SISTEMAS DE CRESCIMENTO COM DEFEITO COLUNAR

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Joint work with

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Colóquio Inter-Institucional
CBPF-IMPA-LNCC-UFRJ

Totally asymmetric exclusion process with slow bond

Consider one-dimensional totally asymmetric exclusion process with the particle density ρ, particles jump at rate 1, except at the origin , where jump rate changes from 1 to $1 - \lambda$, $\lambda \geq 0$.

If the density ρ of particles equals 1/2, does the current in the system change for any value of λ ?

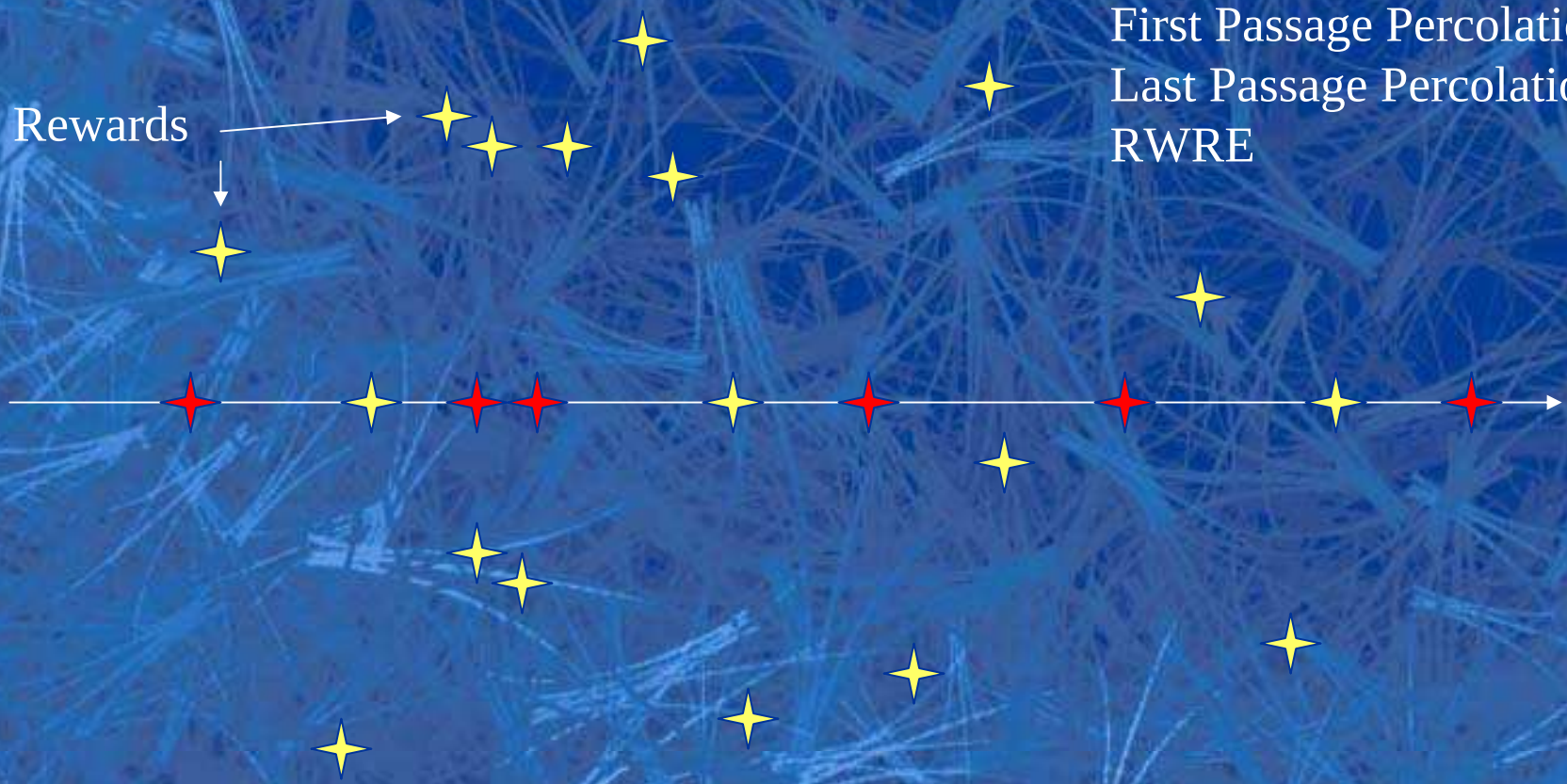
S.A. Janowski, J. L. Lebowitz 1992,

T. Liggett 1994, F. Rezakhanlou et al. 1996, T. Seppalainen 2002

M. den Nijs et al., 2003

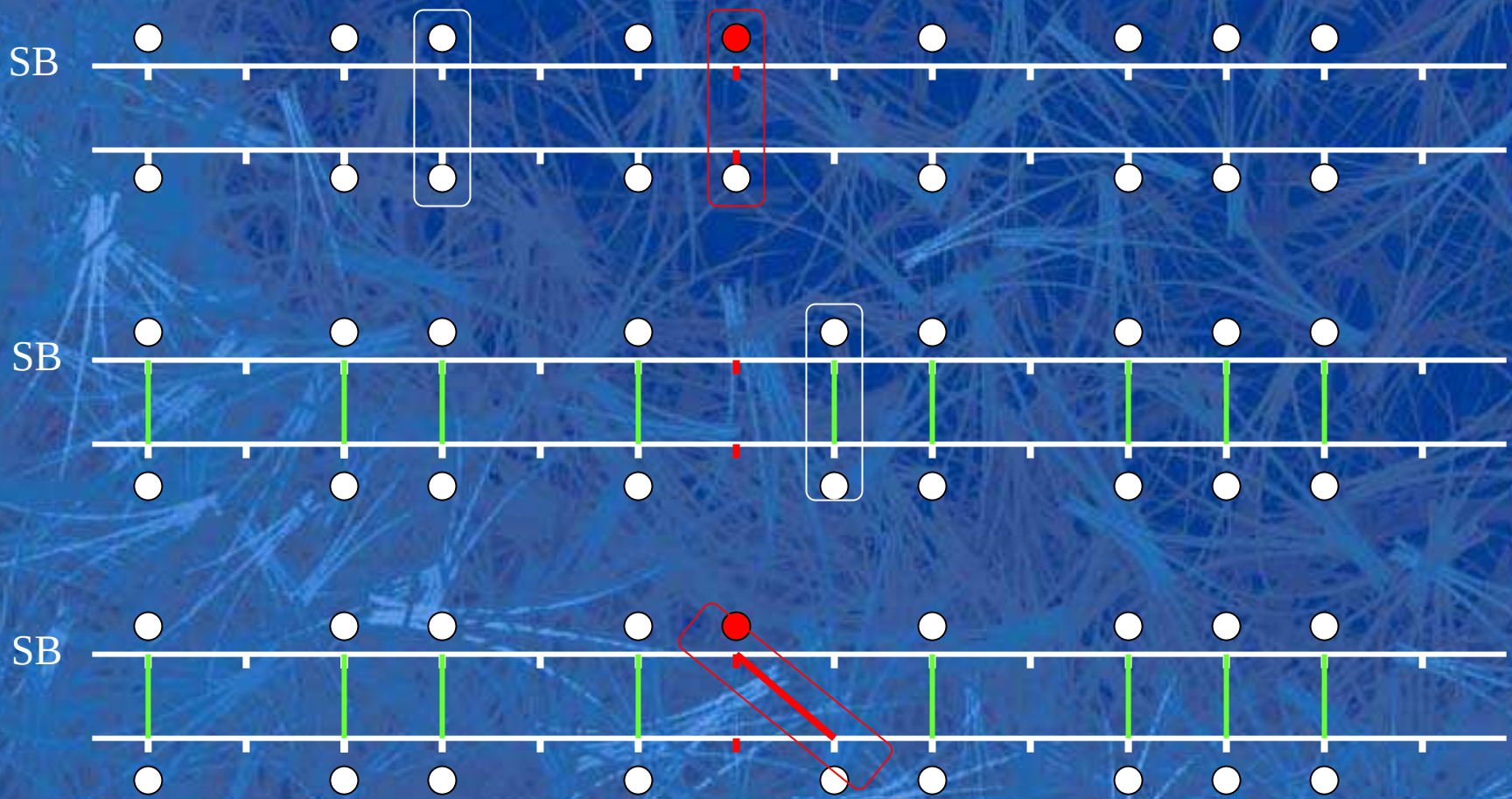
Statement (V. Beffara, V.S., 2006) $\lambda_c = 0$.

- This statement is a corollary of more general theorem characterizing long term behavior of certain class of growth models.
- Pinning/depinning transition for directed polymer in presence of bulk disorder.

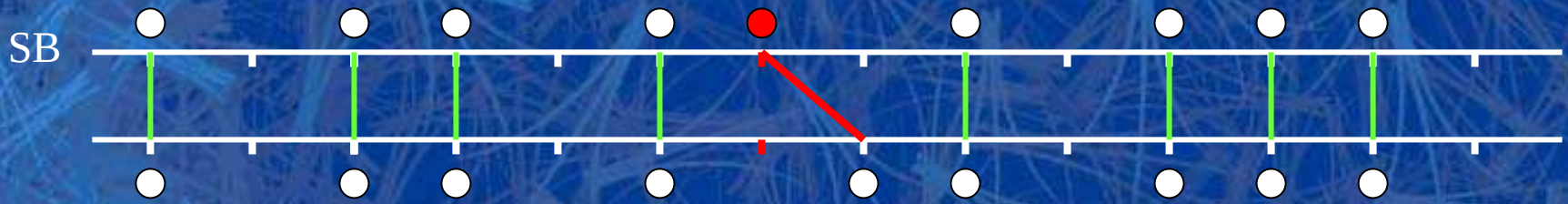


Coupling: - initially all particles are at the same positions and use the same clock while not at 0.

- basic coupling of independent clocks at 0.



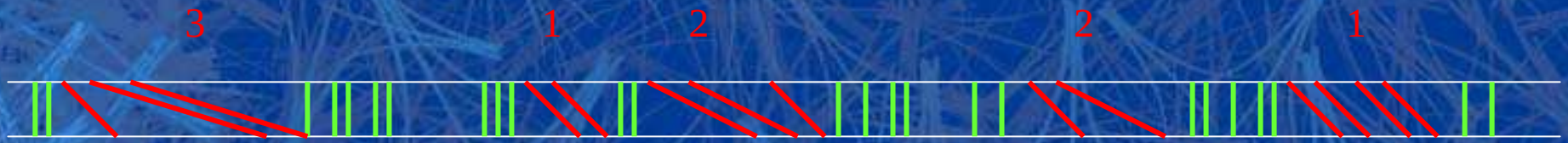
Evolution of discrepancy:



Shrinking (dissapearing)

