

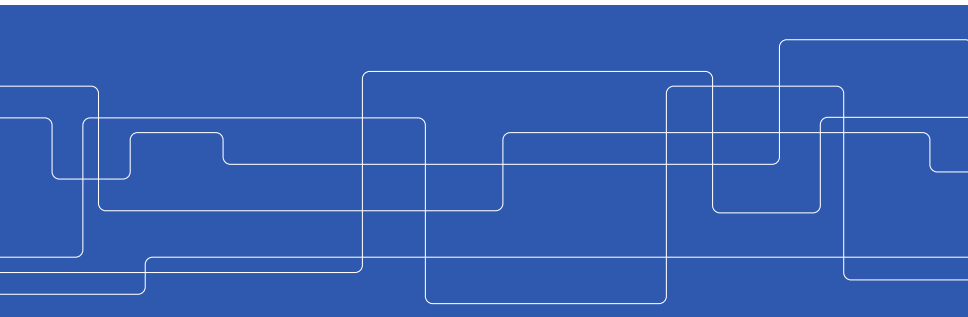


# Weak convergence for a sequence of coalescent processes

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For each  $n \in \mathbb{N}$ ,

- ▶  $\{\mathbf{H}^{(n)}(k)\}_{k \in \mathbb{N}} \subset \mathbb{N}^d$ : the block counting process of the Kingman coalescent, with parent independent mutations, evolving backwards in time ( $d$  types, mutation rate  $\theta$ , mutation probabilities  $(Q_j)_{j=1}^d$ )
- ▶  $\mathbf{X}^{(n)}(k) = \frac{1}{n} \mathbf{H}^{(n)}(k \wedge \tau^{(n)}) \quad k \in \mathbb{N}$
- ▶  $\{\mathbf{M}^{(n)}(k)\}_{k \in \mathbb{N}} = \{(M_{ij}^{(n)}(k))_{i,j=1}^d\}_{k \in \mathbb{N}}$  with  $\mathbf{M}_{ij}^{(n)}(k)$ : number of mutations from type  $i$  to type  $j$  occurred in  $\mathbf{H}^{(n)}$  up to time  $k$

**Theorem (weak convergence):** if  $\mathbf{X}^{(n)}(0) \sim \mu_0^{(n)} \Rightarrow \mu_0$ ,

$$\{(\mathbf{X}^{(n)}(\lfloor nt \rfloor), \mathbf{M}^{(n)}(\lfloor nt \rfloor))\} \Rightarrow_{n \rightarrow \infty} \{(\mathbf{X}(t), \mathbf{M}(t))\}_{t \geq 0}$$

- ▶  $\mathbf{X}$  is a deterministic process

And given  $\mathbf{X}$ , for each  $i, j = 1, \dots, d$ ,

- ▶  $\mathbf{M}_{ij}$  is an independent Poisson processes with varying intensity

$$\lambda_{ij}(t) = \frac{\theta Q_j X_i(t)}{\|\mathbf{X}(t)\|_1^2}.$$