APS Colloquium

Distinguished scientists in all disciplines are invited to lecture on topics of general interest. Objectives include the cross-fertilization of research initiatives at various institutions and the identification of possible uses of the Advanced Photon Source.

When: First Wednesday of each month at 3:00 p.m.
Where: Building 402, APS Auditorium
Refreshments served at 2:45 p.m.

Wednesday, April 7, 2004

André Authier
Université Pierre et Marie Curie, Paris

"The major steps in the development of the dynamical theory of X-ray diffraction: from the early days to modern times"

Biography:

André Authier is Professor Emeritus, University Pierre et Marie Curie, Paris. He graduated from Ecole Normale Supérieure in 1955 and was a Visiting Fellow at MIT in 1955-1956. From 1972 to 1983 he was Director of the Laboratoire de Minéralogie-Cristallographie in Paris. His scientific interests are dynamical diffraction, characterization of materials by X-ray topography and crystal growth. He was President of the European Crystallographic Association (1972-1975) and of the International Union of Crystallography (1990-1993). He is a member of Academia Leopoldina (Germany) and is the author of a book on the dynamical theory of diffraction (2001, 2nd ed. 2003).

Abstract:

The dynamical diffraction theory is used to describe the diffraction by perfect or nearly perfect crystals used in high-technology applications or in synchrotron radiation optical elements, in contrast to the approximate kinematical theory used for structure determinations or powder analysis. Its basic concept is that of wave fields, introduced by Ewald in 1913, and rediscovered by Bloch in 1928. Their physical existence is proved by anomalous absorption, Pendellösung, double refraction and ray tracing. Originally developed for plane waves and perfect crystals, the dynamical theory was extended to spherical waves and to slightly and heavily deformed materials. Its major applications include characterization and recovery of the strain distribution of deformed materials, imaging of crystal defects using X-ray topography, X-ray interferometry and nanometrology, analysis of surfaces and interfaces using standing waves and glancing angle diffraction, determination of triplet phases using *n*-beam diffraction, and X-ray optics for synchrotron radiation. The most recent development concerns time-dependent dynamical diffraction, with application to the diffraction of femto-second pulses from fourth-generation synchrotrons.