First Passage Processes for the Two Paradigmatic Models of Anomalous Diffusion

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The problems of the first passage across a boundary are the corner stones of the theories of random walks and consequently, of modern statistical physics; they also have a great variety of applications. Anomalous diffusion refers to processes where the mean square displacement does not grow linearly in time, but instead exhibits non-linear behavior with the exponent larger or smaller than unity, thus giving rise to super- or subdiffusion, respectively. Anomalous diffusion phenomena have recently been observed in a wide variety of complex systems. In the talk we dwell on the first passage processes for the two paradigmatic models of anomalous diffusion. The first model is the Lévy flight process, that is the Markovian process with independent increments distributed with the heavy-tailed non-Gaussian Lévy stable probability law. The second model is the fractional Brownian motion that is non-Markovian Gaussian process whose increments are strongly correlated. We discuss the first passage processes for the semi-infinite domain and for the truncated harmonic potential well. The physical examples coming from stochastic climate dynamics and kinetics of proteins motivated our studies.