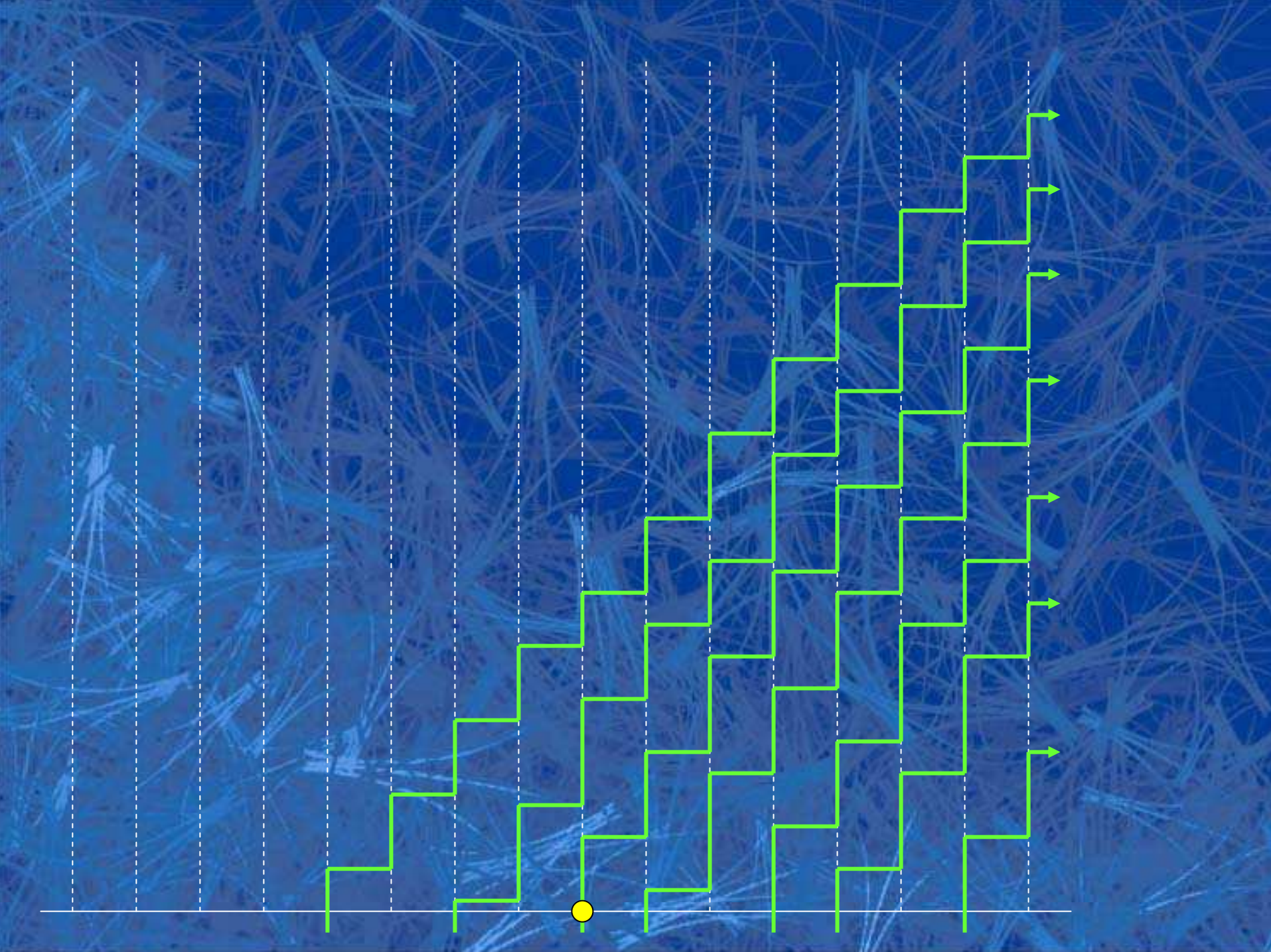
Expanding

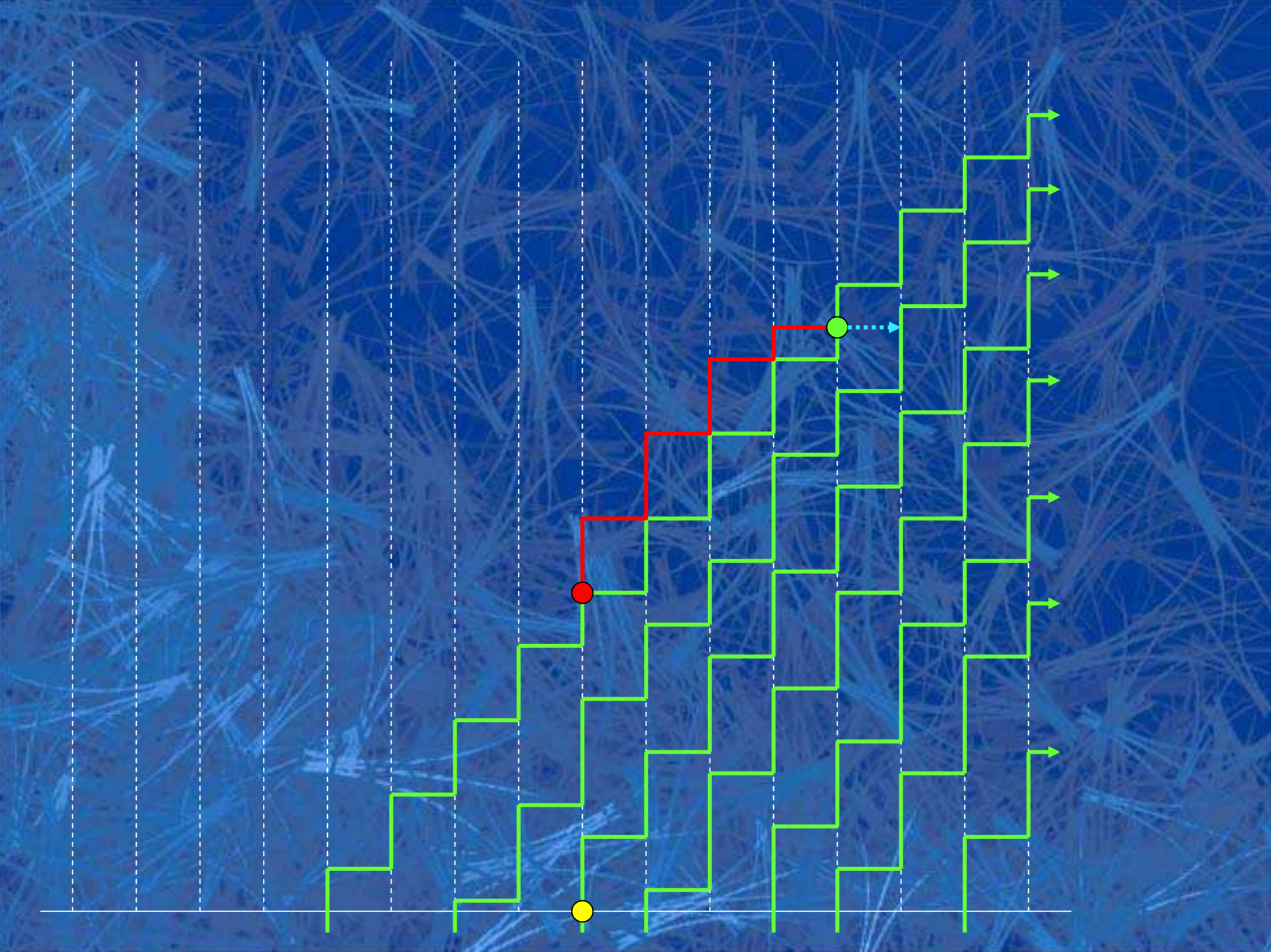
Growing

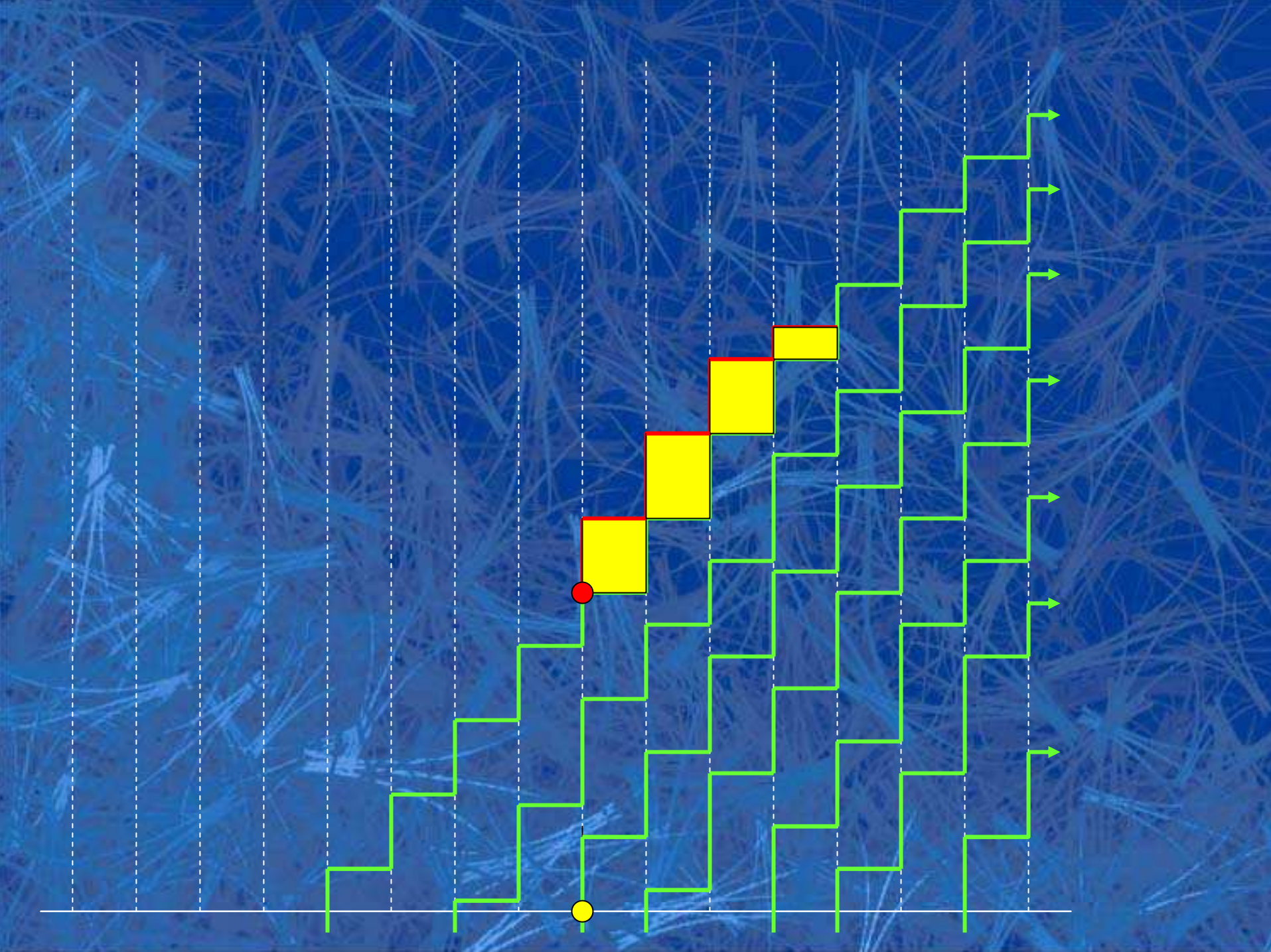


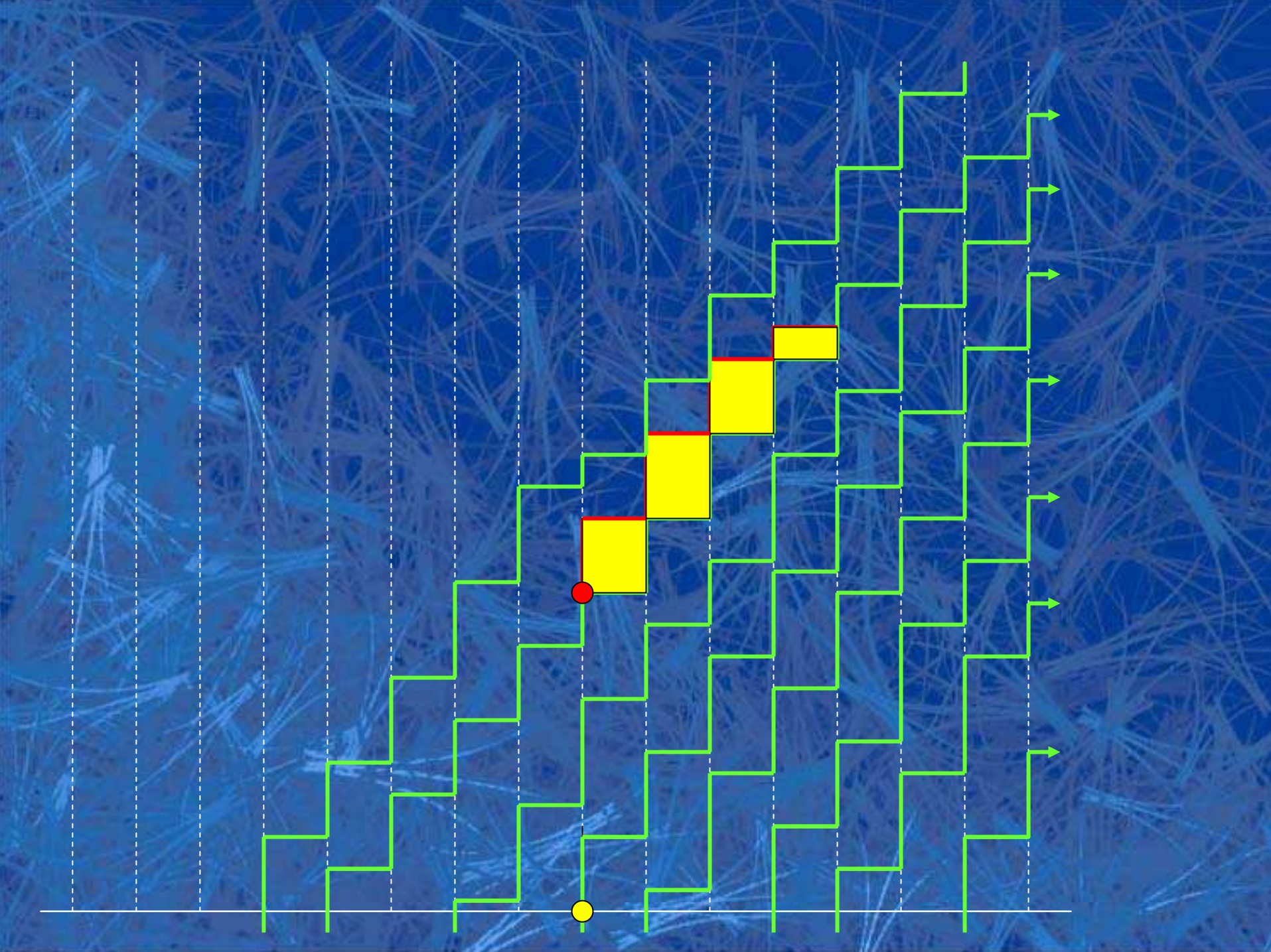
- LLN: the current in TASEP with slow bond is changed if and only if the “slope” between decoupled particles is growing linearly in time.

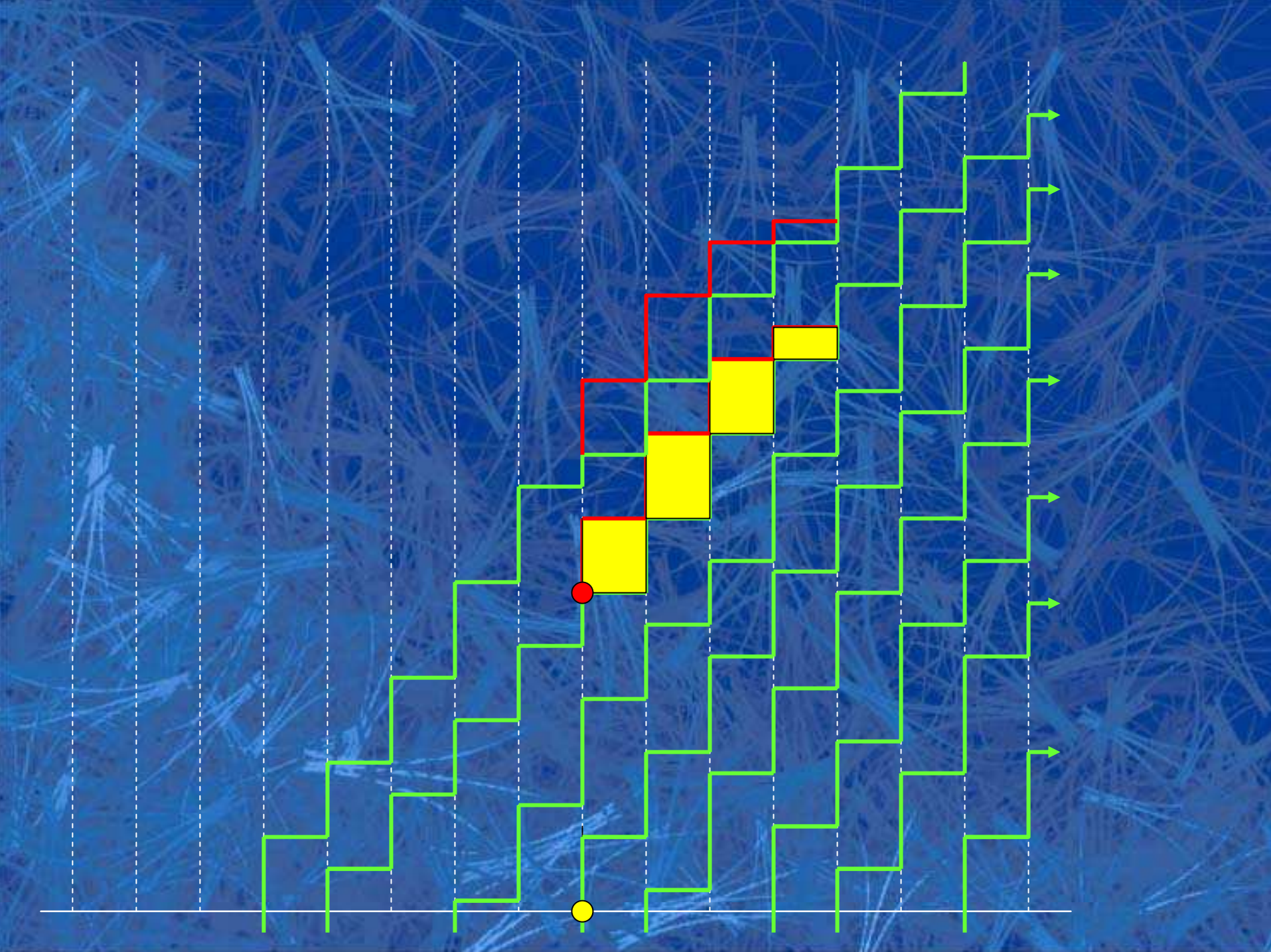
- Droplet growth representation.

