Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Rheology of active polar emulsions: from linear to unidirectional and unviscid flow, and intermittent viscosity GIUSEPPE NEGRO, LIVIO NICOLA CARENZA, Dipartimento di Fisica, Universita degli Studi di Bari and INFN, Sezione di Bari, via Amendola 173, Bari, I-70126, Italy,, ANTONIO LAMURA, Istituto Applicazioni Calcolo, CNR, Via Amendola 122/D, I-70126 Bari, Italy, GIUSEPPE GONNELLA, Dipartimento di Fisica, Universita degli Studi di Bari and INFN, Sezione di Bari, via Amendola 173, Bari, I-70126, Italy,, ADRIANO TIRIBOCCHI, Center for Life Nano Science@La Sapienza, Istituto Italiano di Tecnologia, 00161 Rome, Italy — Active fluids are systems where active components present in the fluid (microtubules with molecular motors such as kinesin or actomyosin bundles) display interesting collective ordering properties. Active fluids also exhibit peculiar rheological properties. Depending on the characteristic of the active stress, activity is capable to heighten viscosity, enough to develop shear-thickening properties in contractile systems or induce in extensile suspensions a superfluid regime under suitable condition. We study, by lattice Boltzmann methods, the rheological behavior of an emulsion made of an active polar component and an isotropic passive fluid. Different flow regimes are found by varying the values of shear rate and extensile activity (occurring, e.g., in microtubule-motor suspensions). By increasing activity, a first transition occurs from linear flow regime to spontaneous persistent unidirectional macro-scale flow, followed by another transition either to (low shear) intermittent flow regime with coexistence of states with positive, negative, and vanishing apparent viscosity, or to (high shear) symmetric shear thinning regime.

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Date submitted: 02 Aug 2019 Electronic form version 1.4