A Closer Look at the Fine Structure of the Random Walk on \((0, 1)\)

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Let \(S_n\) be the random walk on \((0, 1)\). The \(S_n\) have been the subject of intense study; their definition is immediately intuitive. Nevertheless, they are quite disorderly and this disorder is mirrored by the fact that, pointwise, \(\left( \frac{S_n}{\sqrt{n}} \right)_{n \in \mathbb{N}^+}\) behaves quite badly. In this talk we provide our results on the fine structure of the random walk that give insight into the disorderly behavior of the \(S_n\). We will define the notion of extreme sequences in this context, and provide a complete analysis of the levels at which certain sequences first become extreme. It turns out that much of the fine structure of the random walk on \((0, 1)\) depends on how often the sequence \(\{\lfloor k \sqrt{n} \rfloor\}_{n=1}^{\infty}\) increases and the way the fractional part of \(k \sqrt{n}\) is distributed, for a fixed positive integer \(k\). This work lays the groundwork for further developments where \(k\) is a function of \(n\).

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