

Spatiotemporal patterns of membranes induced by surface molecular binding/unbinding

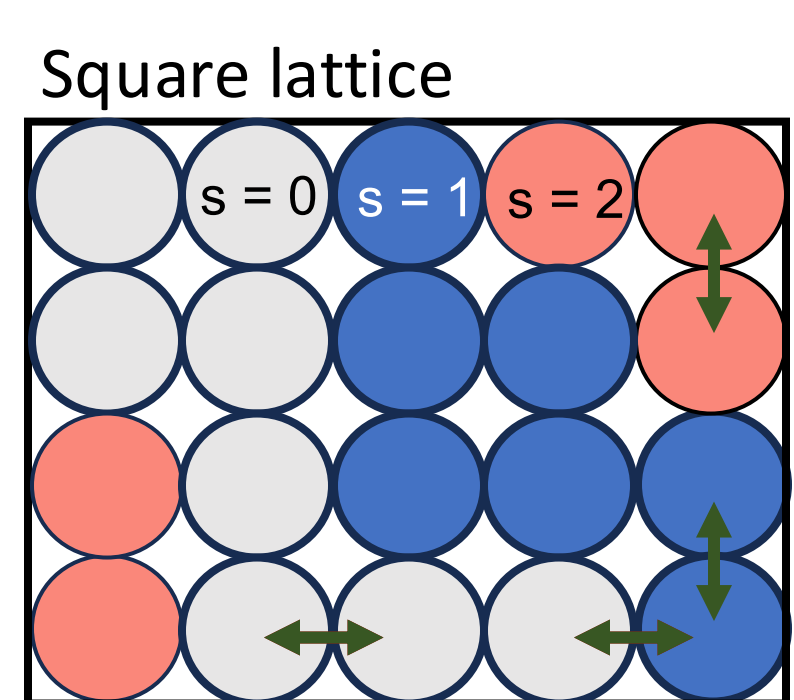
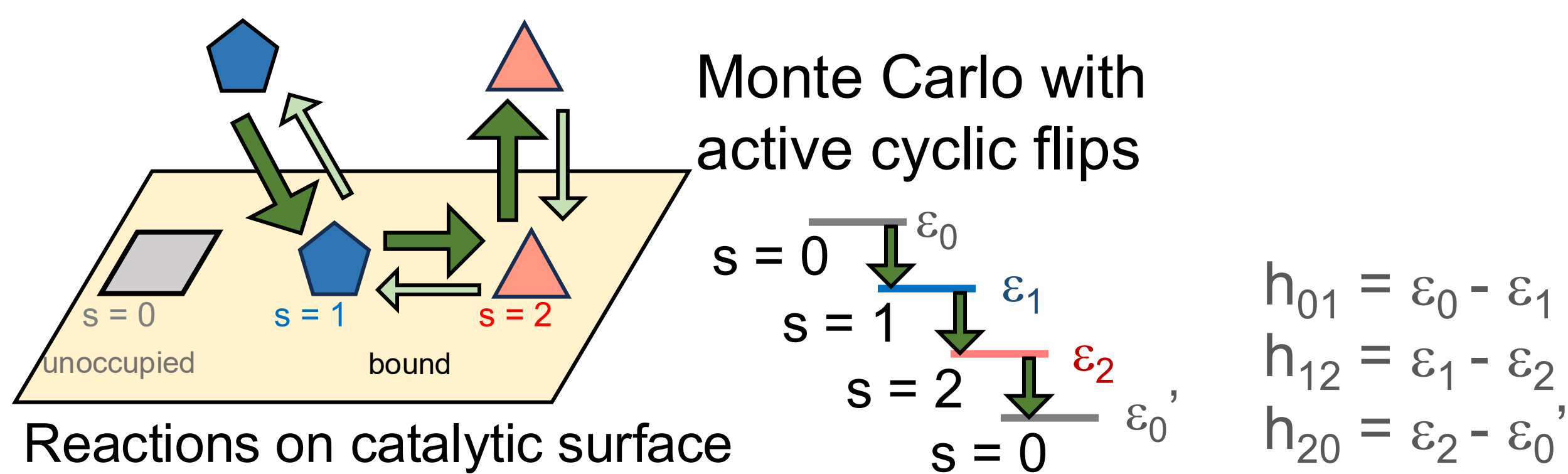
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We simulated the nonequilibrium membrane dynamics under cyclic changes of states [1-6]. We found several dynamic modes: spiral waves, cyclic change of homogeneous phases, moving biphasic domains, and time-irreversible fluctuating patterns.

