

XVIII. PHOTON CORRELATION SPECTROSCOPY AND APPLICATIONS

Academic Research Staff

Prof. S.-H. Chen

Graduate Students

H. Aljuwair
D. Bendedouch

K. Touqan
P. Wang

1. RESEARCH PROGRAM

National Science Foundation (Grant PCM78-15844)

Sow-Hsin Chen

A high-resolution spectroscopic technique based on scattered light intensity fluctuation measurement has been in use for some time. Our method is a variation of the digital time-domain pulse correlation technique using a 256-channel clipped correlator developed in the laboratory. The correlator-multichannel memory system is controlled by a PDP 11/MINC computer system which is capable of high-speed data acquisition and analysis necessary for the study of time-varying phenomena.

We have developed theoretical methods to calculate quasi-elastic light-scattering spectra from cells undergoing Brownian motions or self-propelled motions in liquid media. The methods have been successfully tested with a model bacterium *Escherichia Coli*, and applicability of the model calculation to cells of dimensions of the order of a micron has been ascertained. The photon correlation technique will be further developed to incorporate a flow method which permits us to study time-dependent phenomena with a temporal resolution greater than the time taken for the accumulation of the correlation function. The combined theoretical and experimental progress now enables us to perform the following three categories of experiments:

- a. Motility characteristics of bacteria in response to external stimuli such as light;
 - b. Study of traveling-band formation of bacteria as a result of chemotaxis;
- and

(XVIII. PHOTON CORRELATION SPECTROSCOPY AND APPLICATIONS)

c. Study of conformational change in globular protein induced by disruption of hydrophobic interactions.

Publications

- Holz, M. and S.-H. Chen, "Structural Effects in Quasi-Elastic Light Scattering from Motile Bacteria of E. Coli," Appl. Opt. 17, 1930 (1978).
- Holz, M. and S.-H. Chen, "Rotational-Translational Models for Interpretation of Quasi-Elastic Light Scattering Spectra of Motile Bacteria," Appl. Opt. 17, 3197 (1978).
- Holz, M. and S.-H. Chen, "Quasi-Elastic Light Scattering from Migrating Chemotactic Bands of E. Coli," Biophys. J. 23, 15 (1978).
- Holz, M. and S.-H. Chen, "Tracking Bacterial Movements Using One-Dimensional Fringe System," Opt. Lett. 2, 109 (1978).
- Holz, M. and S.-H. Chen, "Spatio-Temporal Structure of Migrating Chemotactic Bands of E. Coli - I. Traveling Band Profile," Biophys. J. 26, 243 (1979).
- Kotlarchyk, M., S.-H. Chen, and S. Asano, "Accuracy of Rayleigh-Gans-Debye Approximation for Computing Light Scattering Properties of Diffusing and Motile Bacteria," Appl. Opt. 18, 2470 (1979).
- Yangos, J. and S.-H. Chen, "A Simple Low-Cost Digital Events Analyser," Rev. Sci. Inst. 51, 344 (1980).
- Wang, P. and S.-H. Chen, "Quasi-Elastic Light Scattering from Migrating Chemotactic Bands of Escherichia Coli - II. Analysis of Anisotropic Bacterial Motions," to be published in Biophys. J.