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Neutron Spectrometry Using CR-39 Track Etch Detectors

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We have measured track size distributions for etched CR-39 foils exposed to monoenergetic neutrons with energies from 0.144 to 19 MeV. The observed tracks are due to energetic protons, carbon and oxygen ions resulting from interactions with the neutrons. After etching the tracks are visible with an optical microscope and vary in size and configuration ranging from circular to elliptical to teardrop shaped depending on the particle, energy and angle of incidence. We have analyzed the foils using an automatic analysis system that scans the foils, identifies valid tracks and records the (x,y) position and the lengths of the long axis and minor axis of the track. For each foil we have obtained track size distributions consisting of the number of tracks observed versus the long axis or the minor axis of the tracks. We find that these distributions are quantitatively distinct as a function of neutron energy. We have also measured distributions due to fission spectrum neutrons emitted by ²³⁸Pu and find that these are readily distinguishable from background spectra.