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Early Stage of Target Fragmentation Induced by Light Nuclei at E_{LAB} ~ 2A GEV

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Abstract: *Forward–backward grey particle productions following 2.1A GeV ^{4}He and 2.2A GeV ^{7}Li interactions with emulsion nuclei are investigated. The grey particle multiplicity characteristics are found to be dependent only on the target size where the projectile size and energy are not effective. The validity of the nuclear limiting fragmentation hypothesis is examined with respect to the projectile size and energy. The characteristic shape of the forward and backward emitted grey particle multiplicity distributions is decay curves. These distributions are approximated by an exponential decay law. The fit parameters characterizing this law decrease with the target size. The production probabilities and the average multiplicities increase linearly with the target size. The defined asymmetry parameter and anisotropy ratio between the forward and backward production systems, ~ 0.5 and 3 respectively, are constant irrespective of the system size. According to the kinematics of the target rest frame in the framework of the fireball model, the recoiled target nucleon is suggested to be emitted in the forward hemisphere as a result of the binary nucleon–nucleon collisions or intranuclear cascading. The results show that the forward emitted grey particle is three times the backward emitted one. Hence, the main grey particle production source is the intranuclear cascading. Although the emission in the backward hemisphere, beyond the kinematic limits, is suggested to result from a different source, however a scaling feature is observed between the multiplicity characteristics of the two emission systems. This scaling is assessed. On the basis of the nuclear limiting fragmentation validity and the assessed scaling between the two emission systems in the 4– •space, the grey particle multiplicity characteristics can be determined in a universal law.*

Keywords: *^{4}He and ^{7}Li as Light Projectiles / Grey Particle Multiplicity in Terms of System Size and Emission Direction / Nuclear Limiting Fragmentation in A Few A GeV Energy Region / Scaling Indications between The Forward and Backward Emission Systems.*