q-state active Potts models



Phase separation

cyclically symmetric condition

$$h_{01} = h_{12} = h_{20} = h$$

$q = 6$

Non-spiral wave

6 states

3 states

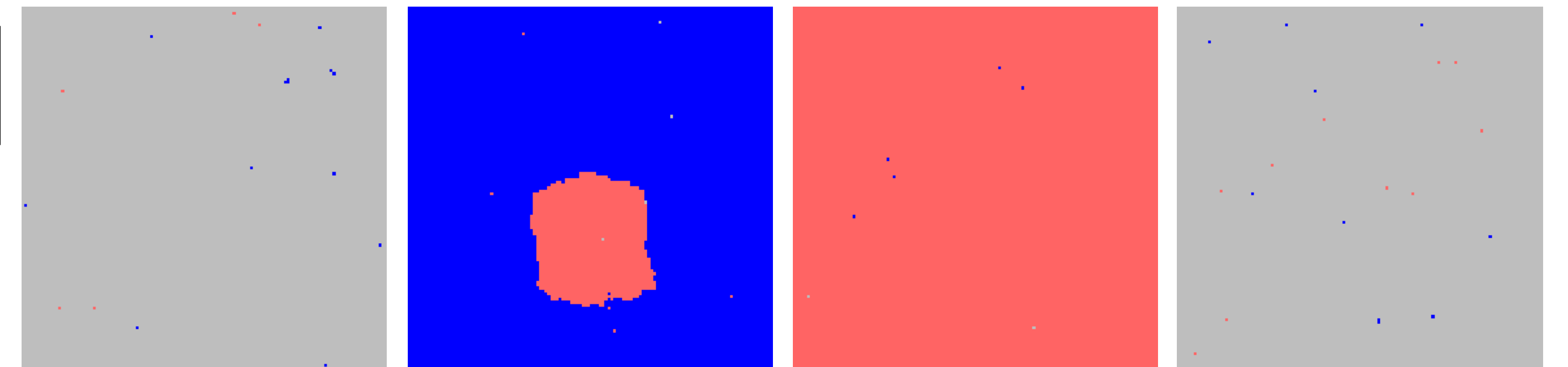
3 mixed states

Mixing of 3 states
(odd or even numbered)

Spiral waves

Homogeneous cycling (HC)

