Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Active carpets, part 1: Transport driven by bacterial clusters and topological defects[1] FRANCISCA GUZMN-LASTRA, Universidad Mayor, ARNOLD MATHIJSSEN, Stanford University, ANDREAS KAISER, Retired, HARTMUT LWEN, Heinrich-Heine University — Biological activity is highly concentrated on surfaces, from molecular motors and ciliary arrays to sessile suspension feeders and biofilms together they form the class of 'active carpets'. While the physics of active suspensions has raised considerable interest, it remains unclear how energy and momentum injection from active surfaces can drive living systems out of equilibrium. Here we demonstrate that active carpets of bacteria or self-propelled colloids generate coherent flows towards the substrate, and we propose that these currents provide efficient pathways to replenish nutrients that feed back into activity. A full theory is developed in terms of gradients in the active matter density and velocity, and applied to bacterial turbulence, topological defects and clustering. Currents with complex spatiotemporal patterns are obtained, which are tunable through confinement. Our findings show that diversity in carpet architecture is essential to maintain biofunctionality.

[1]A. M. acknowledges funding from the Human Frontier Science Program (Fellowship LT001670/2017). F. G. L. acknowledges Millennium Nucleus Physics of active matter of the Millennium Scientific Initiative of the Ministry of Economy, Development and Tourism, Chile. H. L. acknowledges support from the Deutsche Forschungsgemeinschaft, DFG Project No. LO 418/17-2

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Date submitted: 31 Jul 2019 Electronic form version 1.4