

# Abundant rich phase transitions in step skew products

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## Resumo/Abstract:

We study phase transitions for the topological pressure of geometric potentials of transitive sets. The sets considered are partially hyperbolic having a step skew product dynamics over a horseshoe with one-dimensional fibers corresponding to the central direction. The sets are genuinely non-hyperbolic containing intermingled horseshoes of different hyperbolic behavior (contracting and expanding center).

We prove that for every  $k \geq 1$  there is a diffeomorphism  $F$  with a transitive set  $\Lambda$  as above such that the pressure map  $P(t) = P(t\varphi)$  of the potential  $\varphi = -\log dF|_{E^c}$  ( $E^c$  the central direction) defined on  $\Lambda$  has  $k$  rich phase transitions. This means that there are parameters  $t_\ell$ ,  $\ell = 1, \dots, k$ , where  $P(t)$  is not differentiable and this lack of differentiability is due to the coexistence of two equilibrium states of  $t_\ell\varphi$  with positive entropy and different Birkhoff averages. Each phase transition is associated to a gap in the central Lyapunov spectrum of  $F$  on  $\Lambda$ .

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