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Inverse Energy cascade in 3D Navier-Stokes eqs LUCA BIFERALE, University of Rome "Tor Vergata", Italy, STEFANO MUSACCHIO, CNRS-Nice, France, FEDERICO TOSCHI, Applieed Physics, TUE, The Netherlands, ICTR COLLABORATION — We study the statistical properties of homogeneous and isotropic three-dimensional (3D) turbulent flows. We show that all 3D flows in nature possess a subset of possible non-linear evolution leading to a reverse energy transfer: from small to large scales. Up to now, such inverse cascade was only observed in flows under strong rotation and in quasi two-dimensional geometries under strong confinement. We show here that energy flux is always reversed when mirror symmetry is broken leading to a distribution of helicity in the system with a well defined sign at all wavenumbers. Our findings broaden the range of flows where inverse energy cascade may be detected and rationalize the role played by helicity in the energy transfer process showing that both 2D and 3D properties naturally coexist in all flows in nature.

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