This dissertation embodies the work done by the author in Manchester during the academic years 1949-51 on the applications of the theory of stochastic processes to physical problems. The work has been stimulated mainly by the so-called fluctuation problem relating to the cascade theory of cosmic ray showers. The author started this work in collaboration with Professor H.J. Bhabha at the Tata Institute of Fundamental Research, Bombay, and a short account of their joint work has been given in Appendices I and II not only for the sake of completeness but also to illustrate the scope of the problems that arise in a comprehensive statistical treatment of phenomena in physics.

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