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Elements of Neutron Specular Reflection Phase-Inversion. N.F. Berk, NIST Center For Neutron Research, 100 Bureau Dr., Gaithersburg, MD 20899-8562.

Neutron specular reflection probes the laterally averaged scattering length density (SLD) depth profile of thin films. The power of the technique stems in part from its underlying mathematical coherence. Because specular reflection can be cast formally as a one-dimensional wave mechanics problem, it admits to exact solutions of both the “direct” problem of calculating the reflection amplitude spectrum from any SLD profile, and of the “inverse” problem of retrieving the SLD profile from the amplitude spectrum. The formalities establish a one-to-one correspondence between the amplitude spectrum and the profile (for a broad and useful class of SLD profiles), thus enabling reliable interpretations of neutron measurements. What is needed to complete the direct-to-inverse cycle are the means of determining the complex reflection amplitude from measurements of its square modulus, the reflectivity. Reference-layer methods have been developed to solve this “phase” problem exactly for neutrons, thus making “phase-inversion” a realistic measurement technique. In this talk we summarize the basic formal and practical elements of phase-inversion.