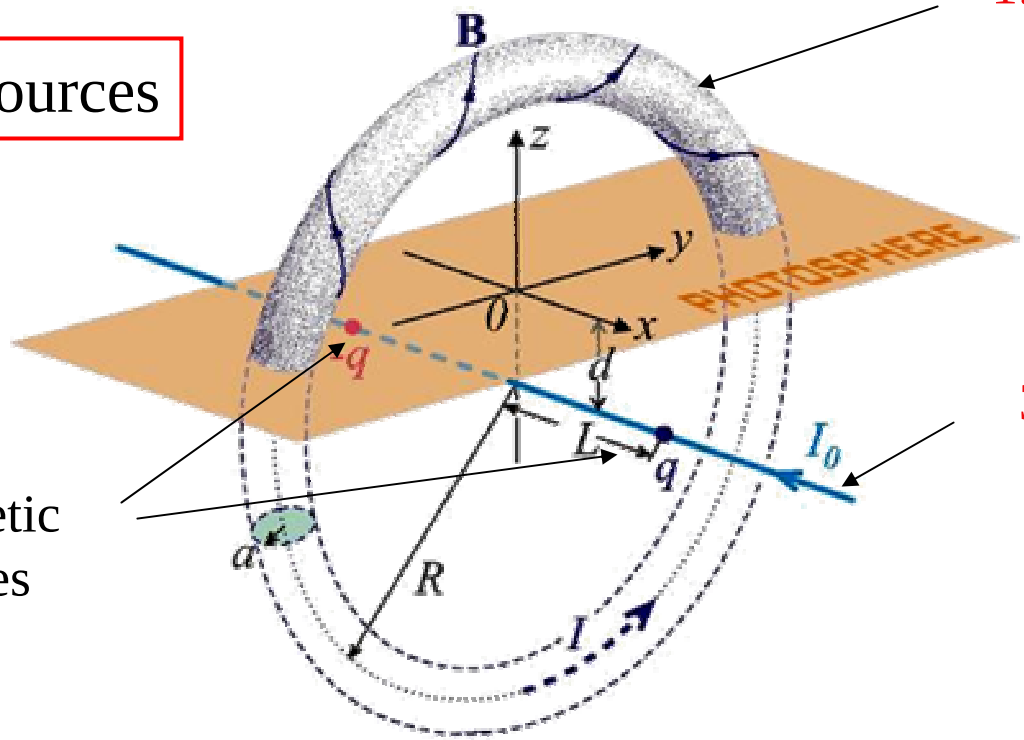
3D Flux rope Model with Adjustable Twist

Titov & Démoulin (1999)

