are algorithms that can be implemented across various computational models in a black-box manner. Modern computational models are tailored to manage large input data while optimising different complexity measures. Classical algorithms, designed for traditional models, often fail to perform well across these varied criteria. Although significant strides have been made in developing algorithms specific to individual computational models in the last few decades, these solutions are highly model-dependent and lack generality. In this talk, I will explore the possibility of creating a unified design approach, eliminating the need to develop separate algorithms for each computational model.