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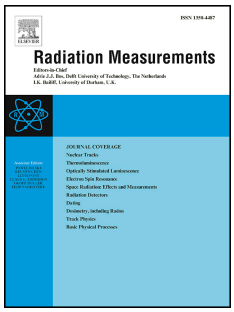

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Alpha Radiation Dosimetry using Fluorescent Nuclear Track Detectors

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ABSTRACT

To answer the need for better tools for alpha radiation radiobiology and microdosimetry research, a novel irradiation setup based on a honeycomb collimator, in combination with Fluorescent Nuclear Track Detectors (FNTD) for alpha radiation dosimetry and spectroscopy, was introduced. FNTDs are a novel type of small, crystalline detector that can visualize individual alpha particles and simultaneously measure their location, velocity direction and energy with good accuracy. The performance of FNTDs for alpha radiation dosimetry was evaluated for the first time and the results were compared to extrapolation chamber measurements and simulations. The surface dose rate to water of the irradiation setup for two different honeycomb collimators, measured using FNTDs, agreed with the extrapolation chamber measurements within 6%. The simulations underestimated the surface dose rate to water for the first collimator and overestimated the dose for the second collimator, indicating the sensitivity to manufacturing errors in the collimators of this irradiation setup. The dose homogeneity in the setup was measured using radiochromic film and showed variations of less than 5%, making this setup, in combination with the rich information obtained regarding the spatial, angular and energy distributions of the alpha particles, obtained using the FNTDs, ideal for microdosimetry and radiobiology experiments. The accuracy and ease-of-use of FNTDs in addition to the surface or absorbed dose and