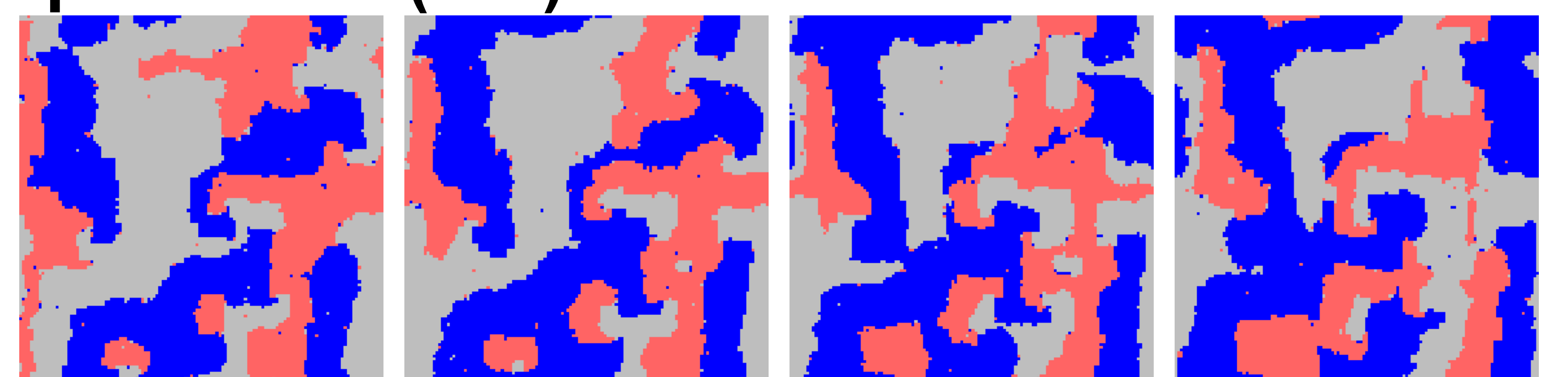
$q = 3$



nucleation and growth

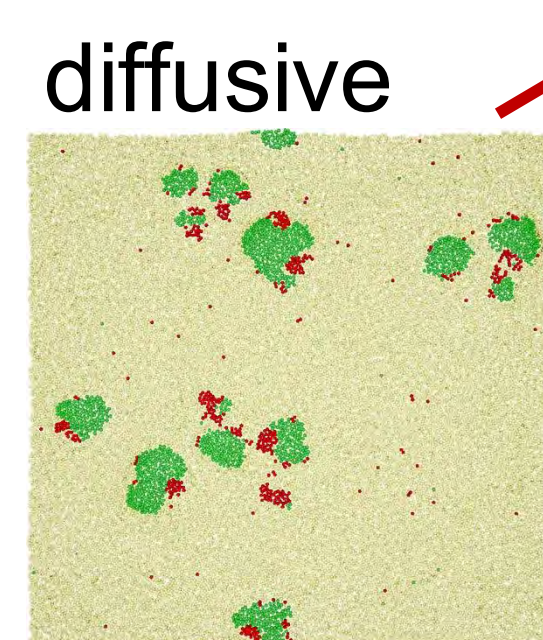