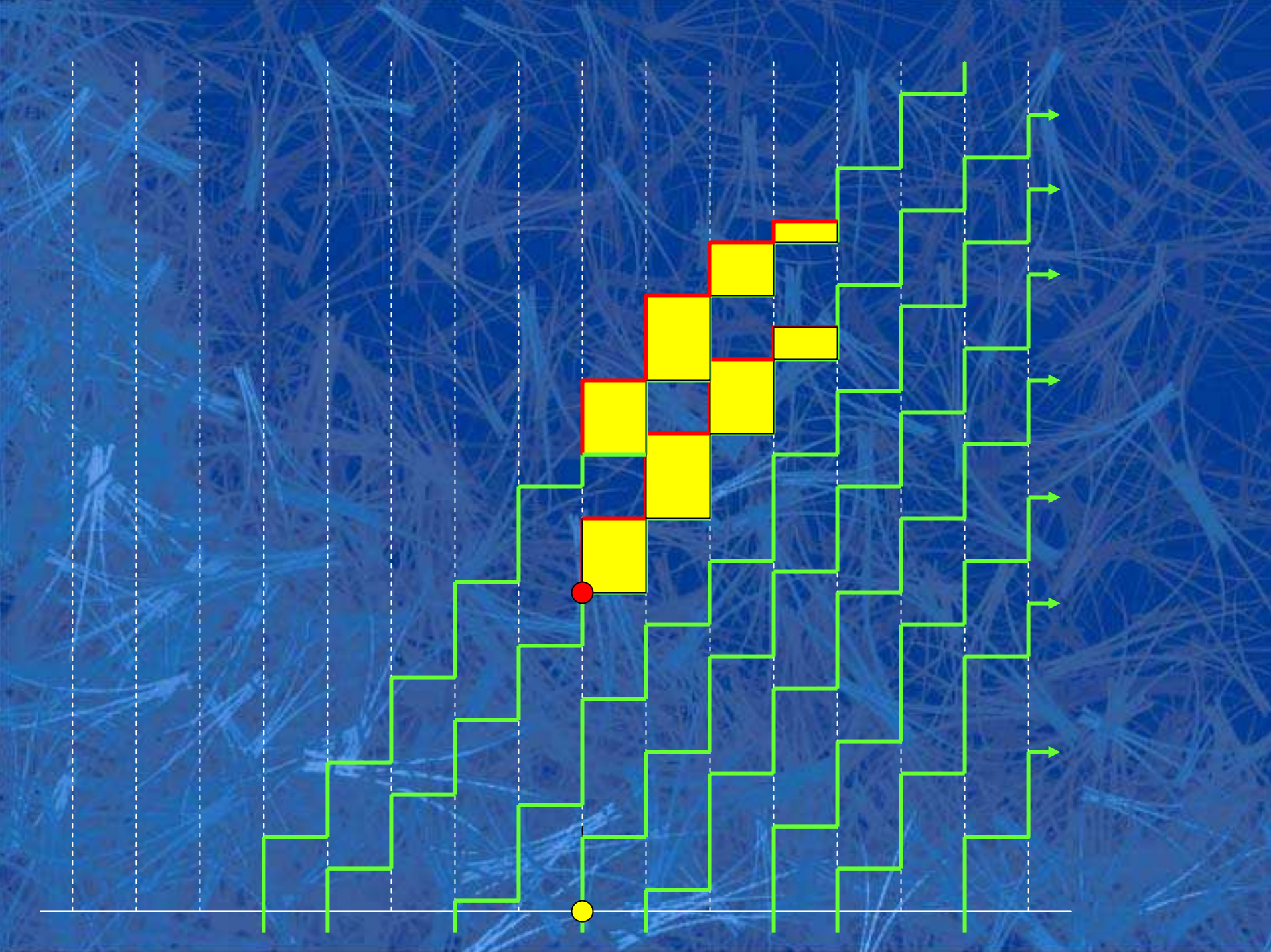


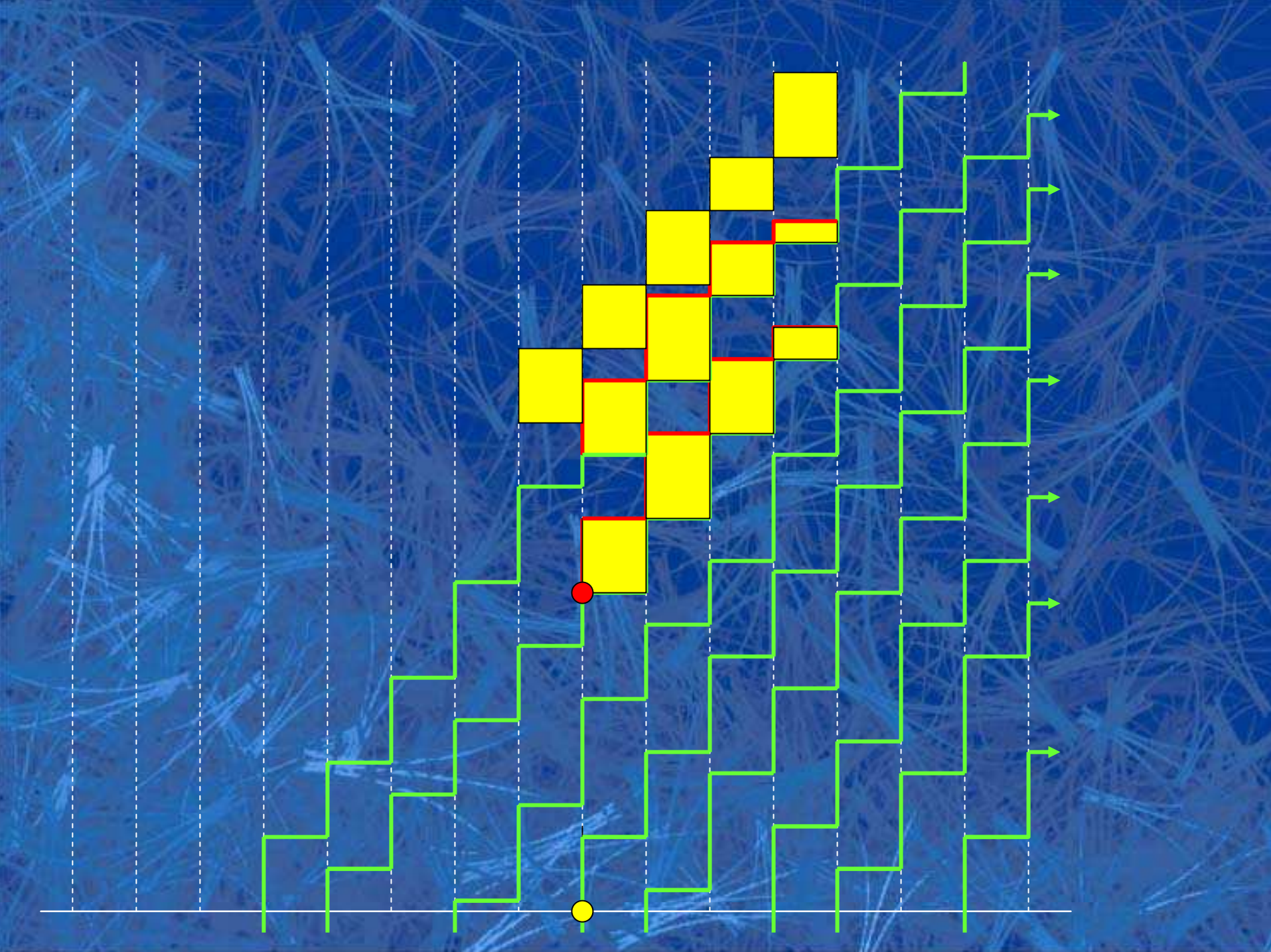


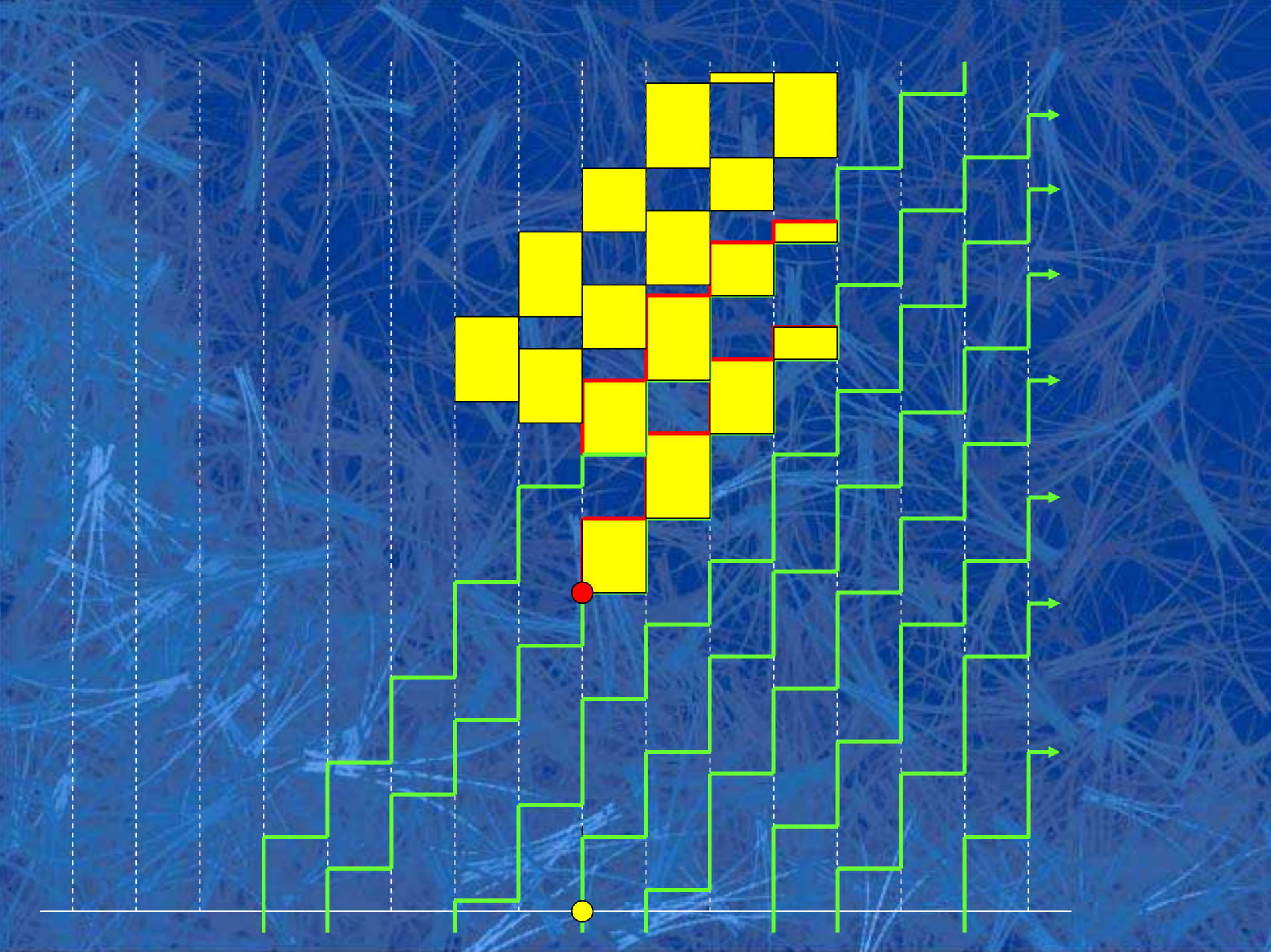


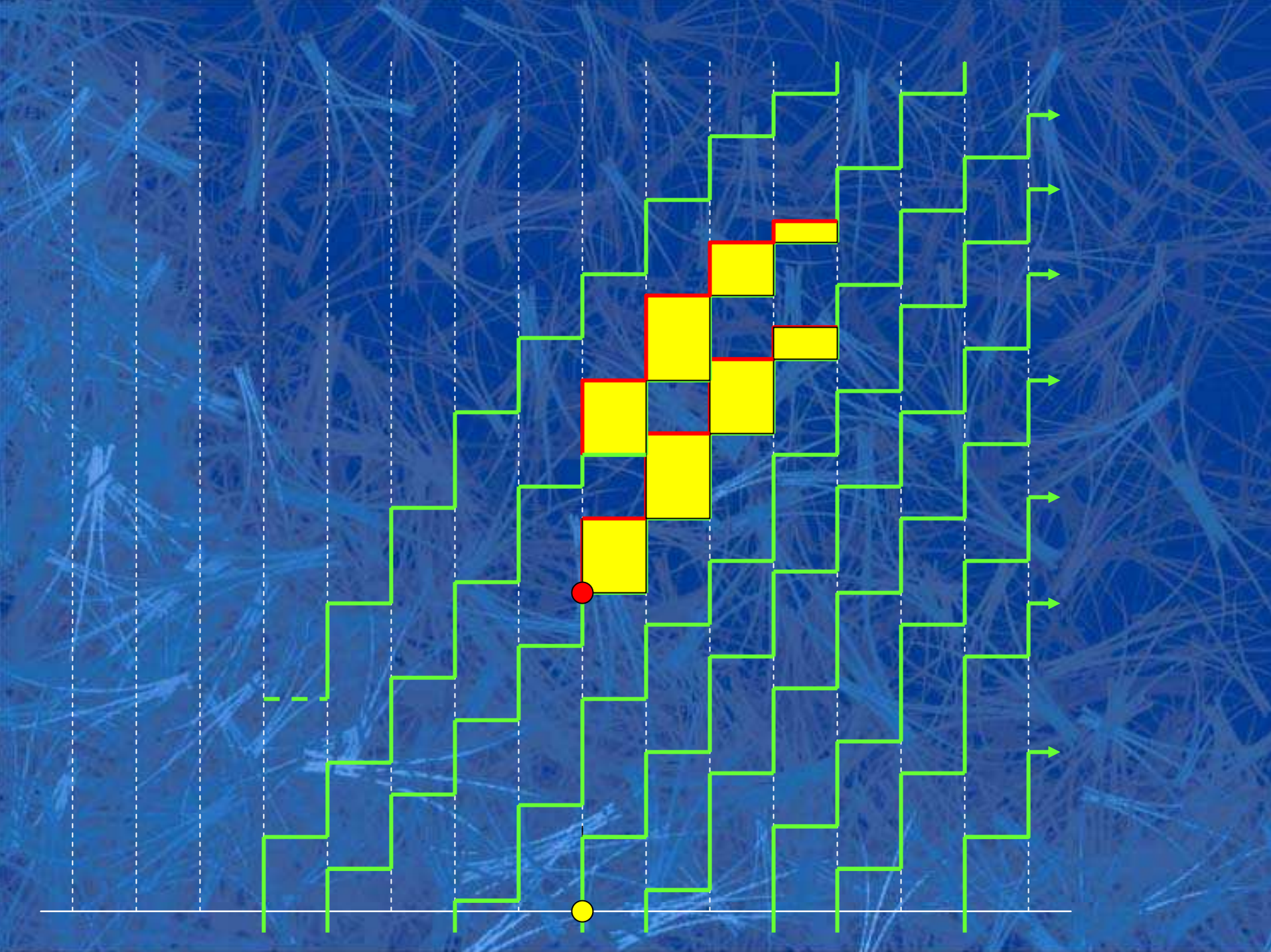




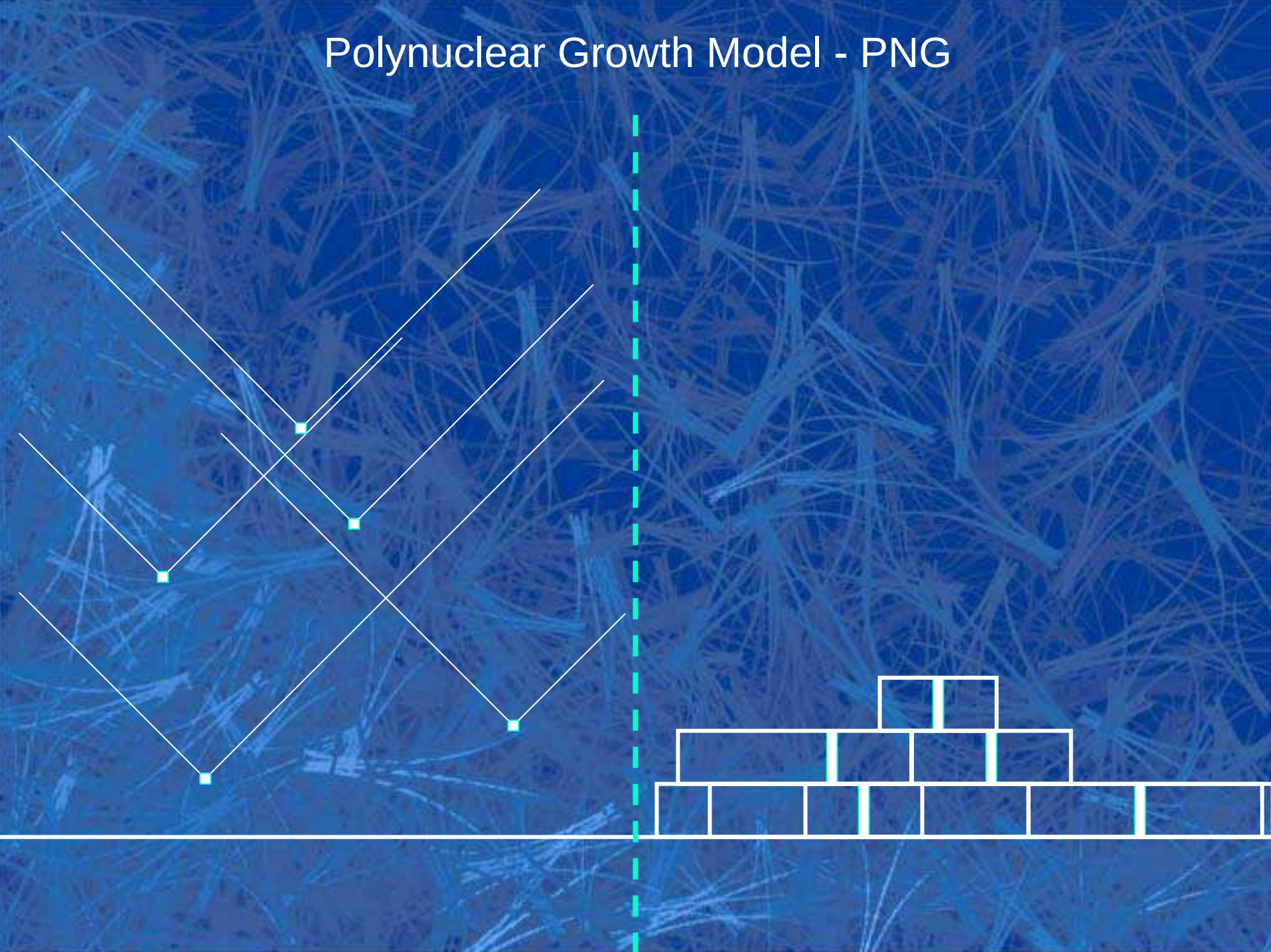








Polynuclear Growth Model - PNG



