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ABSTRACT

Statistical nuclear properties from inelastic neutron scatter using the GENESIS array

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The Gamma-Energy Neutron-Energy Spectrometer for Inelastic Scattering (GENESIS), has been built and commissioned at Lawrence Berkeley National Laboratory's 88-Inch Cyclotron. The detector array consists of 26 EJ-309 organic scintillators with neutron-gamma pulse shape discrimination, a LaBr3 inorganic gamma-ray scintillator, two Ortec "pop-top" high-purity germanium (HPGe) gamma-ray detectors, and two Compton-suppressed, segmented Eurosys Clover HPGe detectors. Neutrons are produced via thick target deuteron breakup on carbon or beryllium targets in an adjacent vault, then collimated into a narrow beam of 10^5 n/cm2/s onto 10-40 gram targets 7 meters from the source. The high-energy end point of this broad neutron spectrum is tunable by selection of the deuteron energy, generally between 14-23 MeV but as high as 55 MeV. Active neutron spectrum monitoring is measured behind the array with a scattered-neutron time-of-flight system. Unlike many charged-particle reactions and decay mechanisms, inelastic neutron scatter populates a broad range of spins, making it a unique probe for non-selective nuclear level excitation. While the primary purpose of the GENESIS array is to measure inelastic neutron cross sections, observation of evaporation neutrons as a function of angle allows the measurement of statistical properties such as nuclear temperature.

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