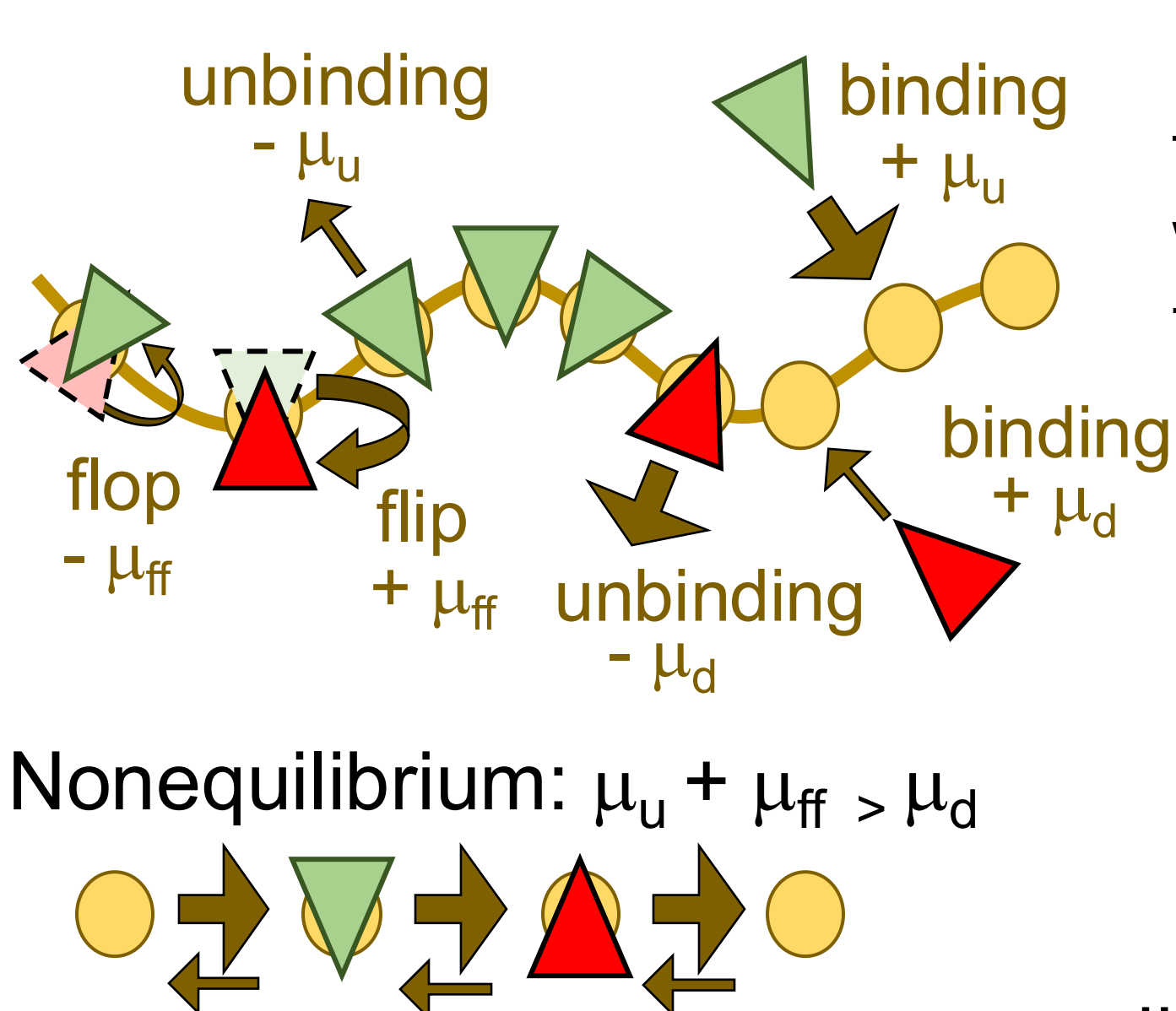
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Spiral wave (SW)



