Joint Mathematics Colloquium ICMAT-UAM-UC3M-UCM

Miraculous Integer Sequences

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We learn in school many interesting integer sequences and their significance. In this Colloquium, I will survey two such sequences, and explain their unexpected miracles.

The first one is the Catalan numbers. I will explain how this integer sequence leads us to two differential equations, their mirror-symmetric relations, and the quantization behind the scenes. We present Lauren polynomials that give solutions to these equations.

The miracle here is that these Laurent polynomials know the topological invariants of the moduli space of pointed Riemann surfaces, calculated by Harer-Zagier, Witten, and Kontsevich.

The second example is analogous to the first one in the sense that it is an integer sequence of genus 0 Gromov-Witten invariants of a particular algebraic 3-fold. We have again two differential equations. The contrast is that although we know mirror symmetric and quantization relation between these equations, the key mechanism to calculate general GW invariants is still missing. The miracle here is that this particular integer sequence knows why Riemann zeta at 3 is irrational, the work of Apery.

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