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Effects of an imposed axial flow on a Ferrofluidic Taylor-Couette flow SEBASTIAN ALTMEYER, Universitat Politecnica de Catalunya, YOUNG-HAE DO, Kyungpook National University — We investigate the effects of an externally imposed axial mass flux (axial pressure gradient, axial through flow) on ferrofluidic Taylor-Couette flow under the influence of either an axial or a transverse magnetic field. Without an imposed axial through flow, due to the symmetry-conserving axial field and the symmetry-breaking transverse field, it gives rise to various vortex flows in ferrofluidic Taylor-Couette flow such as wavy Taylor vortex flow (wTVF), wavy spiral vortex flow (wSPI) and wavy vortex flows (wTVF_{H_x} and wSPI_{H_x}), which are typically produced by a nonlinear interaction of rotational, shear and magnetic instabilities. In addition, when an axial through flow is imposed to a ferrofluidic Taylor-Couette flow in the presence of either an axial or a transverse magnetic field, previously unknown new helical vortex structures are observed. In particular, we uncover modulated Mixed-Cross-Spirals with a combination of at least three different dominant azimuthal wavenumbers. Emergence of such new flow states indicates richer but potentially more controllable dynamics in ferrofluidic flows, i.e., an imposed axial through flow will be a new controllable factor/parameter in applications of a ferrofluidic and magnetic flows.

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