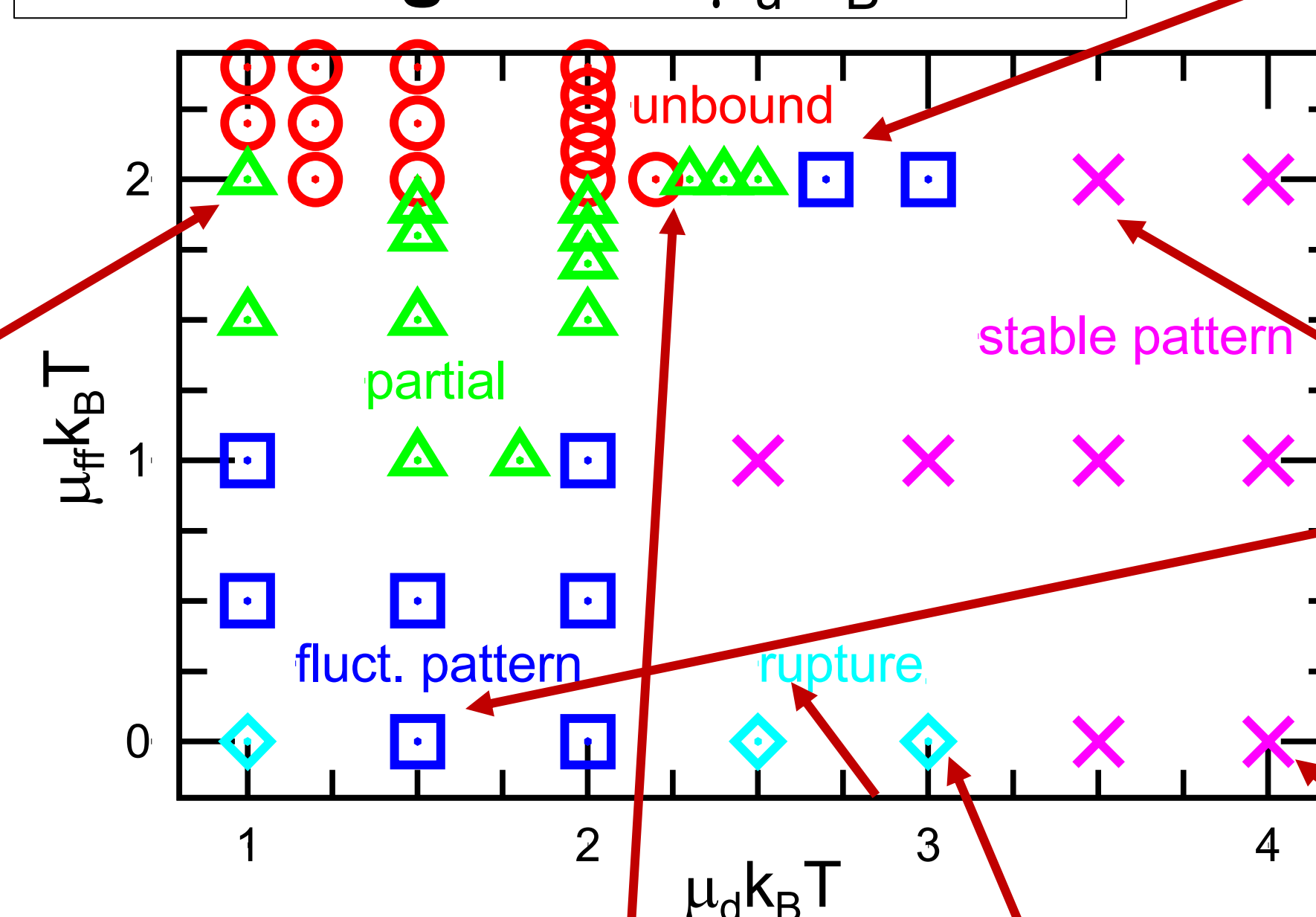
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3-state Potts with membrane bending

