

Spatially resolved nuclear spin relaxation, electron spin relaxation and light absorption in swift heavy ion irradiated LiF crystals

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Spatially resolved ^{19}F and ^7Li spin–lattice relaxation rates are measured for LiF single crystals after irradiation with two kinds of swift heavy ions (^{12}C of 133 MeV and ^{208}Pb of 1.78 GeV incident energy). Like in earlier studies on ^{130}Xe and ^{238}U irradiated LiF crystals, we found a strong enhancement of the nuclear spin–lattice relaxation rate within the ion penetration depth and a slight—but still significant—enhancement beyond. By evaluating the nuclear relaxation rate enhancement within the ion range after irradiation with different projectiles, a universal relationship between the spin–lattice relaxation rate and the dose is deduced. The results of accompanying X-band electron paramagnetic resonance relaxation measurements and optical absorption spectroscopy are included in a physical interpretation of this relationship. Also the reason for the enhanced relaxation rate beyond the ion range is further discussed.