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Dynamic self-assembly of magnetic particles on the fluid interface: surface wave assisted effective magnetic exchange ALEXEY SNEZHKO, IGOR ARANSON, WAI-KWONG KWOK, Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439 — Novel dynamic self-assembled multi-segment magnetic structures ("snakes") induced by a vertical alternating magnetic field in an ensemble of magnetic particles suspended on a liquid/air interface are reported. We demonstrate that these structures are directly related to surface waves in the liquid generated by the collective response of magnetic microparticles to the alternating magnetic field. The segments of magnetic "snake" exhibit long-range antiferromagnetic ordering mediated by the surface waves, while each segment is composed of ferromagnetically aligned chains of microparticles. To describe observed magnetic behavior of the generated structures we propose a simple phenomenological model where the effect of surface waves is replaced by an effective exchange interaction. In the framework of the proposed model the effective exchange constants corresponding to different regimes of magnetic driving were extracted from the experimental data.

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