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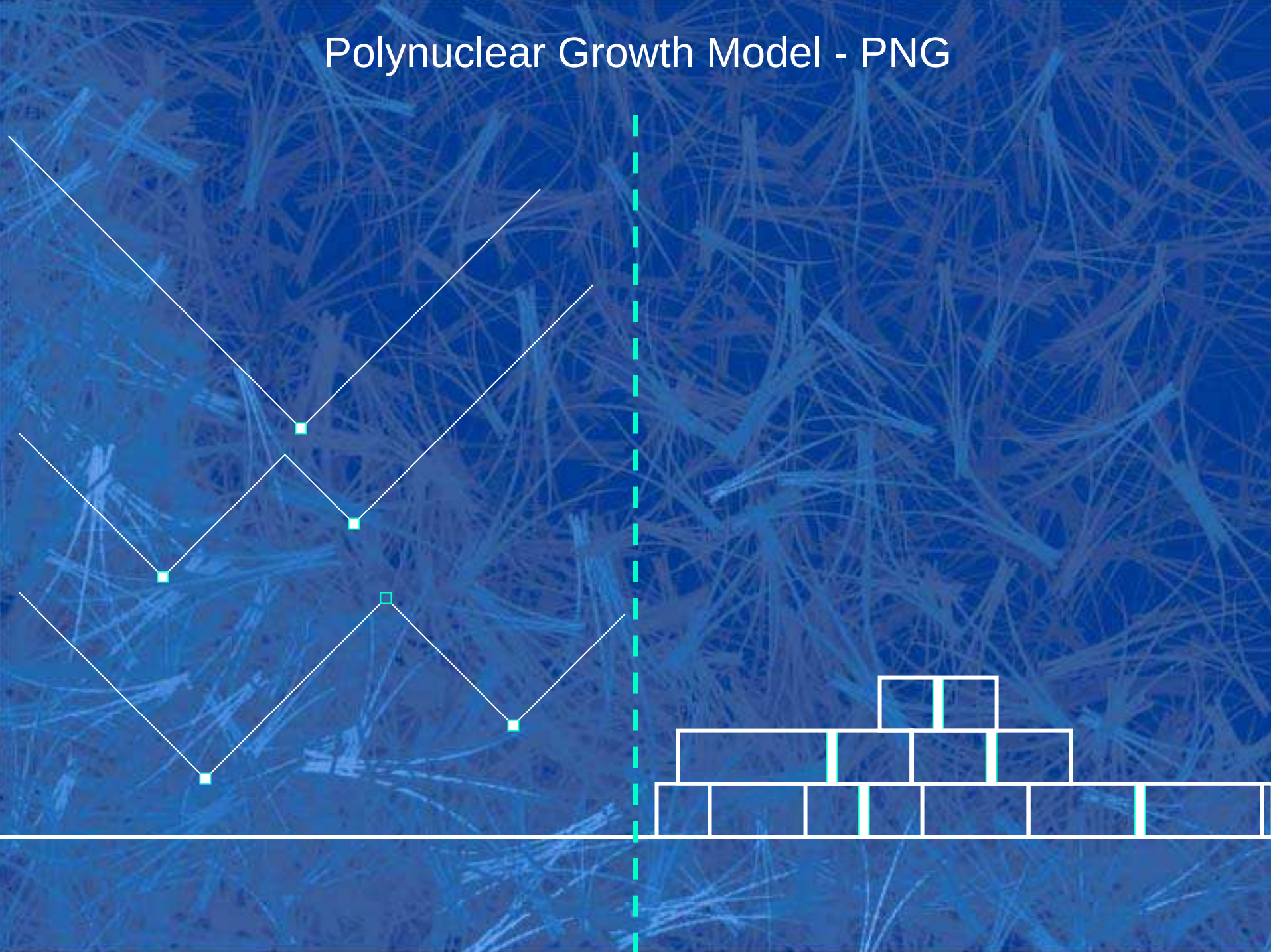
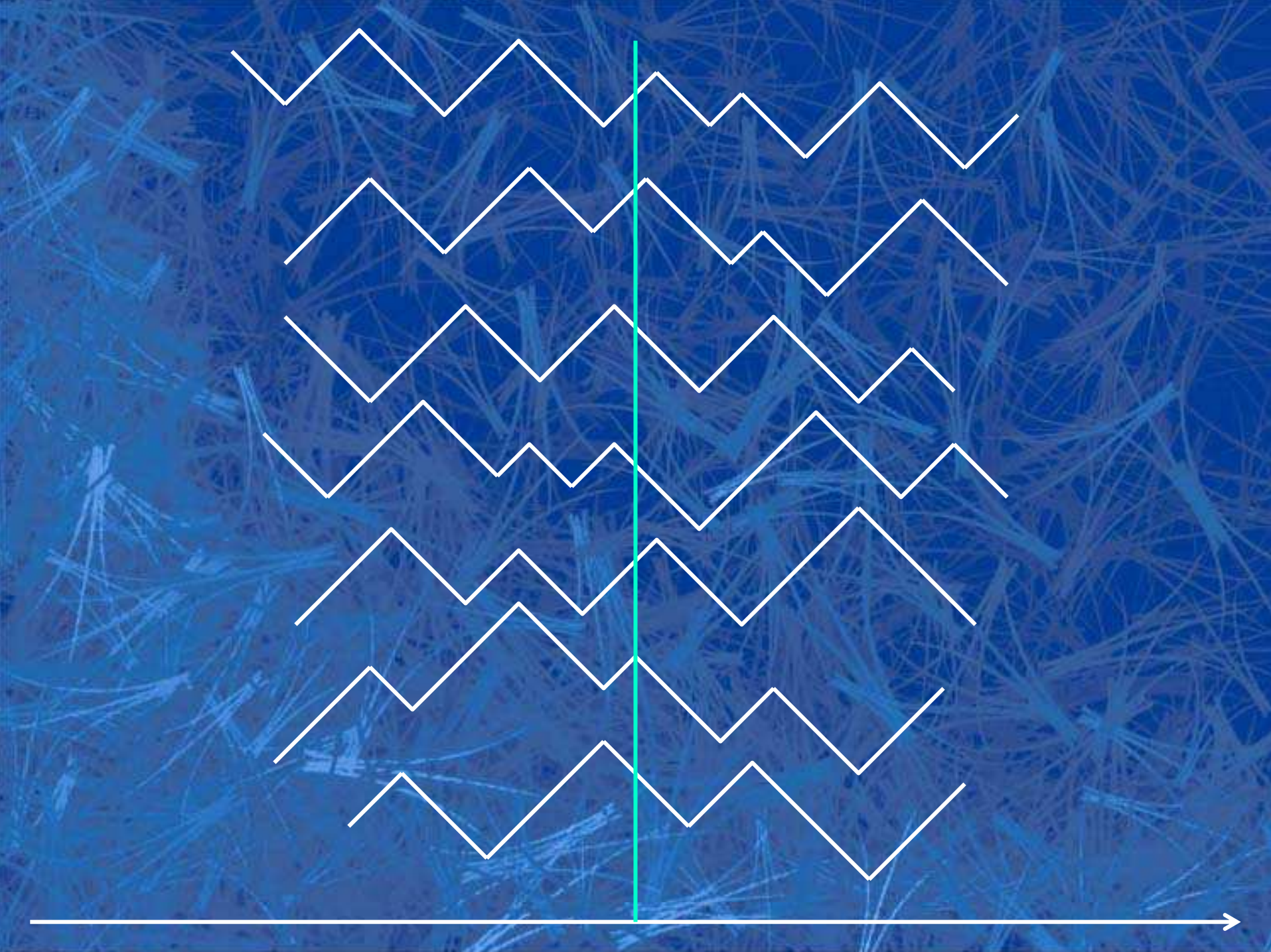
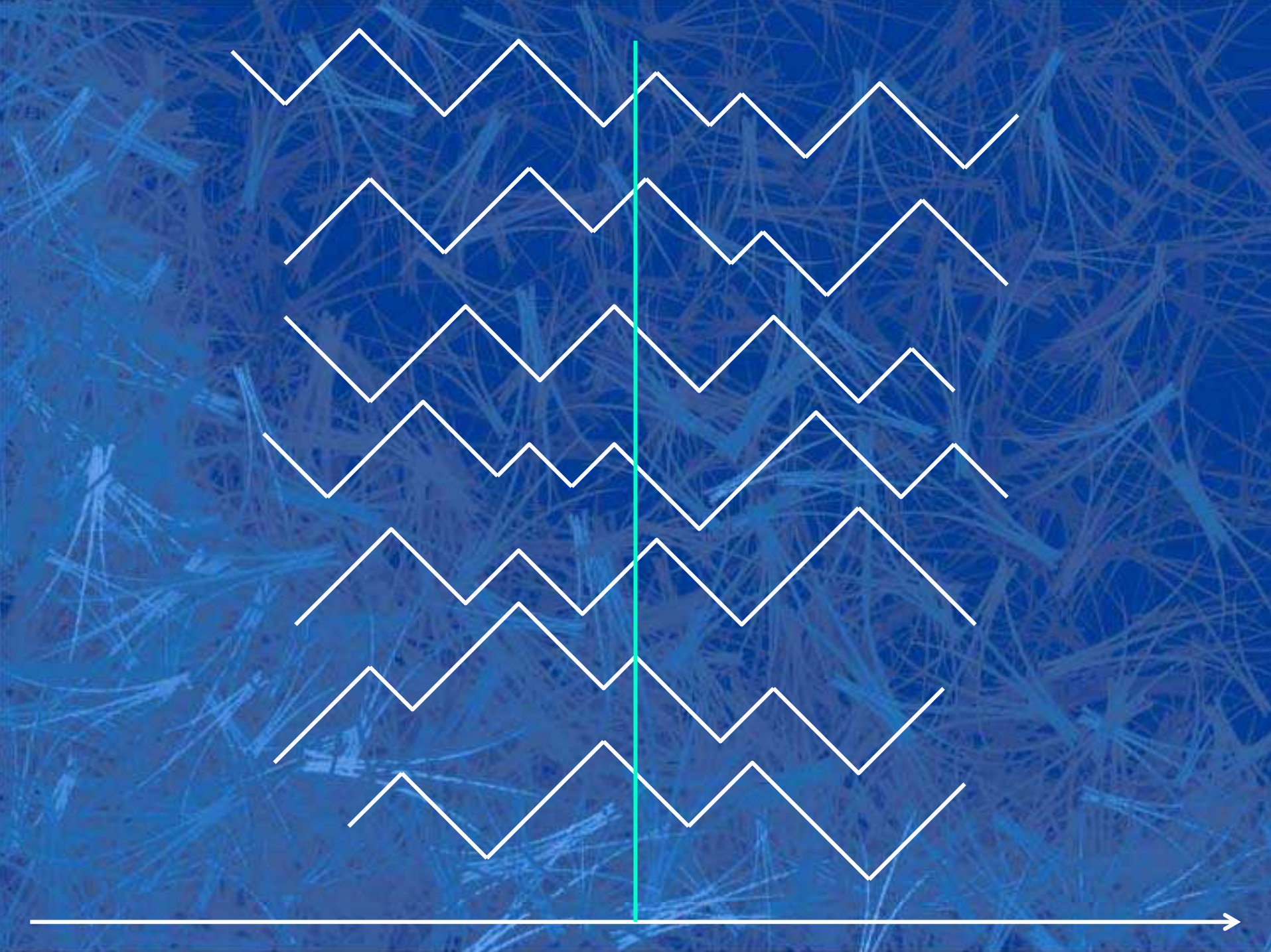
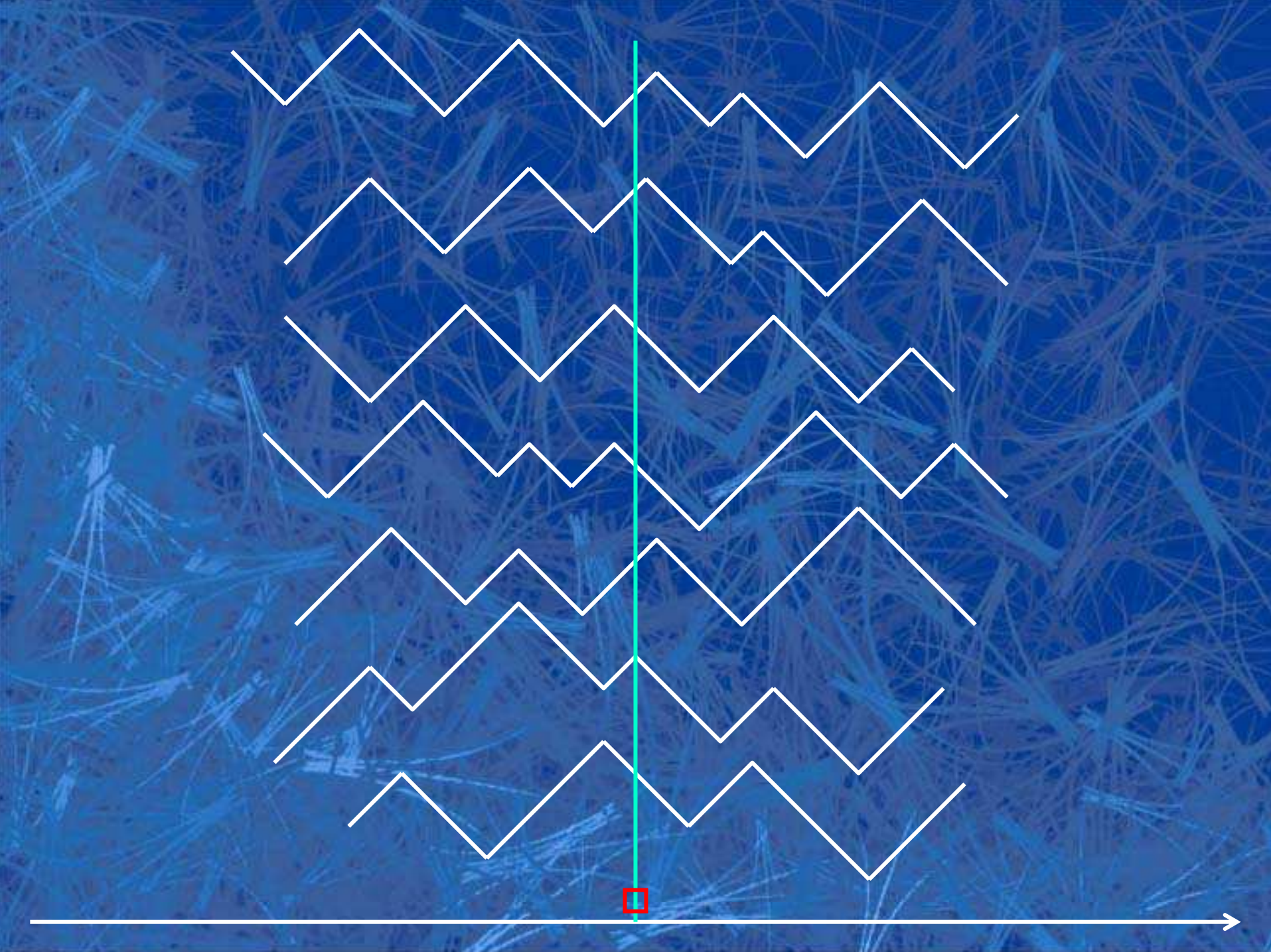
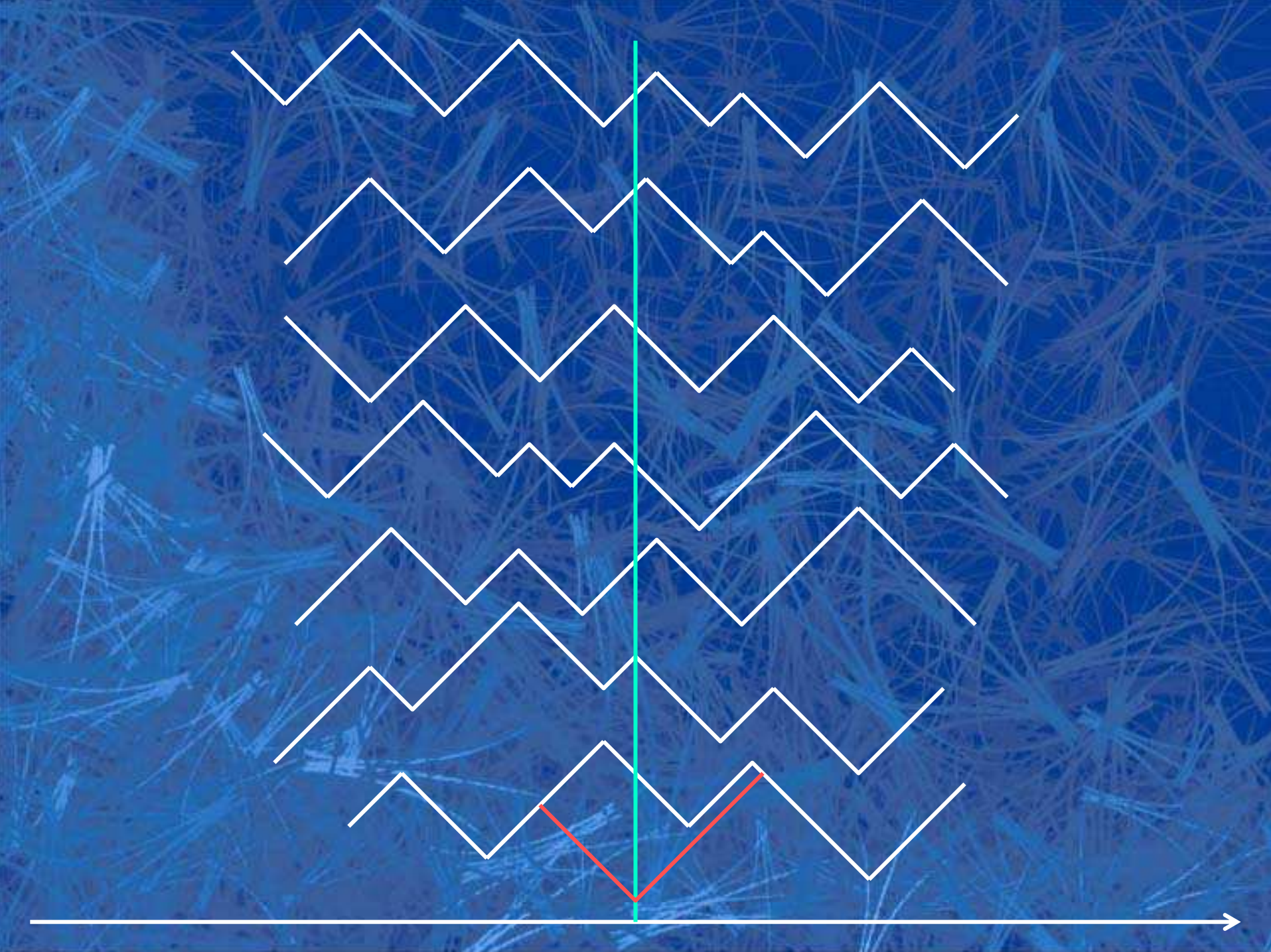
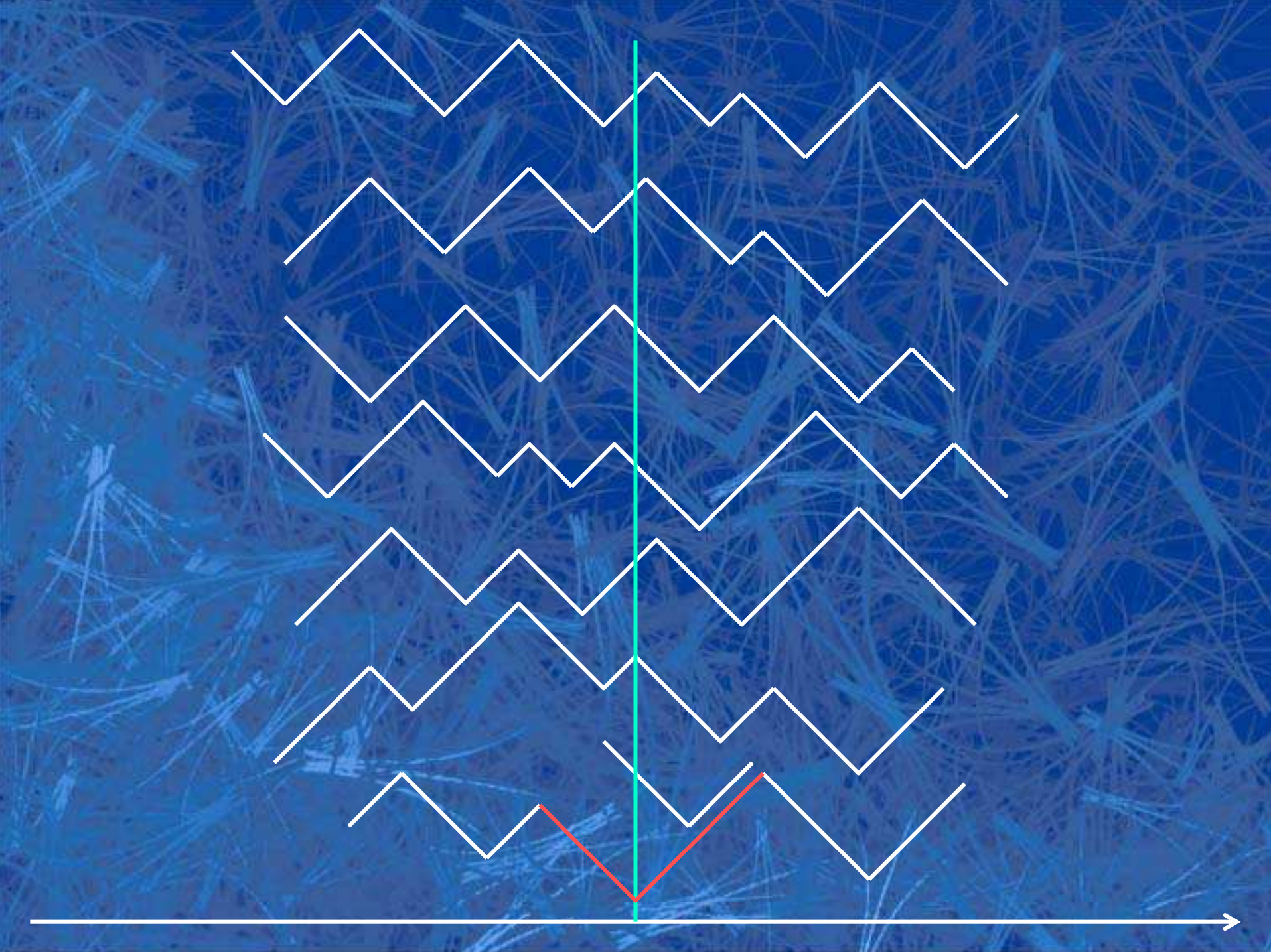


