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How does the chromatic number of a random graph vary?

How much does the chromatic number of the random graph $G(n, \frac{1}{2})$ vary? Shamir and Spencer proved that it is contained in some sequence of intervals of length about $n^{1/2}$. Alon improved this slightly to $\frac{n^{1/2}}{\log n}$. Until recently, however, no lower bounds whatsoever on the fluctuations of the chromatic number of $G(n, \frac{1}{2})$ were known, even though the question was raised by Bollobás many years ago. I will talk about the main ideas needed to prove that, at least for infinitely many n, the chromatic number of $G(n, \frac{1}{2})$ is not concentrated on fewer than $n^{1/2-o(1)}$ consecutive values.

I will also discuss the Zigzag Conjecture, made recently by Bollobás, Heckel, Morris, Panagiotou, Riordan and Smith: this proposes that the correct concentration interval length 'zigzags' between $n^{1/4+o(1)}$ and $n^{1/2+o(1)}$, depending on n.

Joint work with Oliver Riordan.