Exploring effects of the swift heavy ion beam charge state on the ion track production in graphene

K. Tomić[1], D. Iveković[1], H. Vázquez[2], F. Djurabekova[2], A. Gajović[1], P. Dubček[1], Z. Siketić[1], M. Jakšić[1], M. Karlušić[1,*]

1 Ruđer Bošković Institute, Bijenička 54, 10000 Zagreb, Croatia

2 Department of Physics, University of Helsinki, P.O. Box 43, 00014, Helsinki, Finland

* Corresponding author: marko.karlusic@irb.hr

Swift heavy ion impact induced intense electronic excitations can trigger dramatic changes like phase transitions or large scale defects formation along ion trajectory when passing through the material. Dimensions of thus produced ion tracks depend on the deposited energy density that is usually expressed in terms of energy loss (electronic stopping) of the swift heavy ion. In case of graphene and related 2D materials, that have attracted considerable attention over the last years, other factors can contribute to ion track production after swift heavy ion impact.

In the present contribution, we present experimental results obtained in a recent experiment at Zagreb accelerator facility, when Raman spectroscopy and atomic force microscopy have been used for the analysis, showing the damage in graphene can depend strongly on the charge state of the swift heavy ion. Observed additional damage can be attributed to the increased energy loss of the swift heavy ion due to the charge state increase. Molecular dynamics simulations have complemented these experimental results in order to investigate role of the substrate on damage production in graphene.