A MATHEMATICAL JOURNEY THROUGH SCALES

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The tiny world of particles and atoms and the gigantic world of the entire universe are separated by about forty orders of magnitude. As we move from one to the other, the laws of nature can behave in drastically different ways, sometimes obeying quantum physics, general relativity, or Newtons classical mechanics, not to mention other intermediate theories. Understanding the transformations that take place from one scale to another is one of the great classical questions in mathematics and theoretical physics, one that still hasn't been fully resolved. In this lecture, we will explore how these questions still inform and motivate interesting problems in probability theory and why so-called toy models, despite their superficially playful character, can sometimes lead to certain quantitative predictions.

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