UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

Bari Theory Xmas Workshop 2016

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ACTIVE PARTICLE SYSTEMS

From passive co-existence to activity-driven phase separation

SUMMARY

- ACTIVE MATTER
- DUMBBELL MODEL
- PHASE SEPARATION AND PHASE DIAGRAM

ACTIVE MATTER

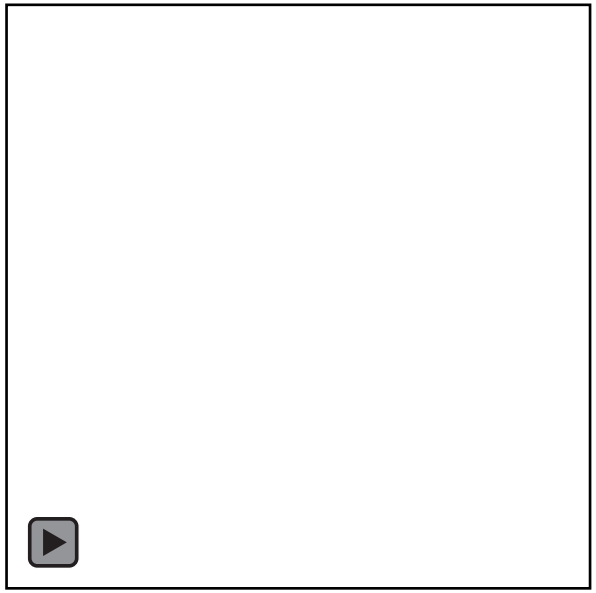
In active matter systems constituents consume energy from the environment and use it to displace.

Active matter is inherently

OUT OF EQUILIBRIUM

New behaviors:

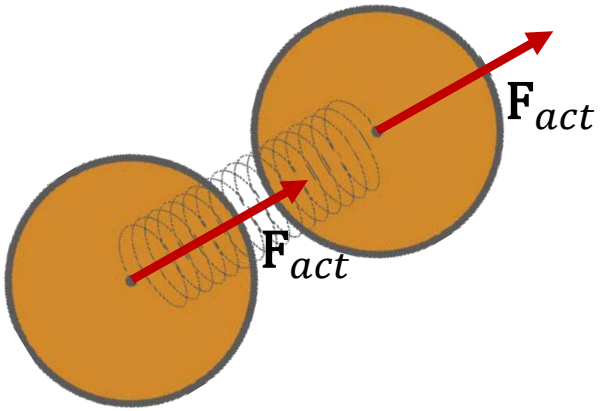
ACTIVITY-INDUCED PHASE SEPARATION



DUMBBELLS

THE 2D DUMBBELL MODEL [1]

- γ friction, $\boldsymbol{\eta}$ uncorrelated Gaussian noise;
- $U_{WCA}(r)$ repulsive potential;
- $F_{FENE}(r)$ finite extensible non-linear force;
- $\mathbf{F}_{act,i}$ active force, constant in magnitude and directed along the main axis.