3 field sources

1. flux rope

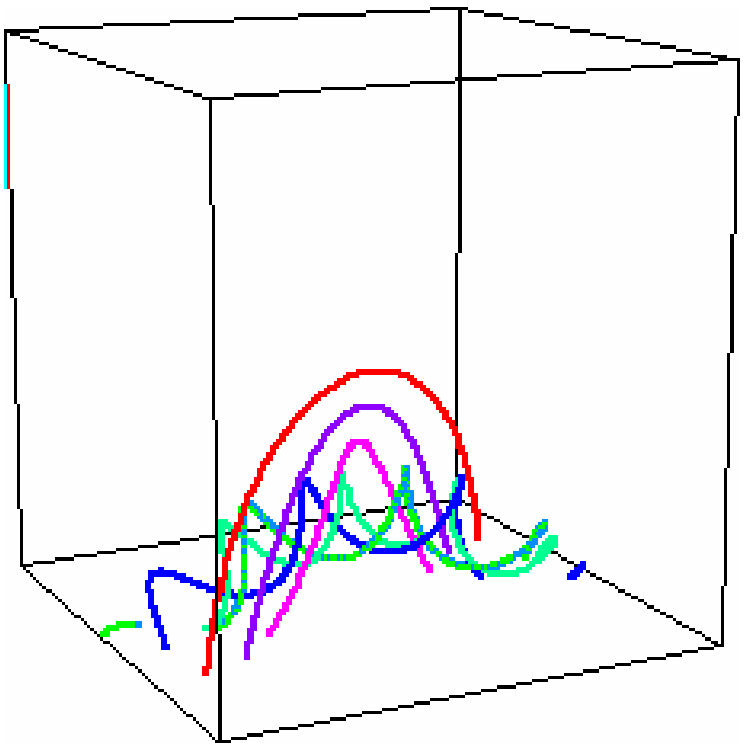


2. magnetic charges

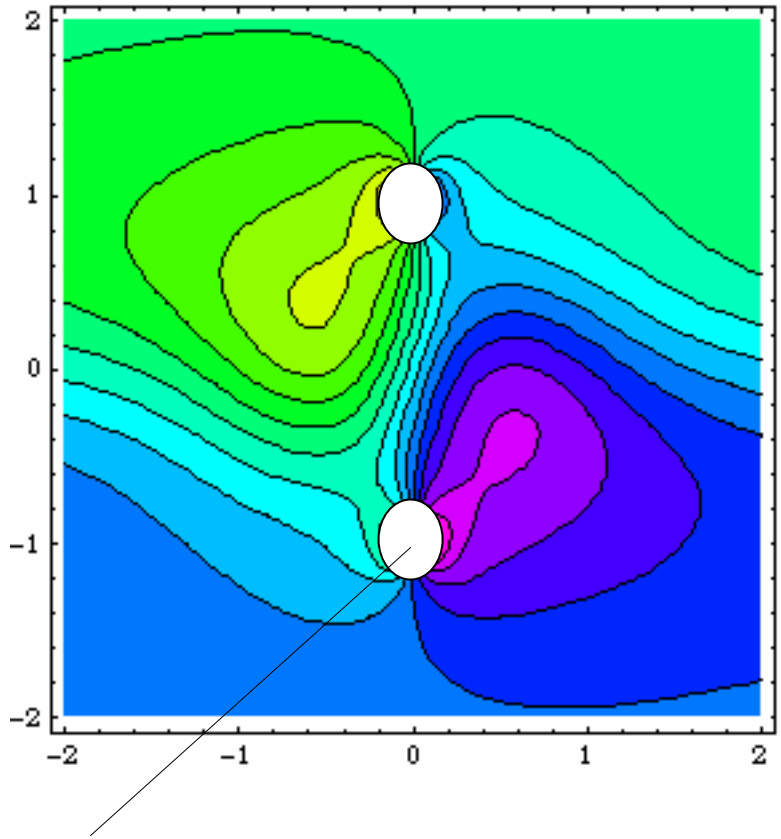
3. line-current

$$I_0 = I$$

Initial Configuration
(Titov & Démoulin)



