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Vortex reconnections and rebounds in trapped atomic BoseEinstein condensates LUCA GALANTUCCI, School of Mathematics and Statistics, Newcastle Univ., SIMONE SERAFINI, ELENA ISENI, TOM BIENAIME', RUSSELL BISSET, FRANCO DALFOVO, GIACOMO LAMPORESI, GABRIELE FERRARI, INO-CNR BEC Center and Dipartimento di Fisica, Univ. di Trento, CARLO F. BARENGHI, School of Mathematics and Statistics, Newcastle Univ. — Reconnections and interactions of filamentary coherent structures play a fundamental role in the dynamics of classical and quantum fluids, plasmas and nematic liquid crystals. In quantum fluids vorticity is concentrated into discrete (quantised) vortex lines (unlike ordinary fluids where vorticity is a continuous field), turning vortex reconnections into isolated events, conceptually easier to study. In order to investigate the impact of non-homogeneous density fields on the dynamics of quantum reconnections, we perform a numerical study of two-vortex interactions in magnetically trapped elongated Bose–Einstein condensates in the T=0 limit. We observe different vortex interactions regimes depending on the vortex orientations and their relative velocity: unperturbed orbiting, bounce dynamics, single and double reconnection events. The key ingredients driving the dynamics are the anti-parallel preferred alignment of the vortices and the impact of density gradients arising from the inhomogeneity of the trapping potential. The results are confirmed by ongoing experiments in Trento performed employing an innovative non–destrutive real–time imaging technique capable of determining the axial dynamics and the orientation of the vortices.

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