Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Dynamics of Staircase Formation and Evolution in a Reduced Model of Beta Plane Turbulence[1] THOMAS BRADLEY, MIKHAIL MALKOV, PATRICK DIAMOND, UCSD — Staircase dynamics relevant to both beta-plane geostrophic and drift-wave plasma turbulence is studied numerically and analytically. It evolves an averaged potential vorticity (PV) whose flux is both driven by and regulates enstrophy field. The model's closure uses a mixing length concept. Its link with bistability, vital to staircase generation, is analyzed and verified by integrating the equations numerically. The staircase evolves through meta-stable quasi-periodic configurations, lasting for hundreds of time units, yet interspersed with abrupt mergers of adjacent steps in the staircase. The mergers occur at the staircase lattice defects where it is not completely relaxed to a strictly periodic solution that can be obtained analytically. The other types of stationary solutions are the solitons and kinks in the PV gradient and enstrophy - profiles. The waiting time between mergers increases with decreasing number of steps in the staircase, because of the exponential decrease in their coupling strength with growing spacing. The long-time staircase dynamics is numerically shown to be local to the adjacent steps. The merger reveals itself through the explosive growth of the turbulent PV-flux which, however, abruptly drops to its global constant value when the merger is completed.

[1]This research was supported by the Department of Energy under Award No. DE-FG02-04ER54738.

Mikhail Malkov
Univ of California - San Diego

Date submitted: 13 Jul 2017 Electronic form version 1.4