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Effect of ion velocity on the creation of point defects halos of latent tracks in alkali-halides

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Parameters of the point defects halos (F-color centers) created in the nanometric vicinities of the trajectories of gold ions of 275 MeV and 2187 MeV in LiF were estimated from absorption spectroscopy experiments. Decelerations of these ions are characterized by the approximately the same electronic stopping: 24.6 and 22.9 keV/nm, respectively. In contrast to the usual concept of the velocity effect that slower ion produces larger structure changes due to the higher deposited energy density, the opposite effect seems to occur for the defect halo revealing larger radii and larger defect concentration at higher ion velocity for the same electronic energy losses. Color centers in alkali-halides appear via decay of self-trapped excitons forming due to self-trapping of valence holes. Therefore, peculiarities of spatial spreading of valence holes generated in the ionization cascades before their self-trapping results finally in a difference between the parameters of the defect halos detected in LiF crystals irradiated with different ions. But the results of application of Monte-Carlo code (TREKIS) show no significant difference in the radial distributions of valence holes in the vicinities of the ion trajectories of the slower and faster ions already at 10-50 fs after the projectile passage. Three mechanisms affecting the kinetics of valence holes, so far were not included into the current version of MC-code TREKIS, are analyzed: (i) lattice excitations during relaxation of the electronic subsystem, (ii) changes in the interatomic potential caused by intensive electronic excitations, and (iii) transient electromagnetic fields created by charge non-neutrality. The third one seems to be dominant.

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