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Structure and Dynamics of Disclination Loops and Lines in 3D Active Nematic Flows DANIEL BELLER, University of California, Merced, GUILLAUME DUCLOS, Brandeis University, RAYMOND ADKINS, University of California, Santa Barbara, DEBARGHYA BANERJEE, Max Planck Institute for Dynamics and SelfOrganization and Universiteit Leiden, MATTHEW PETERSON, MINU VARGHESE, Brandeis University, ITAMAR KOLVIN, University of California, Santa Barbara, ARVIND BASKARAN, Brandeis University, ROBERT PELCOVITS, THOMAS POWERS, Brown University, APARNA BASKARAN, Brandeis University, FEDERICO TOSCHI, Eindhoven University of Technology, MICHAEL HAGAN, Brandeis University, SEBASTIAN STREICHAN, University of California, Santa Barbara, VINCENZO VITELLI, University of Chicago, ZVONIMIR DOGIC, Brandeis University — Topological defects are essential to the chaotic self-stirring of active nematics, whose internally driven flows couple to orientational distortions. However, while the 2D case is well-studied, in 3D the nematic topological defects become much more complex, including curvilinear disclinations of variable winding character. To understand 3D active nematic flow dynamics, we present calculations of active hydrodynamics with nematic elasticity, together with topological analysis of data from the first experiments on bulk 3D active nematics. We show that the dominant topological excitations are a certain geometrical family of topologically neutral closed-loop disclinations, which move, deform, reconnect, and self-annihilate under the flow fields that they generate.

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