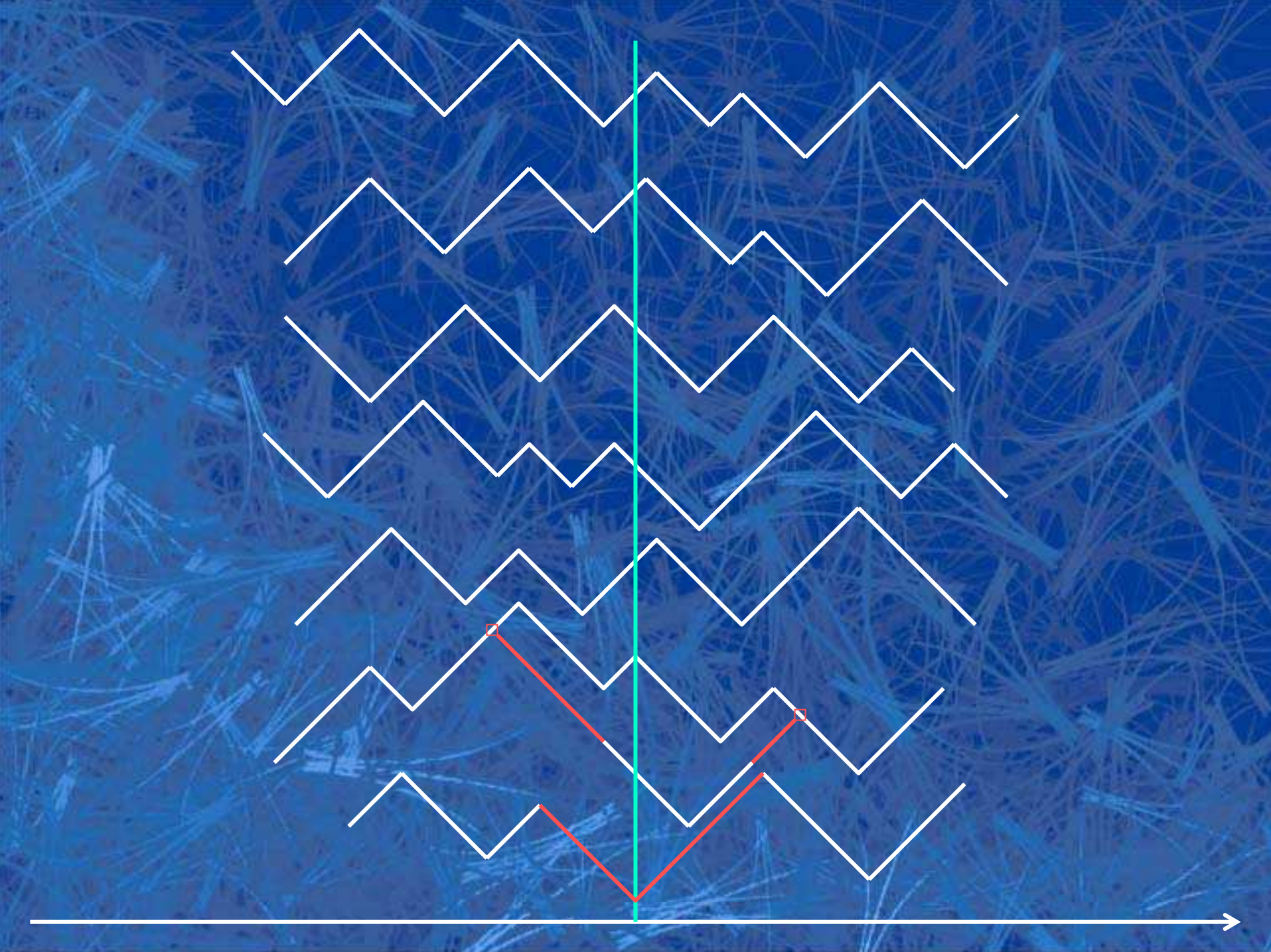


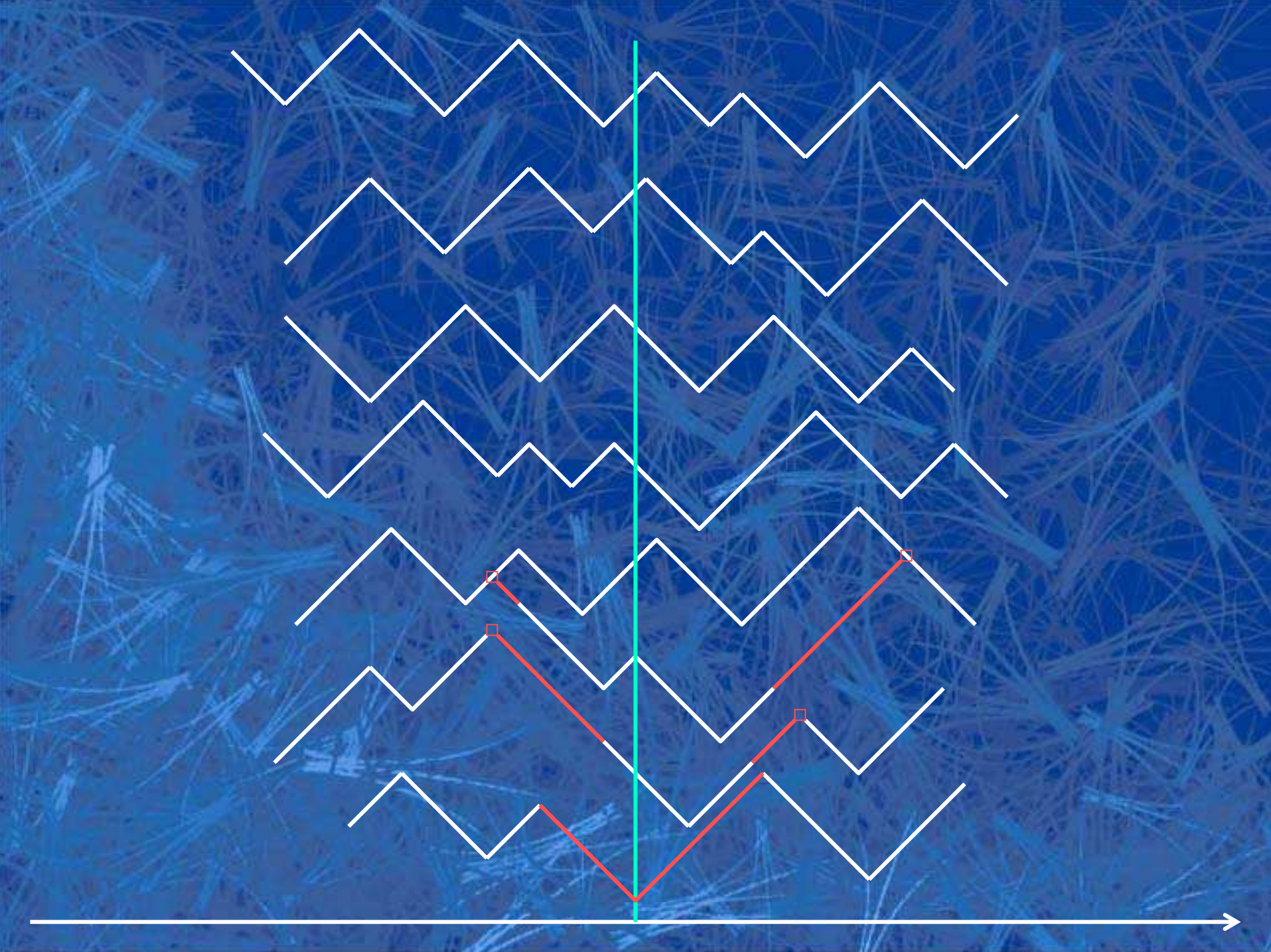


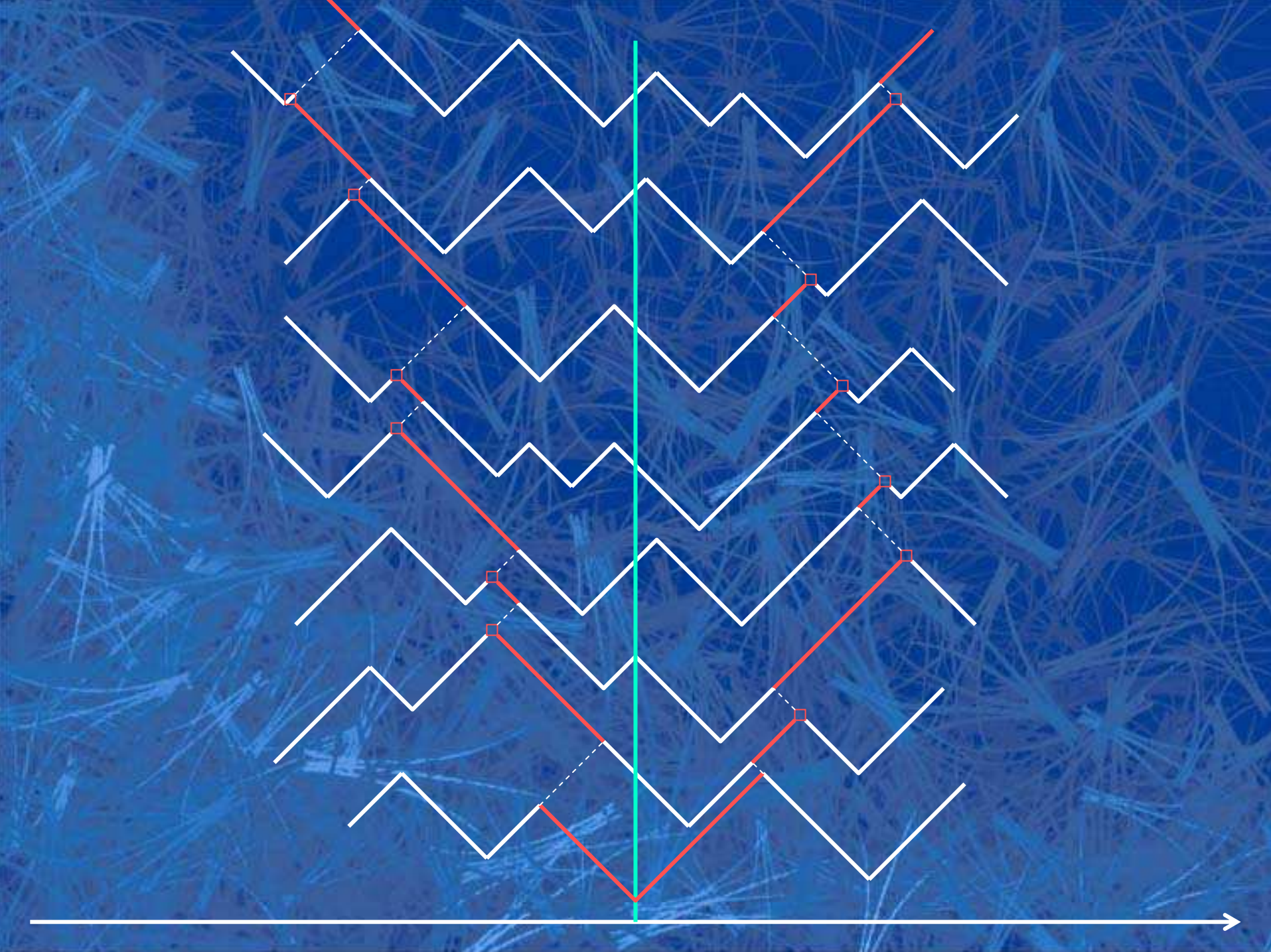


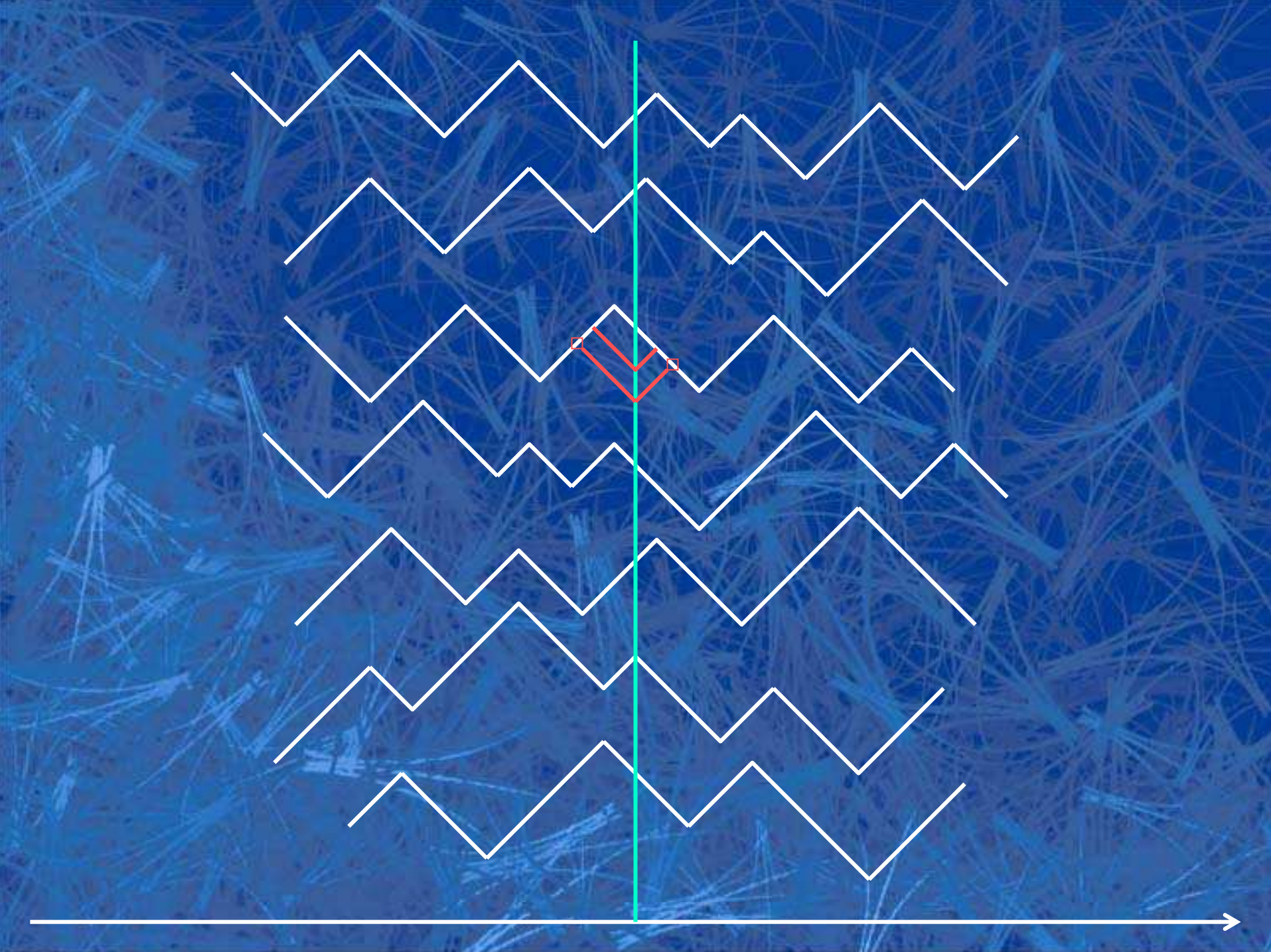


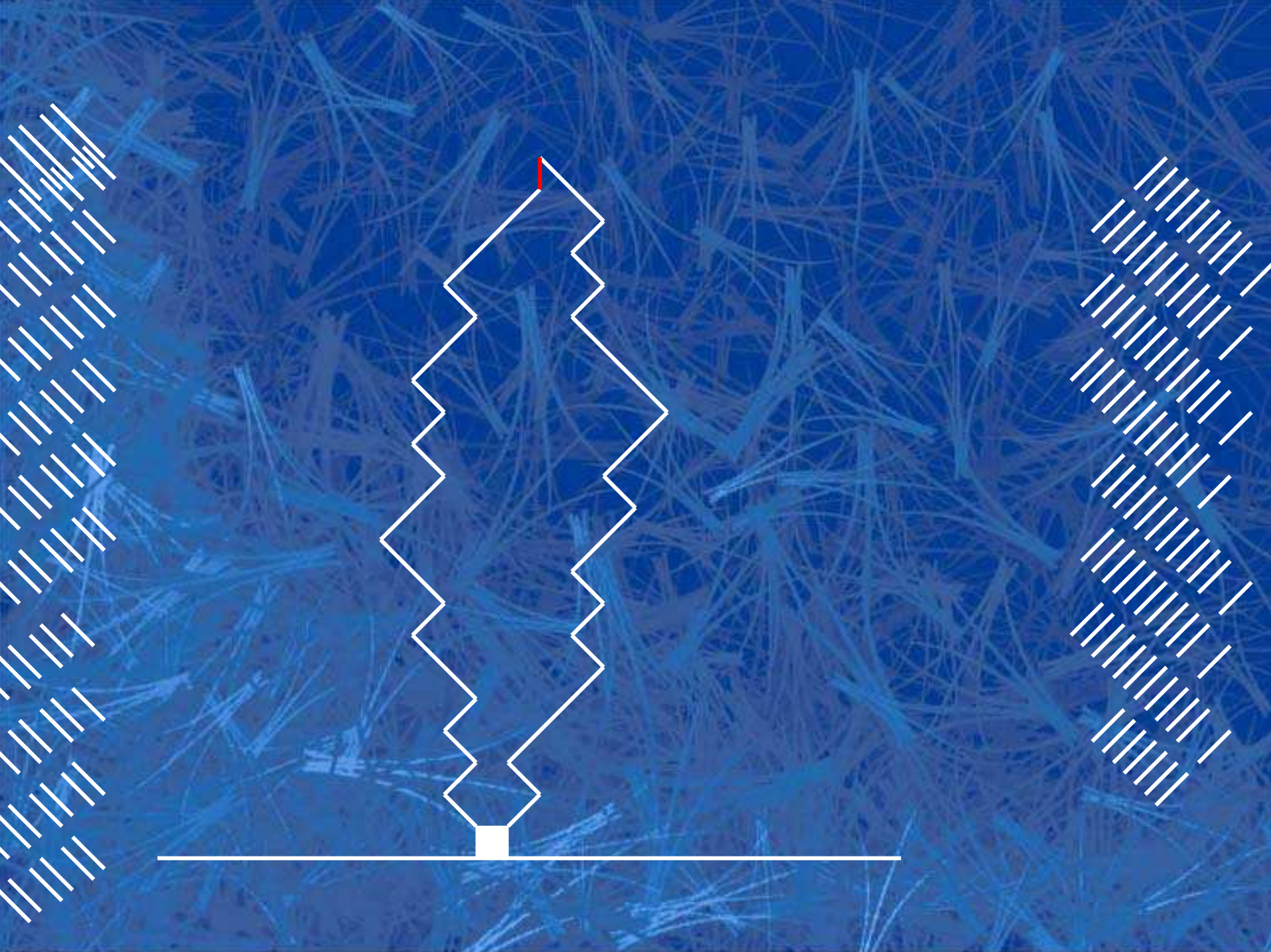


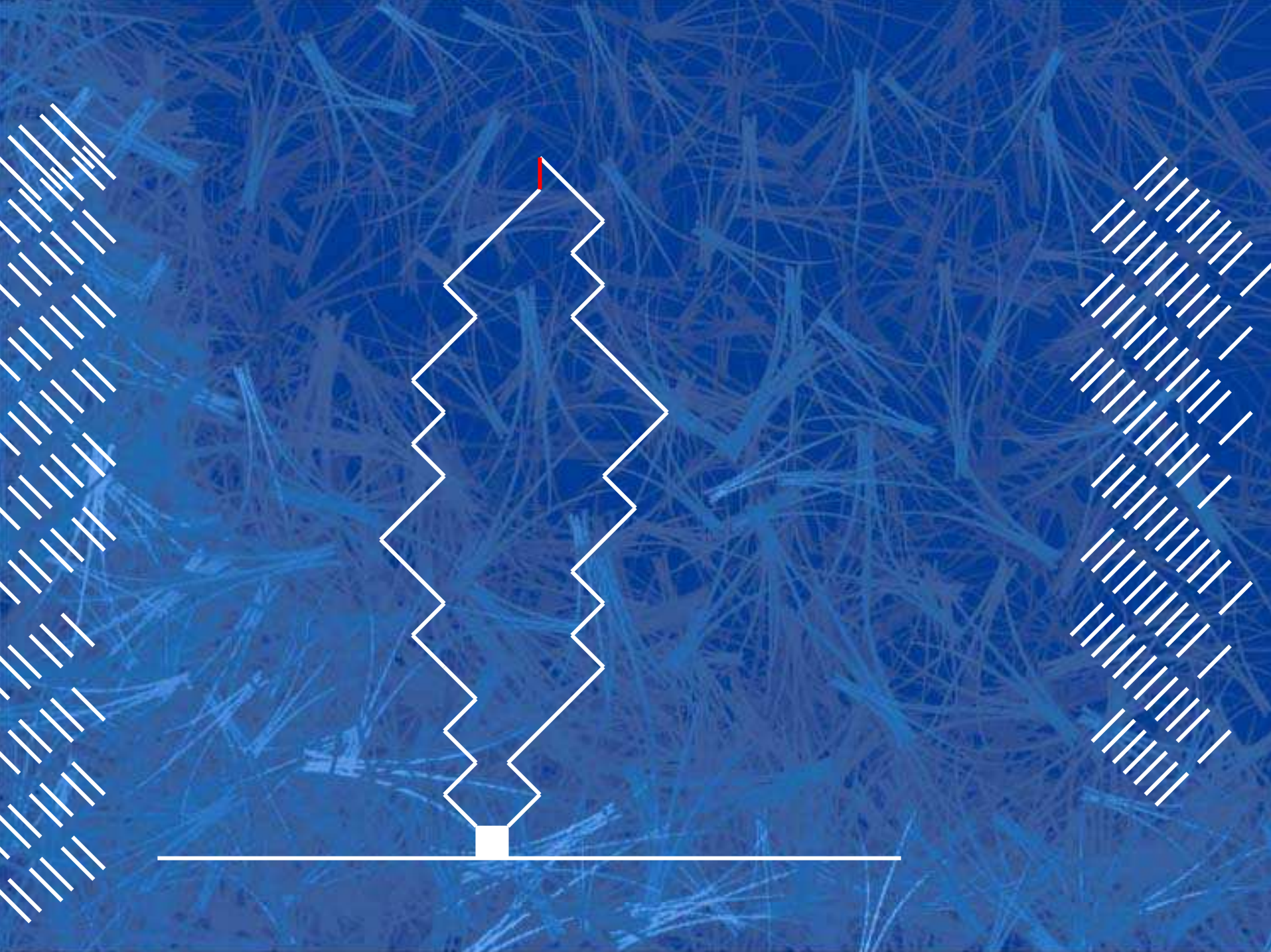






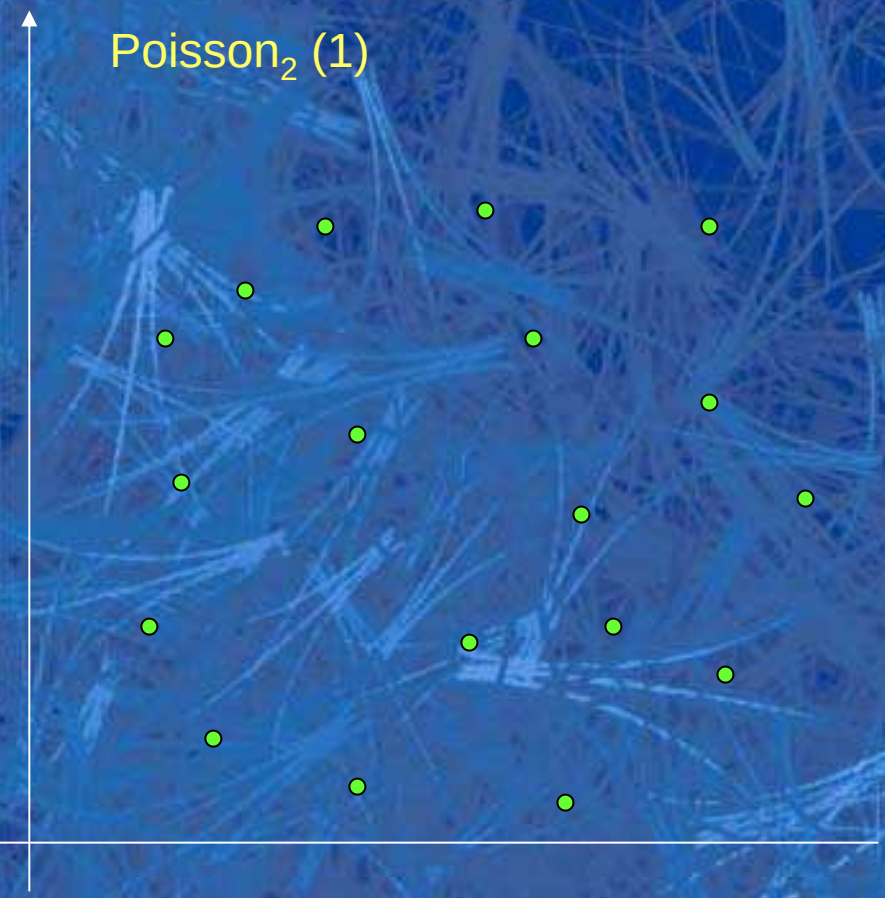






Polynuclear growth (PNG)

