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[ ] Theory [x] Experiment

New Approaches to Neutron Diagnostics of Tokamak and ICF Plasmas,* R.K. Fisher *General Atomics* —Neutron spectroscopy using proton recoil tracks in nuclear emulsions looks promising for two difficult tasks: a) measurements of alpha knock-on tails in tokamaks, and b) measurements of down-scattered neutrons and ρR in ICF target plasmas. Thin emulsions are installed with one edge facing the plasma, and proton tracks are produced throughout the plane of the emulsion. Alternatively, a CH_2 foil is used to create the recoil protons that strike the emulsions. The length of a recoil proton track is ~1000 μm at 14 MeV and increases by ~140 μm per MeV. Range-energy straggling will be <1.5%. Electrons from the gamma and x-ray interactions cannot produce long tracks. Possible approaches to measuring the neutron emission profiles from a tokamak without the massive collimation and shielding required in conventional neutron profile monitors are also discussed. The directions of the longest recoil tracks in edge-on emulsions can be used to determine the incident neutron directions to within ~10 to 15 degrees, as demonstrated in 1988 experiments on PLT. An alternative approach would employ neutron detectors whose detection efficiency falls rapidly below the neutron energy of interest, significantly reducing the required collimator thickness and discriminating against backscattered neutrons.

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