Calculation of the Helicity

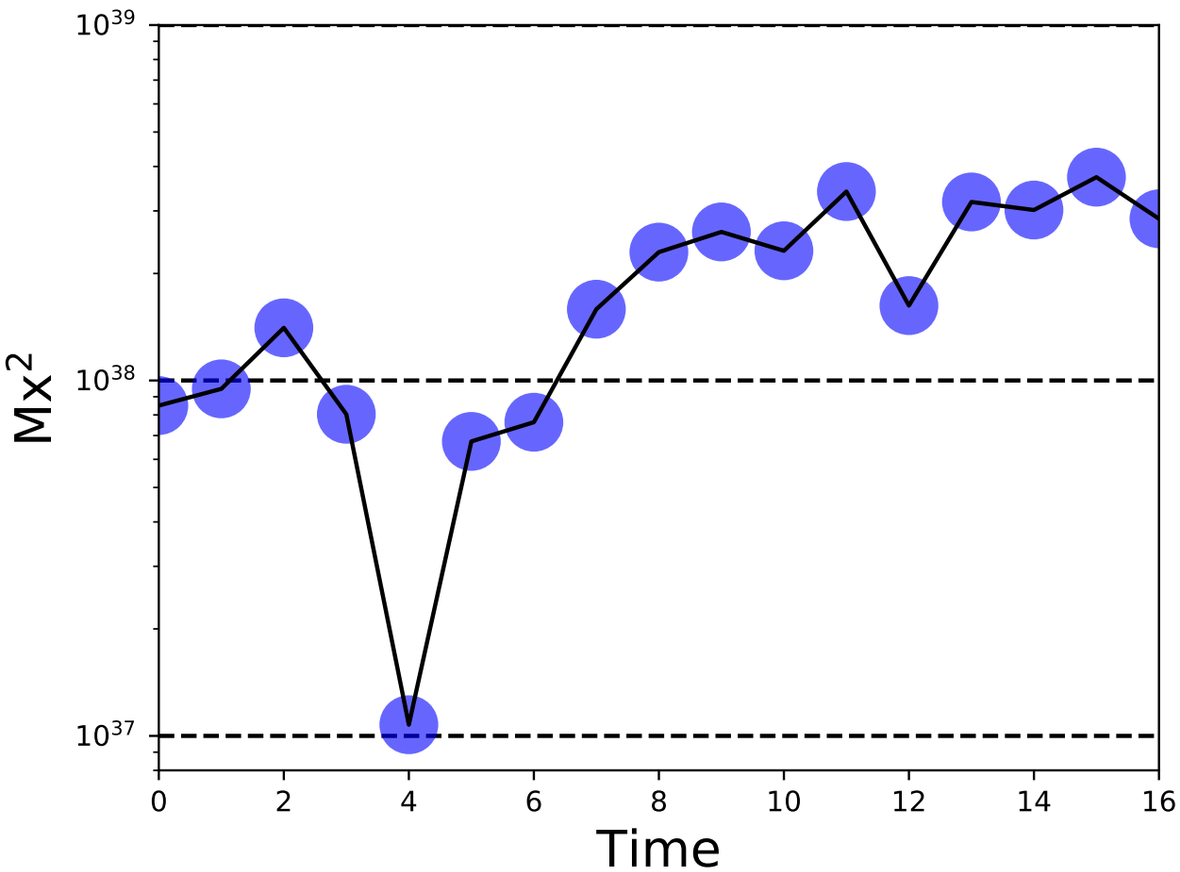
DeVore gauge

$$\begin{cases} A_x(x,y,z) = \int_0^z B_y(x,y,z')\mathrm{d}z' \\ A_y(x,y,z) = f(x,y) - \int_0^z B_x(x,y,z')\mathrm{d}z' \\ A_z(x,y,z) = 0 \\ f(x,y) = \int_0^x B_z(x',y,0)\mathrm{d}x' \end{cases}$$

Malanushenko & Longcope (2009)

$$H_R = \int_\Omega (\mathbf{B} - \mathbf{P}) \cdot (\mathbf{A} + \mathbf{A}_p)\mathrm{d}^3\vec{x}$$

Finn & Antonsen (1985)



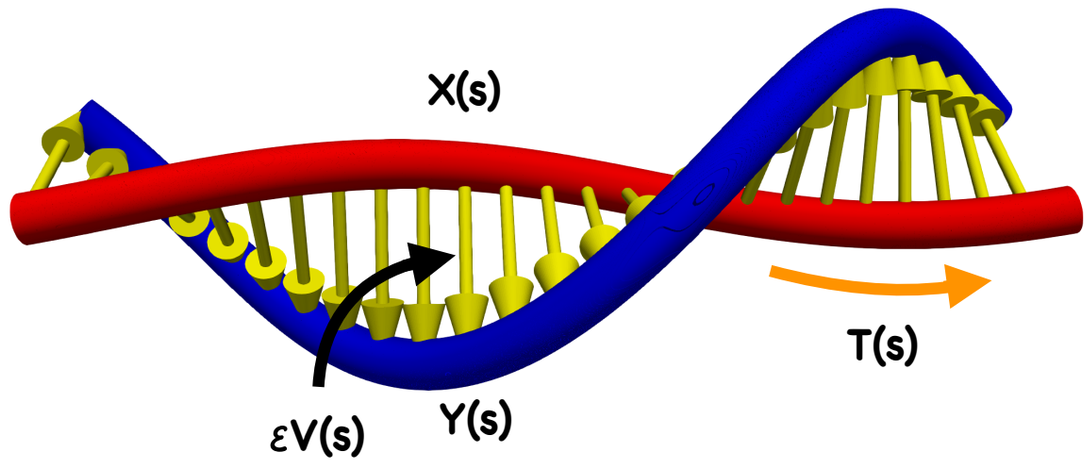
B

Twist

There are three geometrically distinct ways of storing Helicity—or winding vortex field-lines—in vortex tubes

Parallel Current Integral

$$\mathcal{T} = \frac{1}{c}\int \frac{J_{\parallel}}{|\mathbf{B}|}\mathrm{d}s$$



$$\mathcal{T} = \frac{1}{2\pi}\int \mathbf{T}\cdot\mathbf{V}\times\frac{\mathrm{d}V}{\mathrm{d}s}\mathrm{d}s$$