The above growth model is particular case of PNG model with columnar defect at one site. (Ulam's problem)



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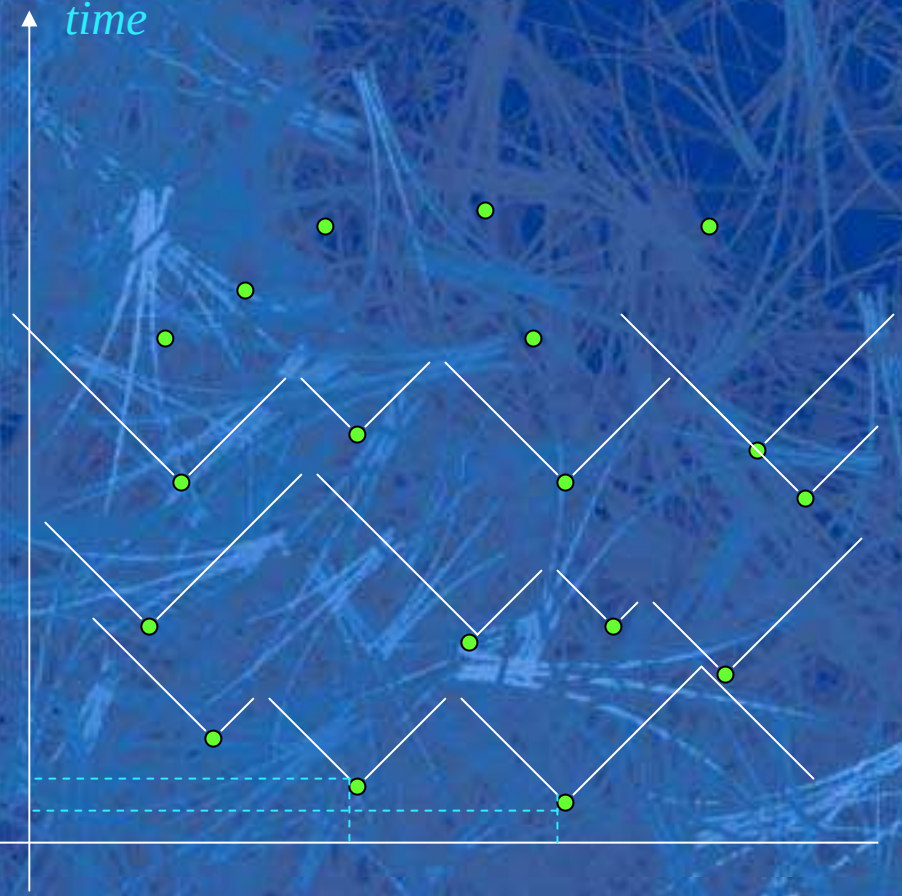
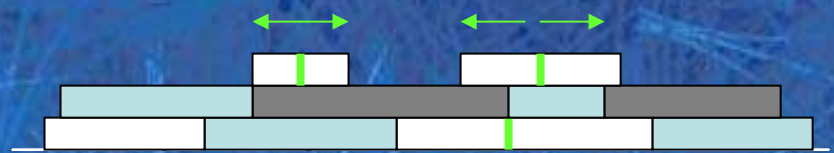


Height of the droplet above given point equals to the number of level lines. [AD]



