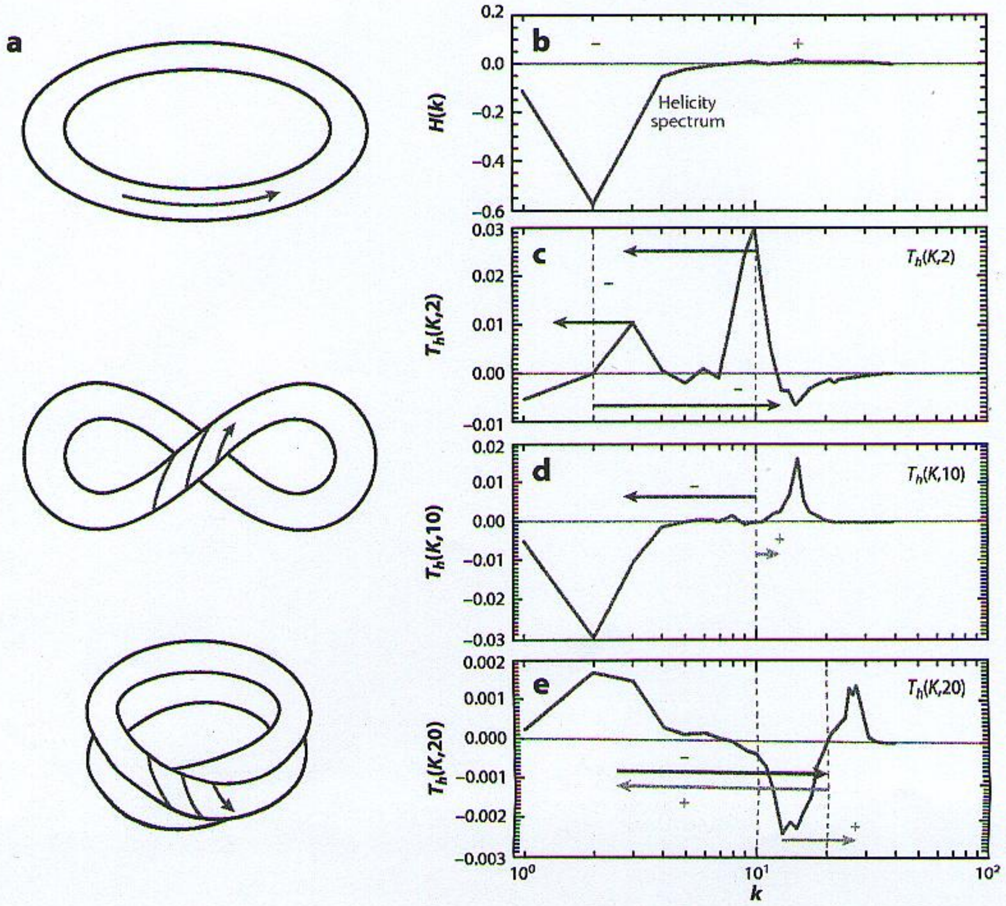

Figure 5

(*a*) The stretch, twist, and fold dynamo mechanism. Each time a closed magnetic flux tube is twisted, magnetic helicity of opposite sign is created at large and small scales. The folding creates regions where helical magnetic fields can reconnect. (*b*) The helicity spectrum in a simulation with (positive) helical mechanical forcing at $k = 10$. Magnetic helicity is negative at larger scales and positive at smaller scales. (*c–e*) The transfer of helicity for $Q = 2$, 10, and 20. The red arrows indicate the transfer of negative helicity, and the blue arrows represent the transfer of positive helicity. At large scales (*c*), negative magnetic helicity inversely cascades locally between neighboring shells and nonlocally from the forced shell to the small-scale shells. At the forced shell (*d*), the forcing injects opposite signs of helicity at large and small scales. At small scales (*e*), positive magnetic helicity has a local direct transfer of helicity, while the small scales also remove negative magnetic helicity from the large scales. Note that the direct transfer of negative helicity is equivalent to the inverse transfer of positive helicity.