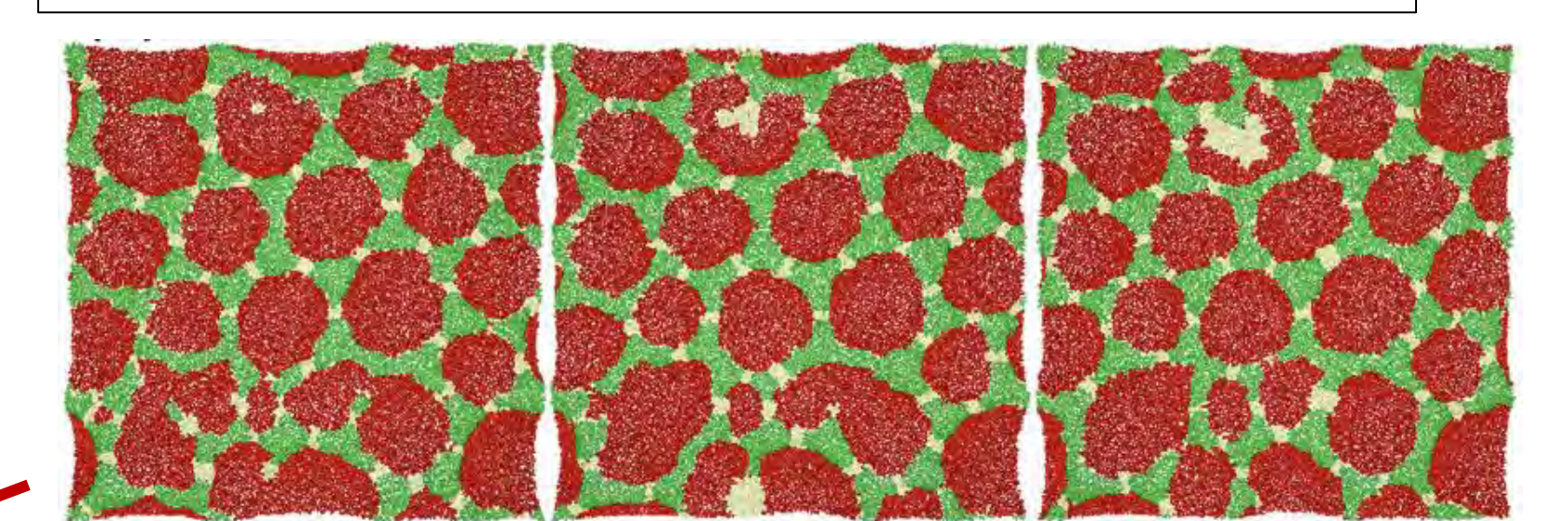


diffusive

Phase diagram at $\mu_u/k_B T = 10$

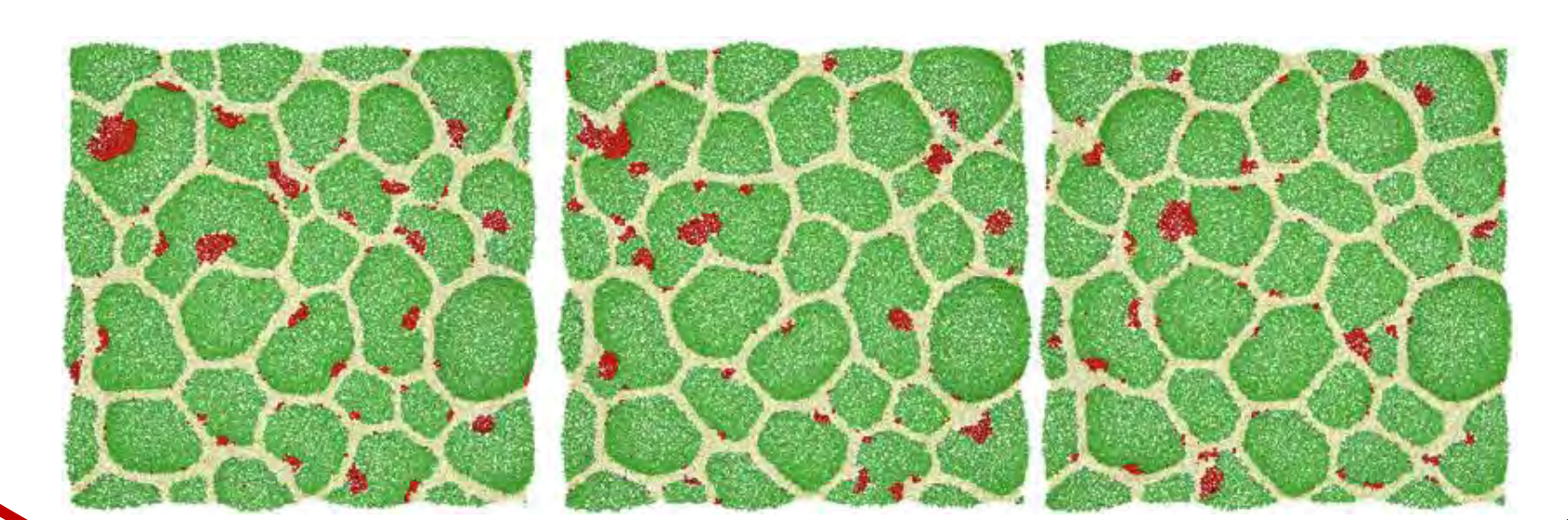


Time-irreversible fluctuation



Yellow eats red.