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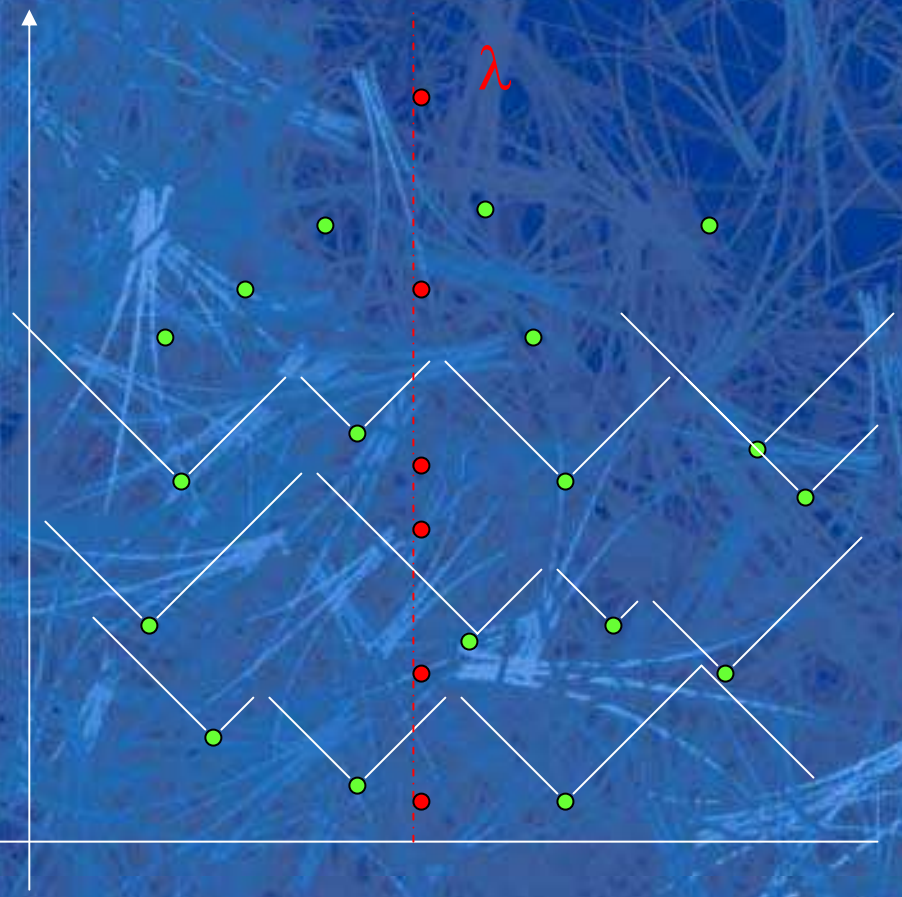
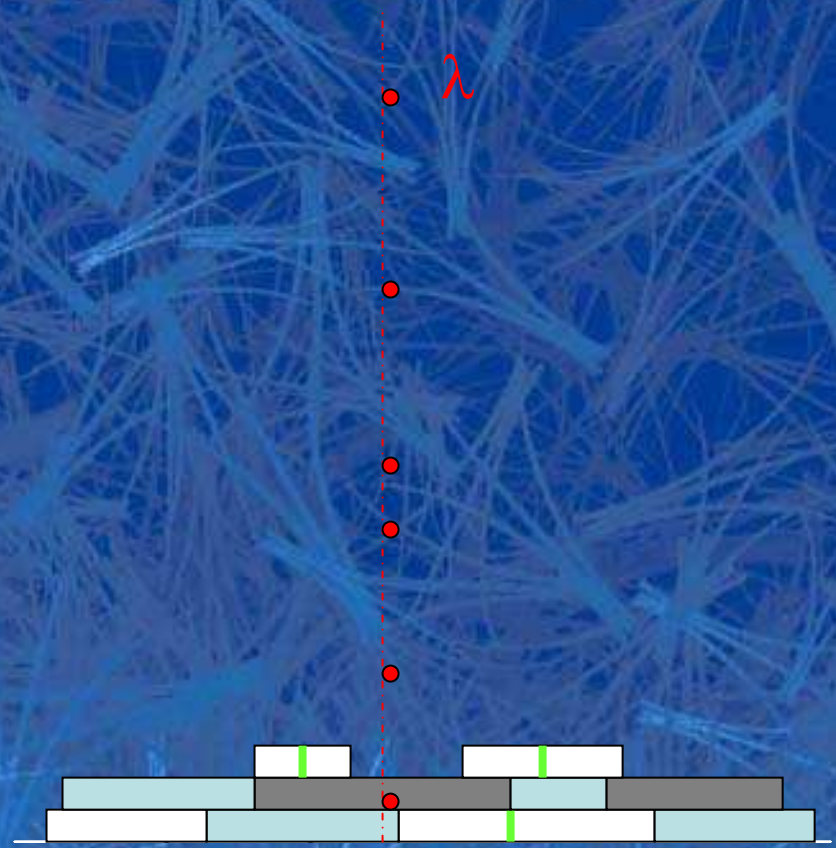
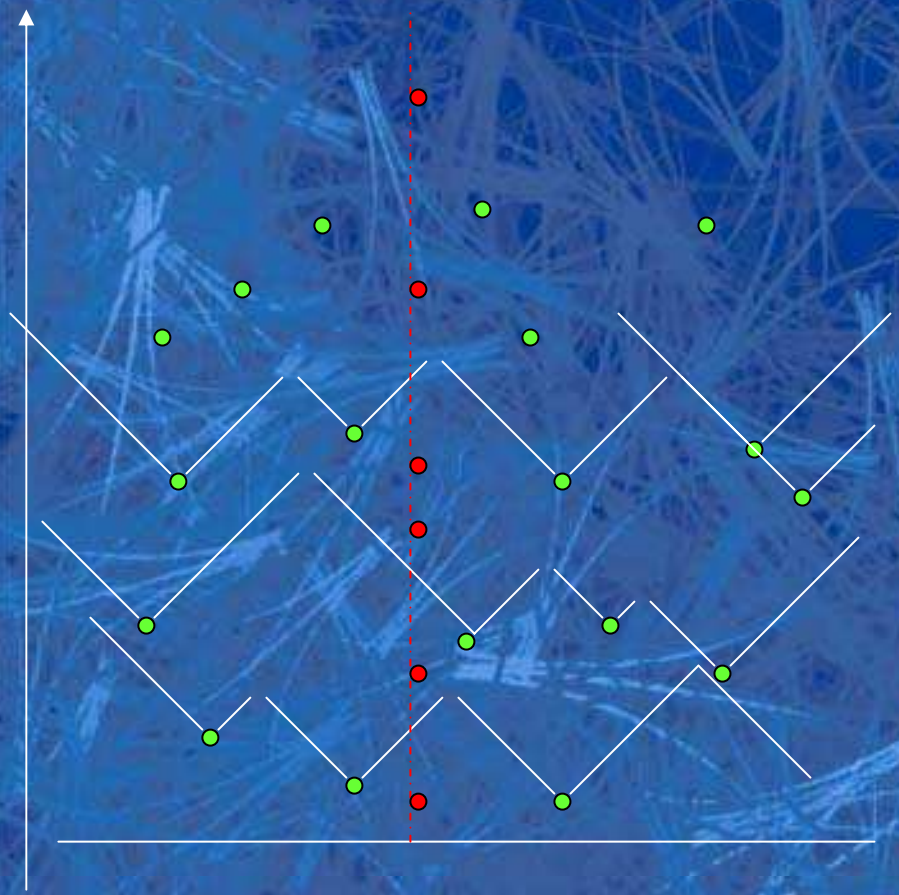




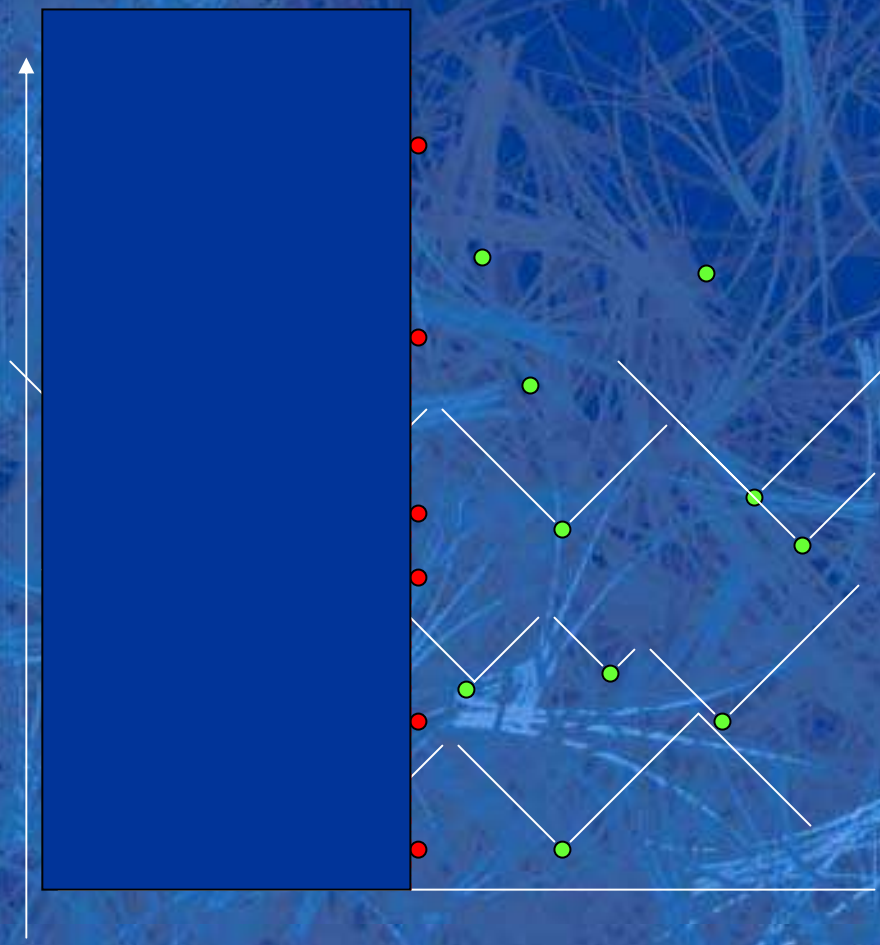
LLN for level lines.

Theorem (V. Beffara, V.S. 2006) For polynuclear growth model $\lambda_c = 0$



Proof. Basic ingredients:

"Half-space case" – J. Baik, E.M. Rains (1999) [BDJ]
T. Sasamoto, T. Imamura (2003)
λ_c (half) = $2^{1/2}$.



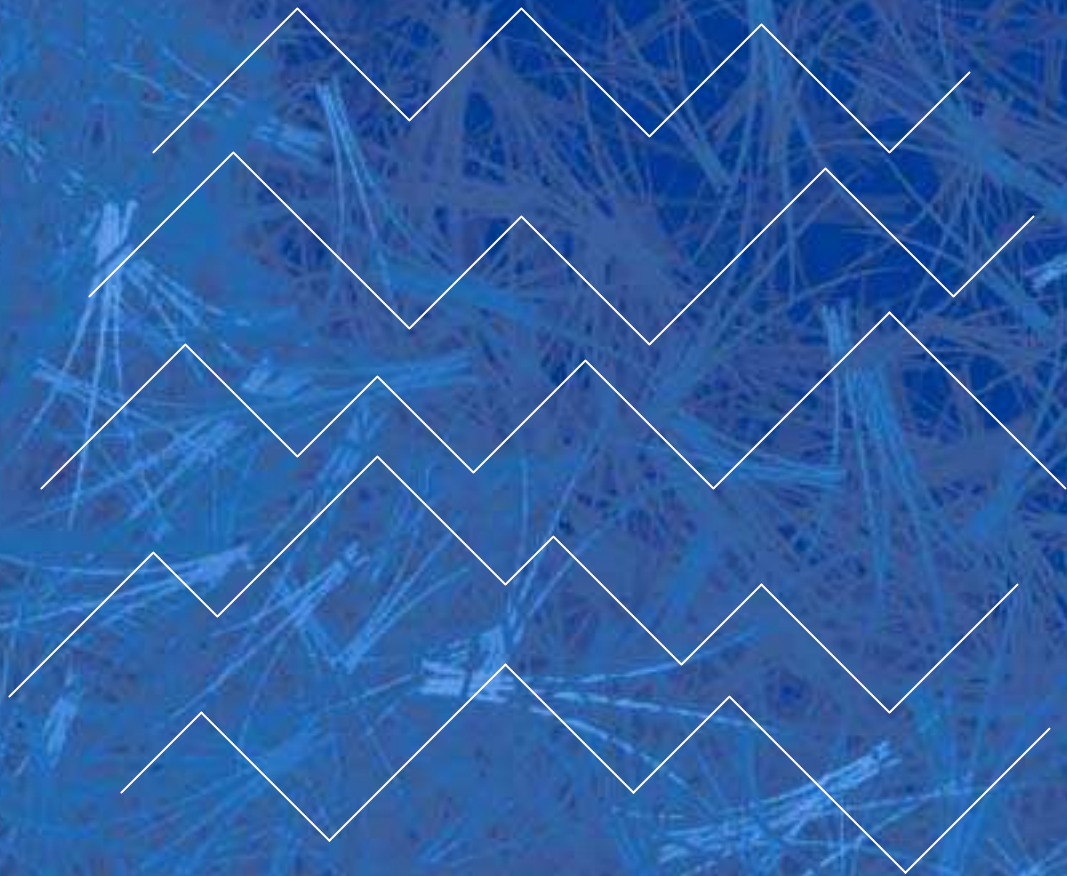
From half space to full space:

"Intersection process" is stationary, with intensity is $2^{3/2}$, (not Poisson).
[V.S., D. Surgailis, M.E.Vares, 1999]

Coupling I:
Half-space + Poisson ($2^{1/2} + \varepsilon$) with full space process restricted to the half plane + Poisson (ε_1) $\Rightarrow$
λ_c (restricted) = 0

Coupling II:
Two restricted processes + Poisson (ε_1) with full space process + Poisson (ε_2)

Percolation of “influence”



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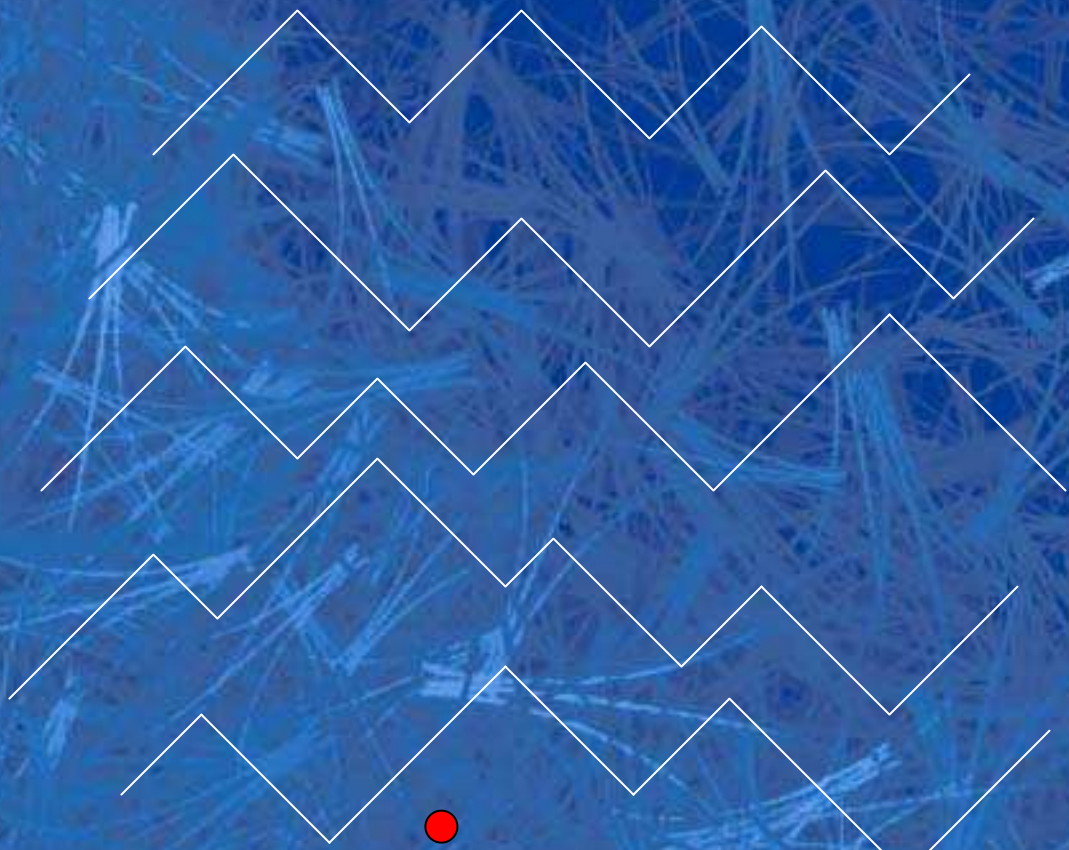

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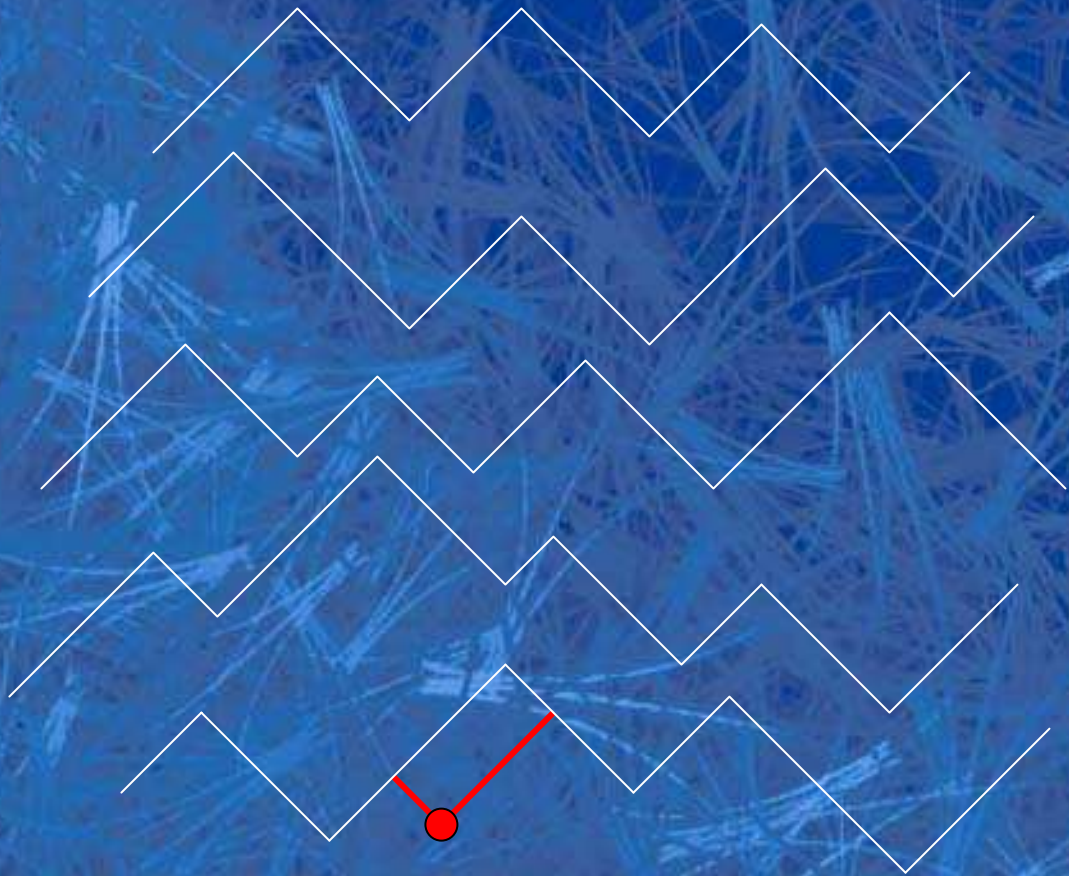

