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Introduction

The theory of reaction rates has engaged the attention of investigators in many fields since the pioneering research of Smoluchowski in the early twentieth century. By now there are a profusion of models that bear on phenomena in many areas in the physical sciences. The original Smoluchowski model has been reexamined from many points of view, but its limitations are only now beginning to be understood. First passage time models for reaction rates have been of interest for at least 30 years, but many exciting results in this area have been produced only within the last five years using the tools provided by singular perturbation theory. Great strides are being made in the generalization of Kramer's analysis of reaction rates viewed as a process in phase space. In company with the theoretical progress in understanding and generalizing both classical and more recent models, new instrumental techniques have enabled chemists to measure rates at increasingly shorter time scales. Because of the enormous progress in this area it seemed fitting to hold a meeting to summarize progress in this field of research as well as to provide introductory material for those interested in any of the various subareas. Such a meeting was held from May 6–8, 1985, at the National Institutes of Health, Bethesday, Maryland, organized by George H. Weiss and Attila Szabo of NIH. The proceedings of the meeting contains some material of a pedagogic nature in accordance with our feeling that speakers should try to do more than simply summarize a narrow research area.

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PROGRAM

1. Overview of the theory of first passage times and bimolecular diffusion-influenced reactions. *Attila Szabo*, National Institutes of Health.
2. Introduction to trapping problems. *Robert Zwanzig*, University of Maryland.

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3. Concentration effects in diffusion-controlled reactions. *Donald Calef*, Lawrence Livermore Laboratory.

4. Macroscopic aspects of diffusion-controlled reactions. *Robert Cukier*, Michigan State University.

5. Rate processes on fractals: theory, simulation, and experiments. *Raoul Kopelman*, University of Michigan.

6. A singular perturbation approach to first passage problems. *Bernard Matkowsky*, Northwestern University.

7. First passage times in engineering. *Bruce West*, La Jolla Institute. *Katja Lindenberg*, University of California—San Diego.

8. Noise activated escape from a metastable state. *Peter Hänggi*, Polytechnic Institute of New York.

9. Dynamics of elementary reactions in liquids: Breakdown in transition rate theory. *David Chandler*, University of Pennsylvania.

10. New concepts in condensed phase chemical kinetics with applications. *Steven Adelman*, Purdue University.

11. Along the reaction coordinate in solution. *James Hynes*, University of Colorado.

12. Activated barrier crossing processes in solution. *Graham Fleming*, University of Chicago.

13. Dielectric relaxation, a rate process picture. *John Bendler*, General Electric Corporate Research and Development and *Michael Shlesinger*, Office of Naval Research.

14. Activated rate processes in the presence of external periodic forces. *Benny Carmeli*, University of Pennsylvania.

15. Dissipative quantum tunneling and quantum coherence. *H. Grabert*, University of Stuttgart.

16. Reactions in disordered systems (continuous time random walks and fractals). *Joseph Klafter*, Exxon Research and Development.

17. Reptation as a first passage time process. *Michael Shlesinger*, Office of Naval Research.

18. First passage time problems for non-Markovian processes. *Peter Talkner*, Universität Basel.

19. Distinct number of sites visited by *n* random walkers. *David Torney*, Los Alamos National Laboratory.

20. Multidimensional WKB calculation of first passage times. *X. W. Wang* and *K. L. Lin*, State University of New York at Buffalo.