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Numerical study of polarized viscous vortex reconnection JIE YAO, FAZLE HUSSAIN, Texas Tech University — Polarized vortical structures (i.e. with axial flow, hence coiled vortex lines) are generic to turbulent flows; hence studying their dynamics and interactions is essential to understanding turbulence phenomena. Vortex reconnection is a frequent event in turbulent shear flows and play an important role in energy cascade, mixing and noise generation. To quantify the polarization effect on vortex reconnection, direct numerical simulation of two anti-parallel helical vortex tubes is performed for vortex Reynolds numbers (≡*circulation/viscosity)* up to 9 000 and initial swirl numbers q (≡*peak azimuthal velocity/peak axial velocity*) between 4 and 0.75. For both the same and opposite polarized cases, the reconnection event is delayed as polarization strength increases (i.e., q decreases), but with a higher circulation transfer rate during reconnection. Compared with the unpolarized case, enstrophy and energy dissipation rates are suppressed for weaker polarized ($q>1.5$) cases, but surprisingly enhanced for strong polarized ($q<1.5$) cases. In addition, increasing the polarization strength alters the energy spectrum in the inertial range with a scaling varying from $k^{-5/3}$ for the unpolarized case to $k^{-7/3}$ for the strongly polarized cases. Hence polarization is found to significantly alter vortex reconnection dynamics.

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