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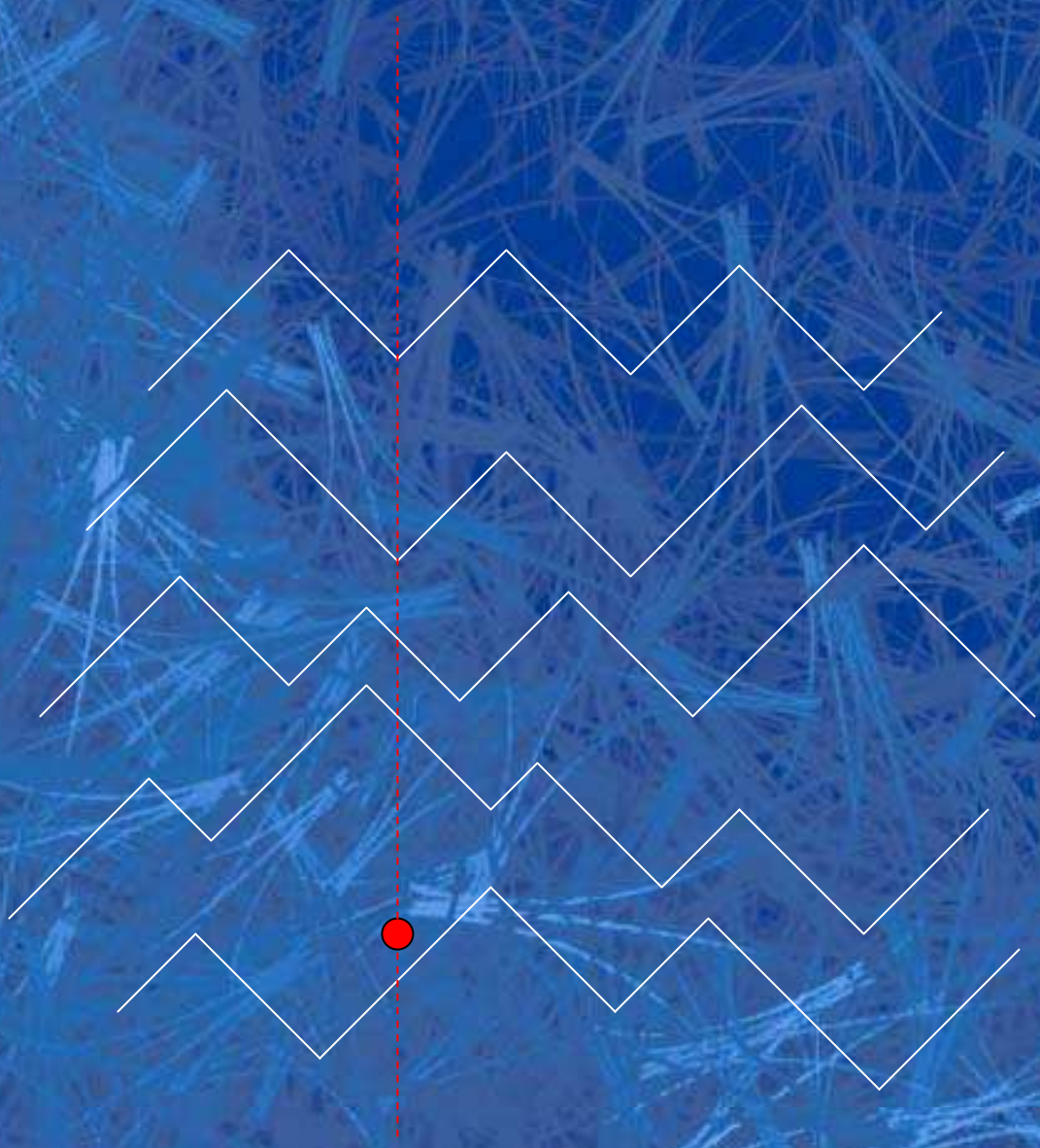

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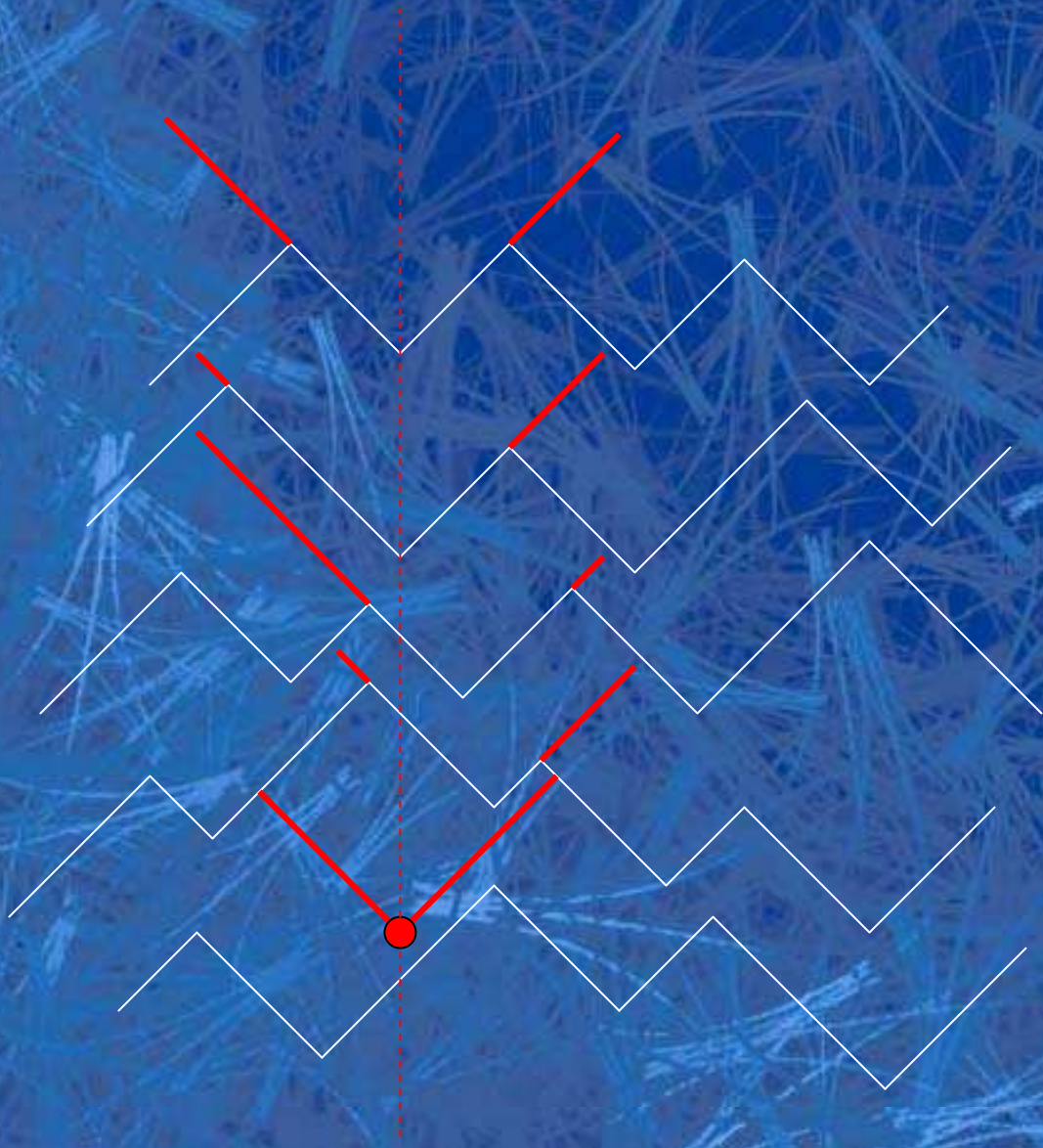

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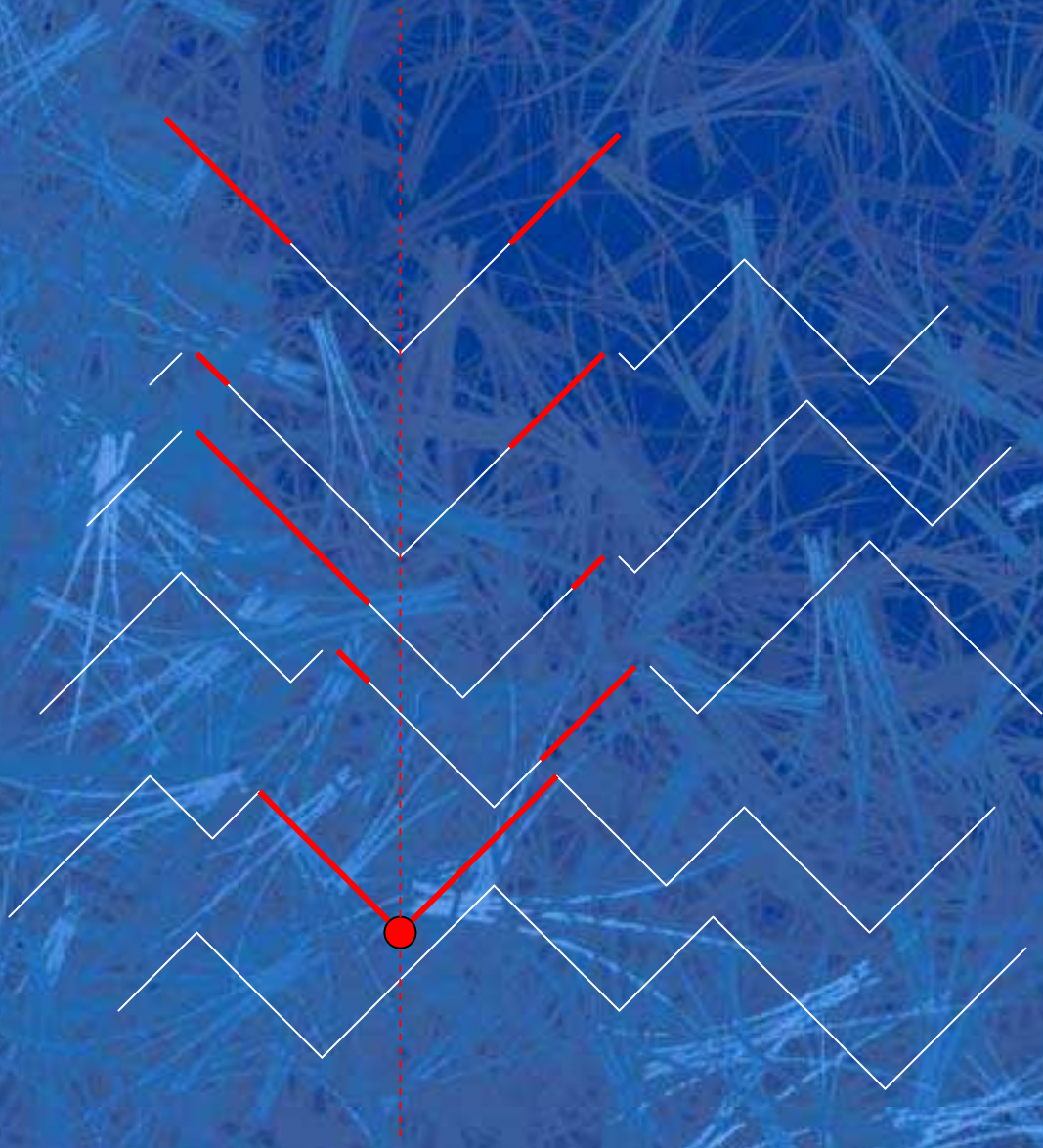

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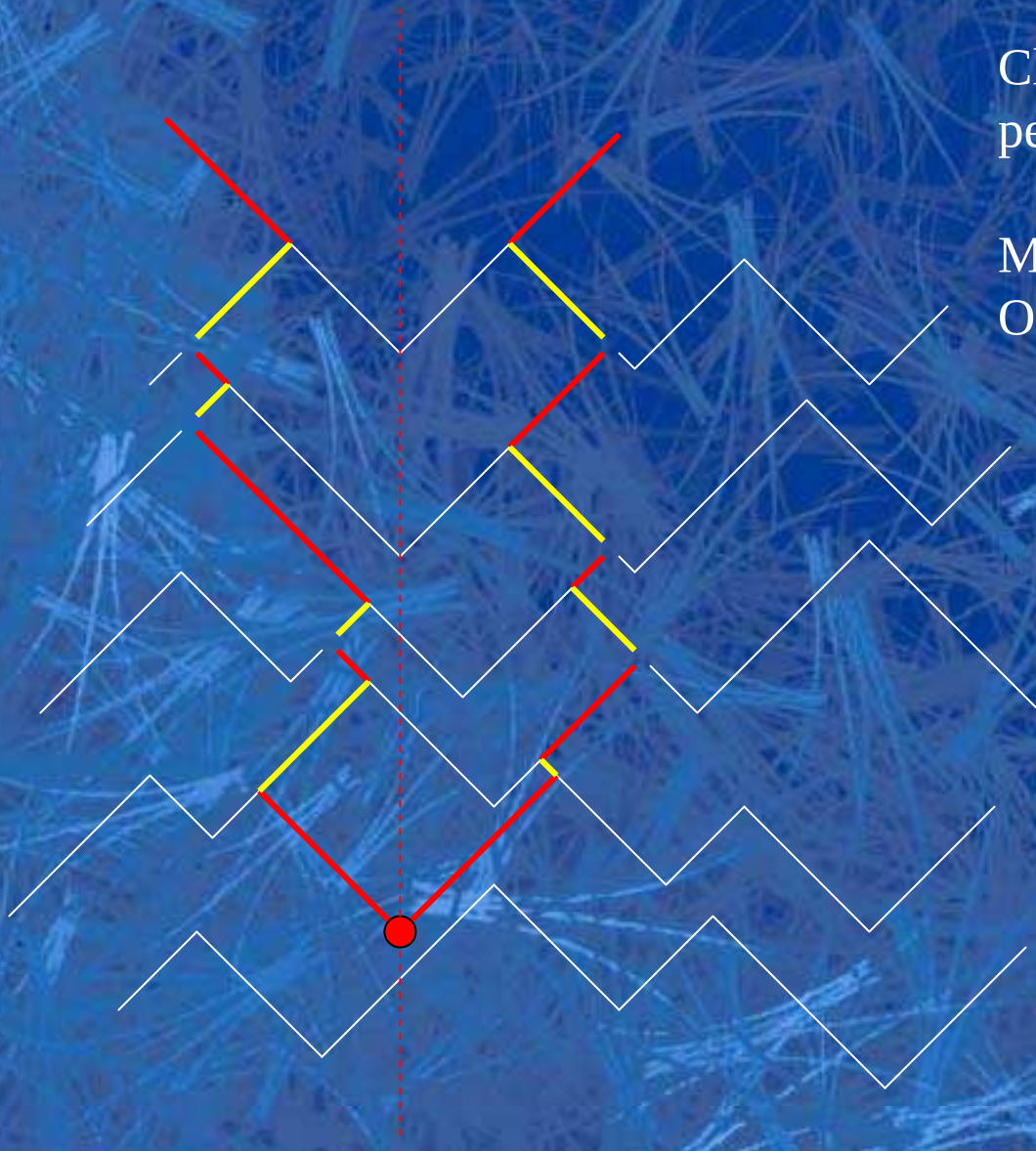
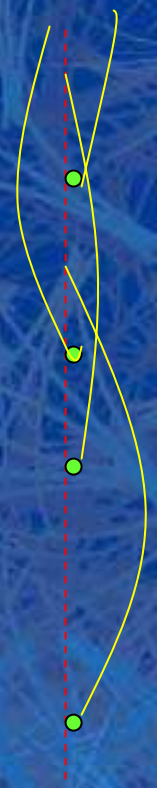


Class of one dimensional long-range percolation models with heavy tails.

M. Aizenman, C.M. Newman (1986)
One-sided Cauchy case



Randomized Polynuclear growth (RPNG)

After nucleation the velocity process of each boundary is a two state Markov which flips at rate $\zeta > 0$.

Theorem (V. Beffara, V.S., M.E. Vares, 2006) For randomized polynuclear growth model $\lambda_c(\zeta) > 0$, for all $\zeta > 0$.