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On galaxies as accelerators of cosmic rays

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One of the hypotheses about nature of ultra-high energetic tails of cosmic ray (CR) spectrum assumes extragalactic origin. Intergalactic CRs includes particles both emitted and reflected by galaxies. The particles entering and leaving galaxies undergo additional acceleration depending on the time spent there. One can assume, that such particles participate, at least partially, in forming the energy spectrum in the ankle region. To estimate characteristics of this process, we consider a simple version, when a charged particle falls on a plane layer of ISM and is reflected from it. As is known, the diffusion approximation fails to get the time and path distributions, so we apply more proper tools for calculations. The time distribution is obtained via the analytical solution of the linearized Boltzmann equation [1], and the acceleration process is calculated by solving the integral reacceleration equation [2]. In addition, our analysis takes a fractal (turbulent) properties of ISM into account in frame of the nonlocal CR transport theory [3]. Results of numerical calculations show that the hypothesized effect really exists, but very sensitive to parameters of turbulent heterogeneity.

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2. Wandel A., Eichler D., Letaw J. R., Silberberg R., Tsao, C. H. (1987) *The Astrophysical Journal*, 316, 676-690.
3. Uchaikin V. V. (2015) *Journal of Applied Mathematics and Physics*, 3(02), 181-194.

Collaboration

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