





SCIENTIFIC AND METHOD MODULES

Module name	Symposium Active Assemblies
Number	2022-A1.2
Aims	Active Matter exhibits new dynamic collective properties that would not be
	possible in thermal equilibrium. The Minisymposium aims at elucidating various
	facets of ongoing research in this new fascinating field.
Basics	Recommended knowledge: basic notions of soft and active matter
	Required knowledge: basic notions of statistical mechanics and
	thermodynamics
Contents	The coupling of active components through physical and chemical interactions
	yields dissipative collective states of considerable complexity. They are
	addressed as active indias of tissues, indictualing conesive swarms, of
	integrated circuits processing information to solve computational tasks, such
	as to equip a squadron of cells with the emergent ability to assemble into
	adaptive metastructures or even to think worry and have fun This
	Minisymposium intends to foster discussions and an exchange of ideas
	between scientists with complementary perspectives on emergent phenomena
	at the intersection of active matter and information processing.
Methods	optical microscopy, many-body theory, computer simulations, single particle
	tracking, colloidal self-assembly, DNA origami, machine learning
Type	Three-day block course
Date (month/year)	September 21-23, 2022
Time	see website: https://home.uni-leipzig.de/~physik/sites/active-
	assemblies/program/
Workload	15 hours presence/45 hours self-study
Examination	Report (5 pages, in English): summary of at least 5 talks giving an overview
	of the relevance of the talks topic, the key findings reported and a personal
	statement why you selected the specific talk
	submission until October 5, 2022 to Andrea Kramer: firstname.lastname@uni-
	leipzig.de
Credit points	2
Responsible	Cichos, Kroy, Seidel
scientists	
International guest	see website: <u>https://home.uni-leipzig.de/~physik/sites/active-assemblies/</u>
lecturers	
Industrial partners	-
Recommendations	Introductory Material
for literature, e-	
learning	C. Bechinger, R. Di Leonardo, H. Löwen, C. Reichhardt, G. Volpe, G. Volpe: Active
	particles in complex and crowded environments, Rev. Mod. Phys. 88 , 045006 (2016).
	Topical Material
	K. Kroy, D. Chakraborty, F. Cichos: Hot microswimmers, Eur. Phys. J. Spec. Top. 225,
	2207–2225 (2016).
	S. Mulnos-Landin, A. Fischer, N.A. Söker, F. Cichos: Emergent collective phenomena
	Bhys : Condens, Matter 32 , 103001 (2020)
	Phys. Condens. Maller 32 , 193001 (2020).
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T. Bäuerle, R.C. Löffler, C. Bechinger: Formation of stable and responsive collective states in suspensions of active colloids, Nat. Commun. **11**, 2547 (2020).

M.H. Matheny et al.: Exotic states in a simple network of nanoelectromechanical oscillators, Science **363**, eaav7932 (2019).

V. Soni et al.: The odd free surface flows of a colloidal chiral fluid, Nat. Phys. **15**, 1188–1194 (2019).

A. Aubret, M. Youssef, S. Sacanna, J. Palacci: Targeted assembly and synchronization of self-spinning microgears, Nat. Phys. **14**, 1114–1118 (2018).

J. Palacci, S. Sacanna, A.P. Steinberg, D.J. Pine, P.M. Chaikin: Living crystals of light-activated colloidal surfers, Science **339**, 936–940 (2013).

S. Ketzetzi, M. Rinaldin, P. Dröge, J. de Graaf, D.J. Kraft: Activity-induced interactions, and cooperation of artificial microswimmers in one-dimensional environments, Nat. Commun. **13**, 1772 (2022).

F. Ginot et al.: Nonequilibrium equation of state in suspensions of active colloids, Phys. Rev. X **5**, 1–8 (2015).

A.C.H. Tsang, A.T. Lam, I.H. Riedel-Kruse: Polygonal motion and adaptable phototaxis via flagellar beat switching in the microswimmer Euglena gracilis, Nat. Phys. **14**, 1216–1222 (2018).

L.S. Palacios et al.: Guided accumulation of active particles by topological design of a second-order skin effect, Nat. Commun. **12**, 4691 (2021).

P. Rahmani, F. Peruani, P. Romanczuk: Topological flocking models in spatially heterogeneous environments, Commun. Phys. **4**, 206 (2021).

F. Cichos, K. Gustavsson, B. Mehlig, G. Volpe: Machine learning for active matter, Nat. Mach. Intell. **2**, 94–103 (2020).

U. Khadka, V. Holubec, H. Yang, F. Cichos: Active particles bound by information flows, Nat. Commun. **9**, 3864 (2018)

G. Falasco, R. Pfaller, A.P. Bregulla, F. Cichos, K. Kroy: Exact symmetries in the velocity fluctuations of a hot Brownian swimmer, Phys. Rev. E **94**, 030602(R) (2016).