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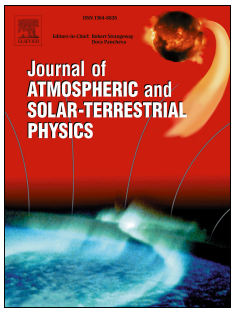


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# Surfatron acceleration of weakly relativistic electrons by electromagnetic wave packet in space plasma

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**Abstract**

Resonant interactions between an electromagnetic wave packet and charged particles based on numerical calculations are investigated. The strong surfatron acceleration of weakly relativistic electrons by an electromagnetic wave packet in space plasma is studied. In the central area of the wave packet, the electric field amplitude is above a threshold value and this makes it possible to capture particles in the surfing mode. The work is carried out by exact solving of second order nonlinear, nonstationary equations for the wave packet phase on the particle's trajectory at the carrying frequency. Numerical modeling shows that the trapping of weakly relativistic electrons in strong acceleration mode occurs immediately for a wide enough range of favorable initial wave phase values (80 % and more). Furthermore it has been demonstrated that the combination of ranges of the particle's initial parameters corresponding to the capturing in surfatron acceleration is large enough. Temporal dynamics of momentum components and velocities for accelerated particles, the particularities of their trajectory, taking into account cyclotron rotation at the initial stage and phase plane structure for numerically solved nonlinear equations, are considered. Simulation results let us drawing conclusions about the possibility of surfatron acceleration of weakly relativistic charged particles in space plasma by an electromagnetic wave packet.

***Key words***: *Space plasma, electromagnetic waves, electron surfatron acceleration, phase plane structure, particles capture, potential well*

## 1. Introduction

The investigation of the processes resulting in the generation of relativistic particle fluxes is one of the actual tasks of space plasma physics. In particular, it is of considerable interest for the problem of cosmic rays (CR) generation in astrophysics. One of the possible mechanisms of ultrarelativistic charged particle fluxes generation in space plasma is the particle surfing on electromagnetic waves. For the correct estimation of accelerated charged particles parameters, conditions of trapping into acceleration mode, and to determine the efficiency of