equal amounts of magnetic helicity of opposite signs at large and small scales. The process can be understood using the conceptual stretch, twist, and fold dynamo mechanism (Childress & Gilbert 1995, Vainshtein & Zeldovich 1972). Each time a closed magnetic flux tube is twisted by the helical velocity field, magnetic helicity is created at large scales, while small-scale magnetic field lines are twisted in the opposite direction, thus creating an equal amount of magnetic helicity of opposite sign in the small scales. As the stretch, twist, and fold process is repeated, the large-scale helicity is transferred inversely both locally and nonlocally (with constant flux), while the small-scale helicity is pushed toward smaller scales (see **Figure 5**). This latter process removes magnetic helicity from the large scales and allows the magnetic field to disentangle through reconnection

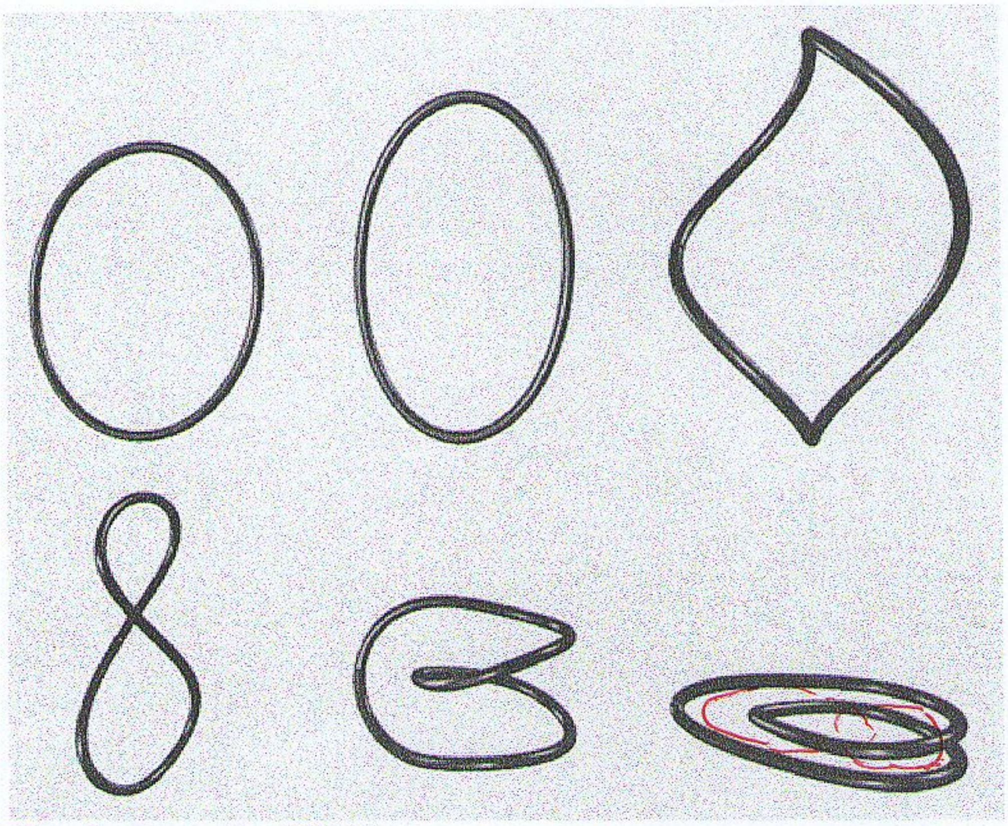

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Figure 1. The STF process. Top row: An initial circular flux tube (□ = 0) is stretched (□ = 0) and twisted (□ = 0.295). Bottom row: The tube is compressed into a figure 8 (□ = 0.739), folded (□ = 1.12), and compressed again (□ = 1.15). Writhe can be computed by counting the (signed) number of crossings seen in a plane projection, then averaging over all projection angles. Thus, for the figure 8, a positive crossing is seen from 74% of all projection angles. Note that the last two tubes have a writhe slightly >1; from some angles these tubes exhibit two crossings (e.g., if rotated from their present positions by 45° about the vertical).