FAST HEATING OF SWIFT HEAVY ION TRACKS BY NONTHERMAL ACCELERATION OF ATOMS

N.A.Medvedev,1,2), A.E. Volkov 3,\*)

1) Institute of Physics, Prague, Czech Republic

2) Institute of Plasma Physics, Prague, Czech Republic

3) NRC Kurchatov Institute, Moscow, Russia

\*) e-mail: a.e.volkov@list.ru

Atomic heating in tracks swift heavy ions decelerated in the electronic stopping regime has to occur within a time of electronic cooling there, i.e. ~100 fs. This implies a necessity of an extremely fast electron-atomic lattice energy exchange (“electron-phonon coupling”) for the production of damaged ion tracks. In contrast, laser-irradiation experiments and calculations show too slow electron-phonon energy exchange to cause structural changes detected in swift heavy ion tracks in solids. We demonstrate /1/ that this contradiction can be resolved by taking into account that electron-phonon coupling is not the sole mechanism of energy exchange between electrons and ions in condensed matter. Excitation of the electronic system alters the potential energy surface of atoms, causing them to accelerate and increase their kinetic energy at ultrashort times.

REFERENCES

1. N.Medvedev, A.E.Volkov // J. Appl. Phys., 2022, 131, 225903.