Argonne NATIONAL LABORATORY

PHY Seminar

Physics Division Seminar

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The Dispersive Optical Model as a Tool to Provide a Consistent Description of Nuclear Reactions

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The dispersive optical model (DOM), originally conceived by Claude Mahaux, provides a unified description of both elastic nucleon scattering and structure information related to single-particle properties below the Fermi energy. Extensions of this framework developed in St. Louis, have introduced a fully nonlocal implementation for ^{40}Ca, ^{48}Ca, and ^{208}Pb. For the first time properties below the Fermi energy like the charge density and the presence of high-momentum nucleons can be included in the DOM while elastic cross section data continue be represented as accurately as in the local DOM implementation. Application of the nonlocal DOM to ^{48}Ca generates a prediction for the neutron skin of 0.249 ± 0.023 fm for this nucleus, which is larger than most mean-field and available ab initio results. The DOM provides critical ingredients for the description of important nuclear reactions. Application to the (e,e'p) reaction provides an assessment of the validity of the distorted-wave impulse approximation used to describe Nikhef data. Improved descriptions of transfer reactions like (d,p) and (p,d) are also discussed while identifying a strategy to raise the standard of the treatment of the deuteron.