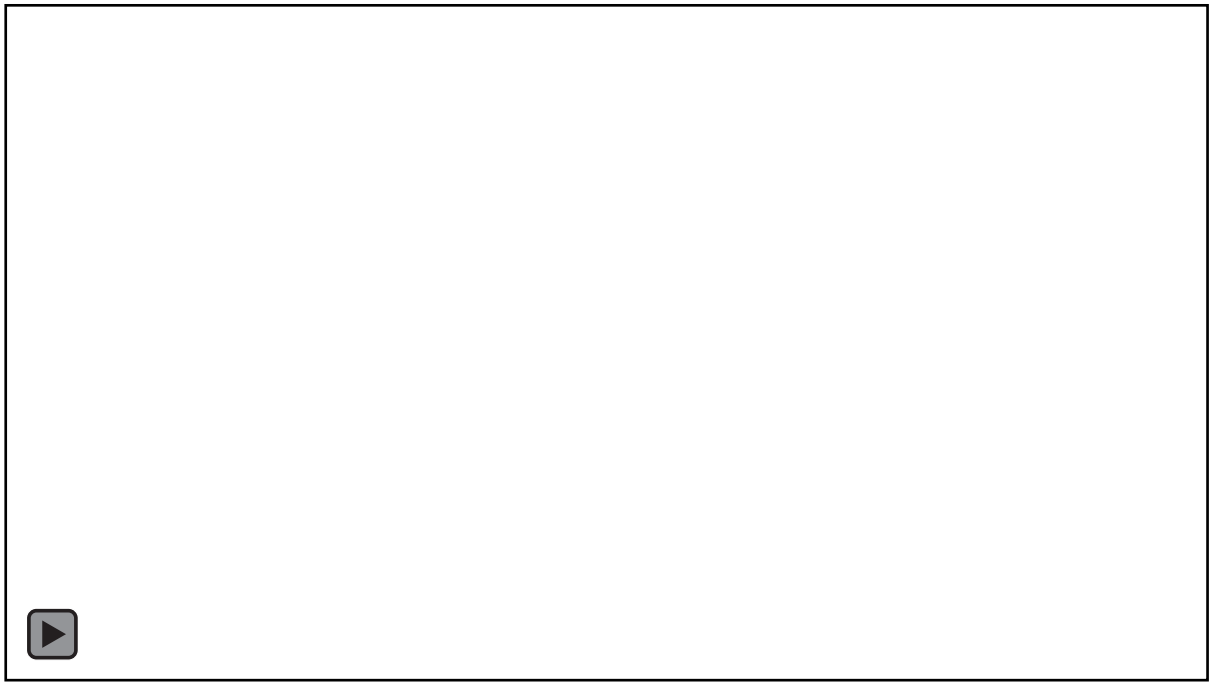


$$m\,\ddot{\boldsymbol{r}}_i(t) = -\gamma\dot{\boldsymbol{r}}_i(t) - \frac{\partial U_{FENE}}{\partial r_{i,i+1}}\hat{\boldsymbol{r}}_{i,i+1} - \sum_{j\neq i}^{2N}\frac{\partial U_{WCA}}{\partial r_{ij}}\hat{\boldsymbol{r}}_{i,j} + \sqrt{2\gamma k_B T}\,\boldsymbol{\eta}_i + \mathbf{F}_{act,i}$$

[1] A. Suma, G. Gonnella, *et al.*, Phys. Rev. E, 2014.

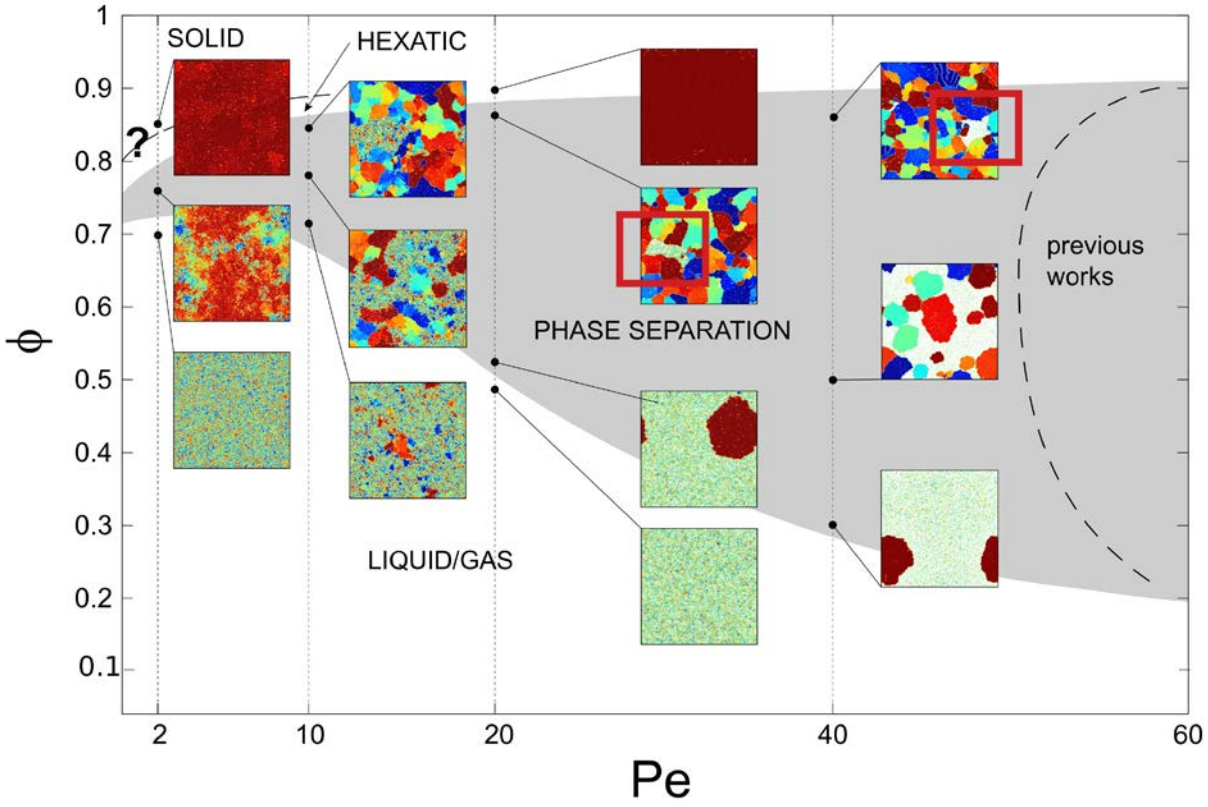
DUMBBELLS

PHASE SEPARATION IN THE DUMBBELL MODEL[1]



[1] L.F. Cugliandolo, P. Digregorio, G. Gonnella, A. Suma, arXiv, 2016.

PHASE DIAGRAM [1]



[1] L.F. Cugliandolo, P. Digregorio, G. Gonnella, A. Suma, **arXiv**, 2016.

THANK YOU FOR YOUR ATTENTION !!