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**Flagellum synchronization inhibits large-scale hydrodynamic instabilities in sperm suspensions** SIMON F. SCHÖLLER[1], ERIC E. KEAVENY, Imperial College London — Sperm in suspension can exhibit large-scale collective motion and form coherent structures. Our picture of such coherent motion is largely based on reduced models that treat the swimmers as self-locomoting rigid bodies that interact via steady dipolar flow fields. Swimming sperm, however, have many more degrees of freedom due to elasticity, have a more exotic shape, and generate spatially-complex, time-dependent flow fields. While these complexities are known to lead to phenomena such as flagellum synchronization and attraction, how these effects impact the overall suspension behaviour and coherent structure formation is largely unknown. Using a computational model that captures both flagellum beating and elasticity, we simulate suspensions on the order of $10^3$ individual swimming sperm cells whose motion is coupled through the surrounding Stokesian fluid. We find that the tendency for flagella to synchronize and sperm to aggregate inhibits the emergence of the large-scale hydrodynamic instabilities often associated with active suspensions. However, when synchronization is repressed by adding noise in the flagellum actuation mechanism, the picture changes and the structures that resemble large-scale vortices appear to re-emerge.

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