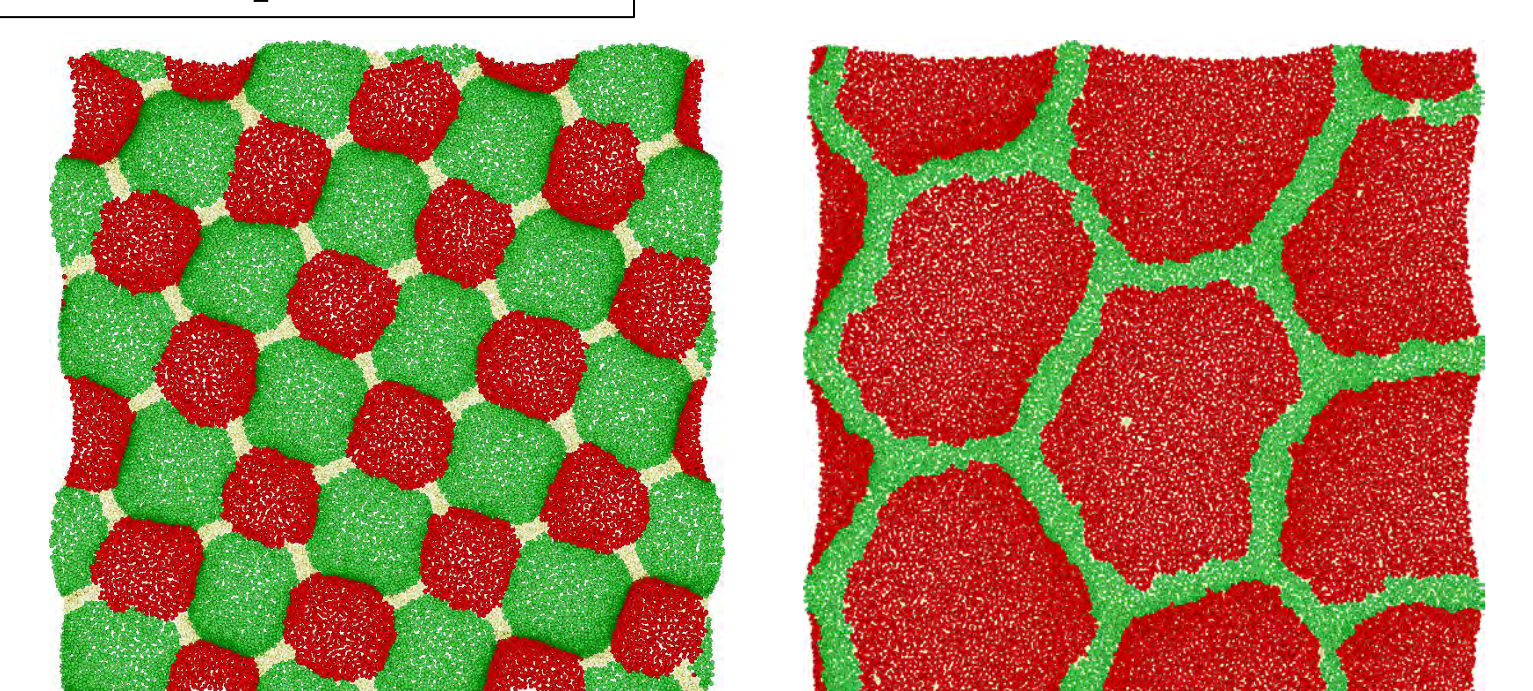
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Small red domain eats green.

