Nick Wormald: *Properties of graphs of large girth*

It has long been known that there is a simple procedure for converting deterministic results about graphs of large girth, of appropriate type, into results on random regular graphs. (The girth is the length of the shortest cycle.) One aim of this talk is to show that this procedure is to some extent reversible. Another aim is to present old and new bounds on the size of the largest independent set and smallest dominating set in regular graphs of given degree and large girth. For independent sets, these results easily extend to graphs with given maximum degree and large girth. The proof of the new results involves the "probabilistic method" in an unlikely-sounding way. This achieves the reversibility mentioned above. We find typical properties of random structures in a large set C, and then show separately that the properties "transfer" to all structures in C. Naturally, such an optimistic method can only work under special circumstances. In this case, the proof is strongly related to applications of the differential equation method for random regular graphs.