Normal Field at Surface



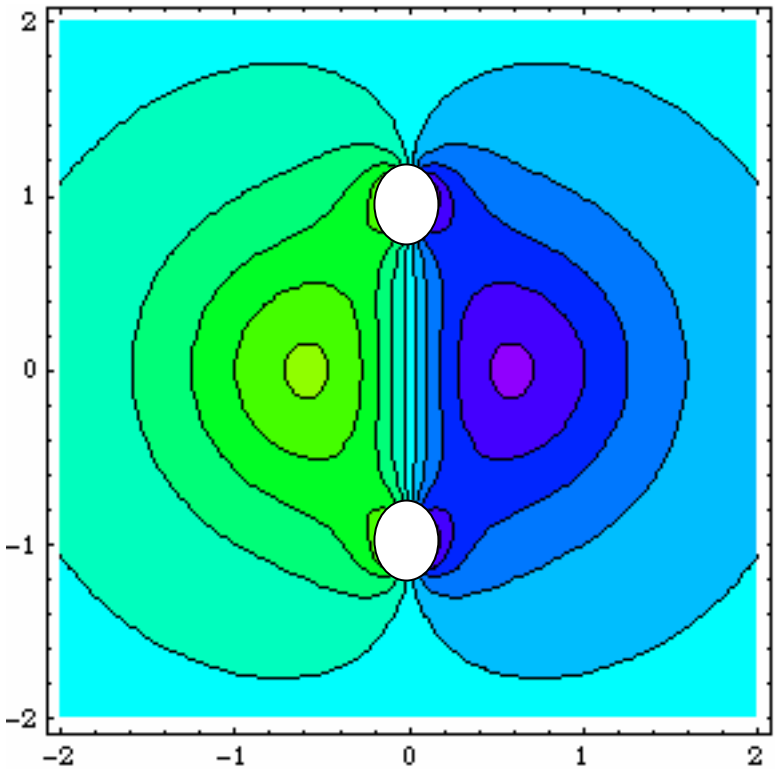
flux-rope footprint

I : flux rope current

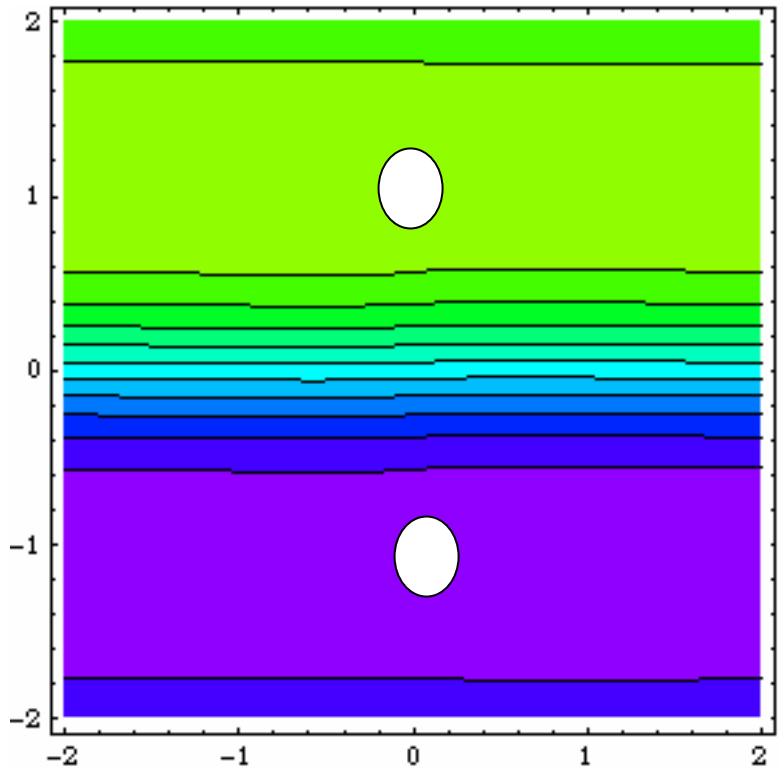
I_0 : sub-surface line current

Extreme Limits of T&D Configuration

$I_0 = 0$



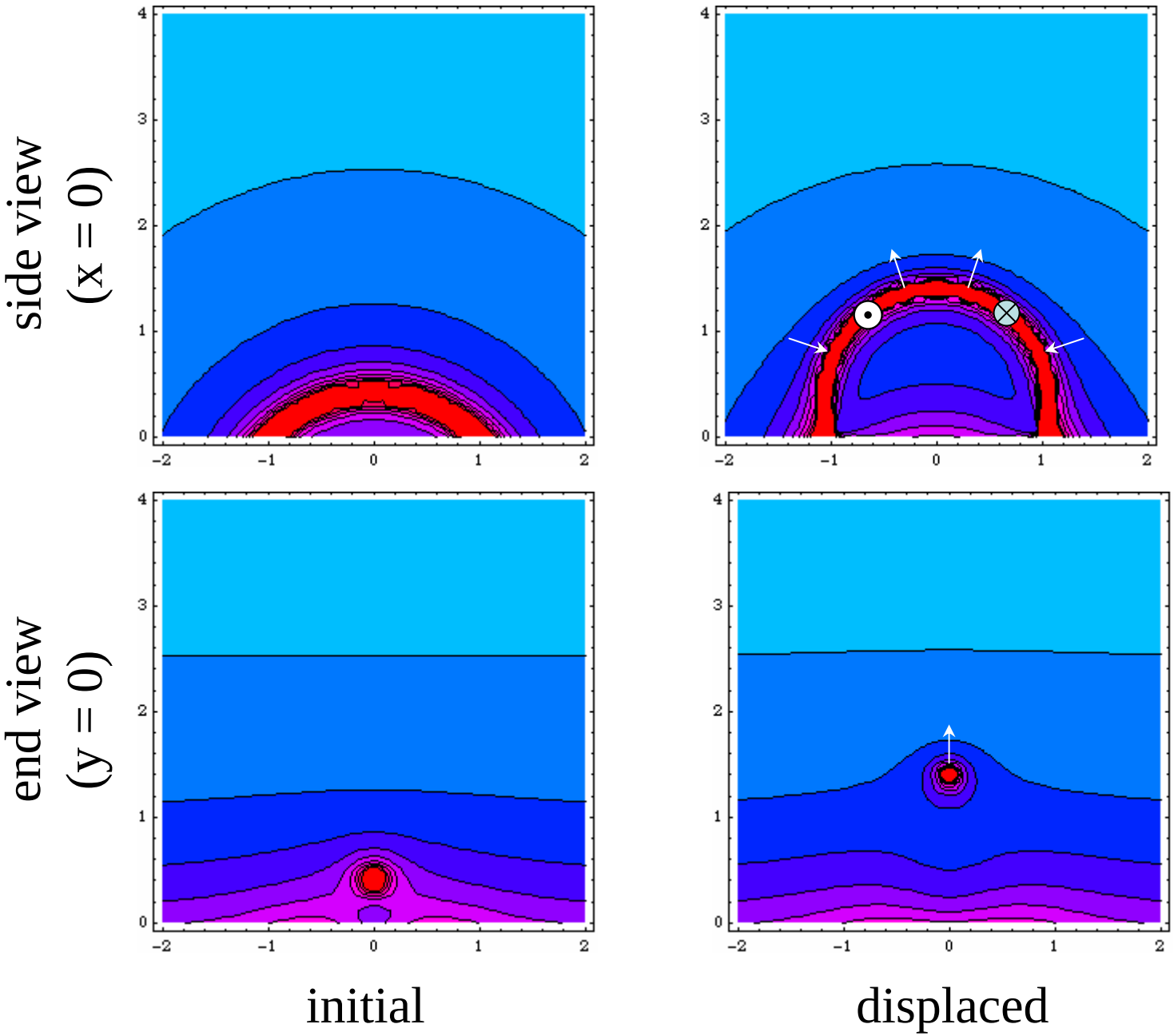
$I_0 = 500\, I$



I : flux rope current

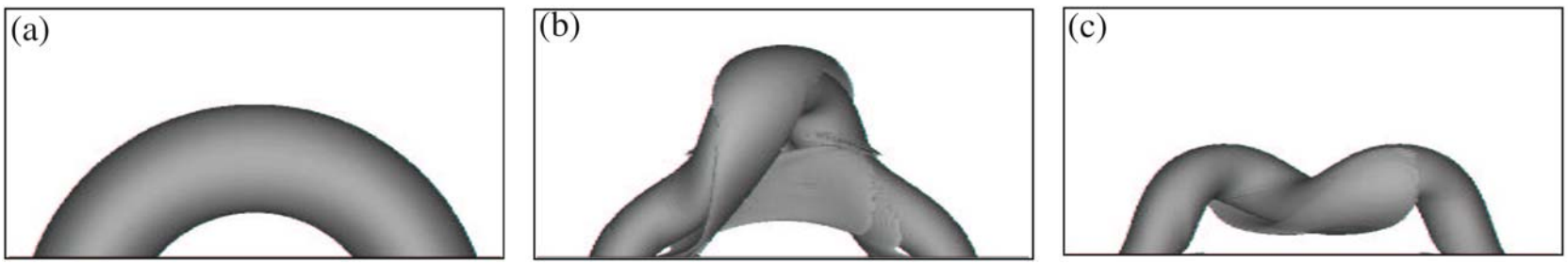
I_0 : sub-surface line current

Line-Tied Displacements



Principal Results of 3D Analysis

1. Eruption without escape
2. Out-of-plane twisting motion
3. Aneurism-like evolution
4. Existence of lower equilibrium



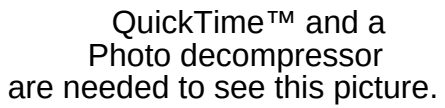
Confined Eruption

Kliem & Török (2004)

strong toroidal field everywhere
(large sub-surface line current)

QuickTime™ and a
YUV420 codec decompressor
are needed to see this picture.

“Failed Eruption” Observed by TRACE

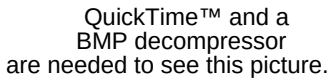


Simulation of “Torus*” Instability

QuickTime™ and a
GIF decompressor
are needed to see this picture.

1. no subsurface line current
2. subcritical twist for helical kink
3. torus center near surface

*nonhelical kink
(see Bateman 1973)


QuickTime™ and a
BMP decompressor
are needed to see this picture.