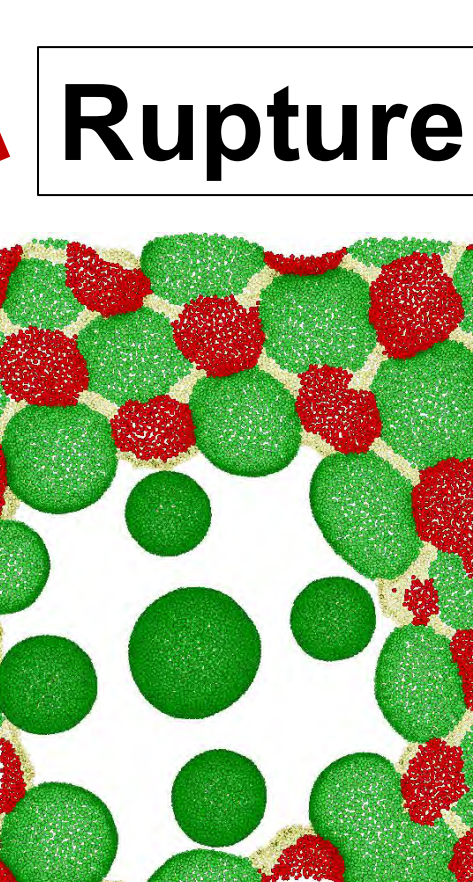
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Stable pattern

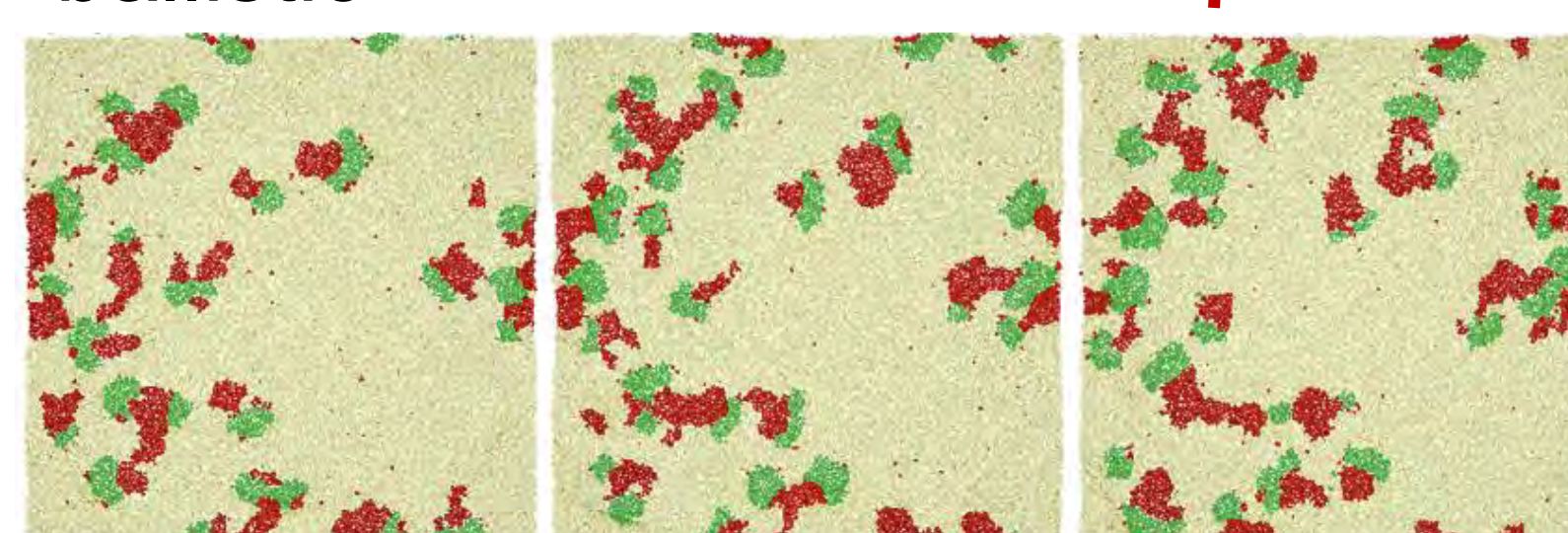


square
4.8.8 tiling

hexagonal



Rupture



ballistic

t

Locomotion of biphasic domains

