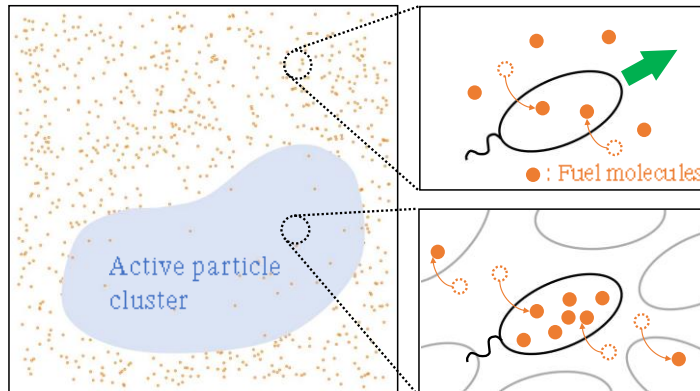


Emergent Dynamic Patterns in Chemokinetic Active Matter with Fuel Consumption

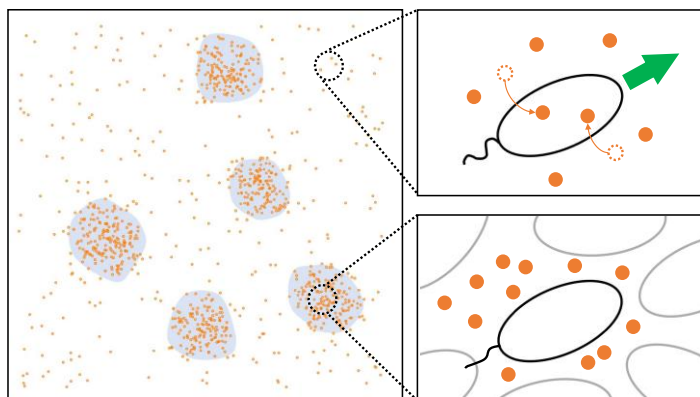
Euijoon Kwon, Seoul National University

Two mechanisms of fuel consumption

Basal Metabolic Regime (BMR)



Active Metabolic Regime (AMR)



The model: particle-based description

Chemokinetic active particles

$$\dot{\mathbf{r}}_k = \mu v[\rho_{\text{local}}, n] \hat{\mathbf{e}}_k + \sqrt{2\mu T} \xi_k, \quad v[\rho_{\text{local}}, n] = \alpha n - \zeta \rho_{\text{local}}$$

slowdown due to collision

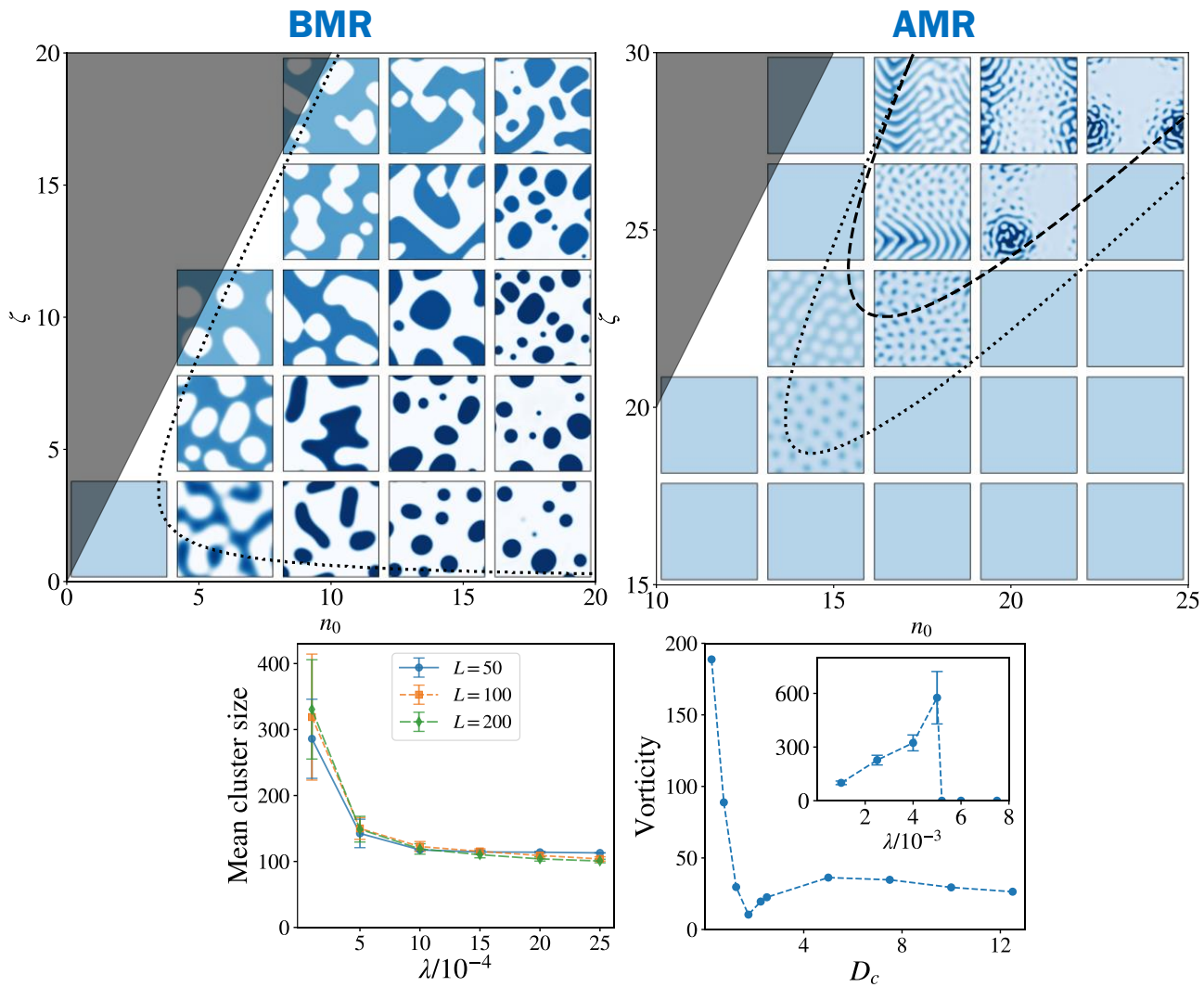
Fuel

$$\dot{n}(\mathbf{r}, t) = \underbrace{D_c \nabla^2 n}_{\text{diffusion of fuel}} + \underbrace{I}_{\text{global injection}} - \underbrace{\lambda f(n, \{\mathbf{r}_k, \dot{\mathbf{r}}_k\})}_{\text{local consumption}}$$

$$f(n, \{\mathbf{r}_k, \dot{\mathbf{r}}_k\}) = \begin{cases} \int d^2\mathbf{r}' n(\mathbf{r}) \delta(\mathbf{r} - \mathbf{r}') \sum_{k'=1}^N \delta(\mathbf{r}' - \mathbf{r}_{k'}), & \text{BMR} \\ \int d^2\mathbf{r}' n(\mathbf{r}) \delta(\mathbf{r} - \mathbf{r}') \sum_{k'=1}^N \dot{\mathbf{r}}_{k'} \cdot \hat{\mathbf{e}}_{k'} \delta(\mathbf{r}' - \mathbf{r}_{k'}), & \text{AMR} \end{cases}$$

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Mean-field hydrodynamics



Particle-based simulation

