# Implications of Breakout for Interplanetary Observations

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See Posters by Lynch and by Linker


<u>**Unique characteristics of breakout model**</u>:

- Multipolarity of large-scale coronal field
  - But not excluded by other models – flux cancellation and tether cutting
- Reconnection between field overlying filament channel and neighboring systems (breakout or external reconnection)
  - Again not excluded by other models
  - Timing of reconnection vs eruption will be difficult to detect in IP
- Sheared arcade structure for filament channel field
  - Also feature in tether cutting model
 - Will need simulations to distinguish between models
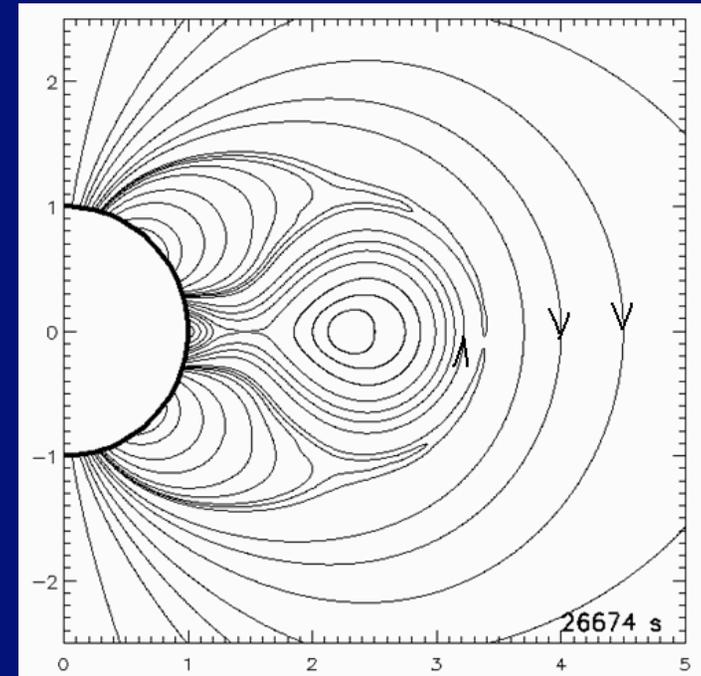
Magnetic Structure Predicted by Breakout

- Axisymmetric simulation by MacNeice et al
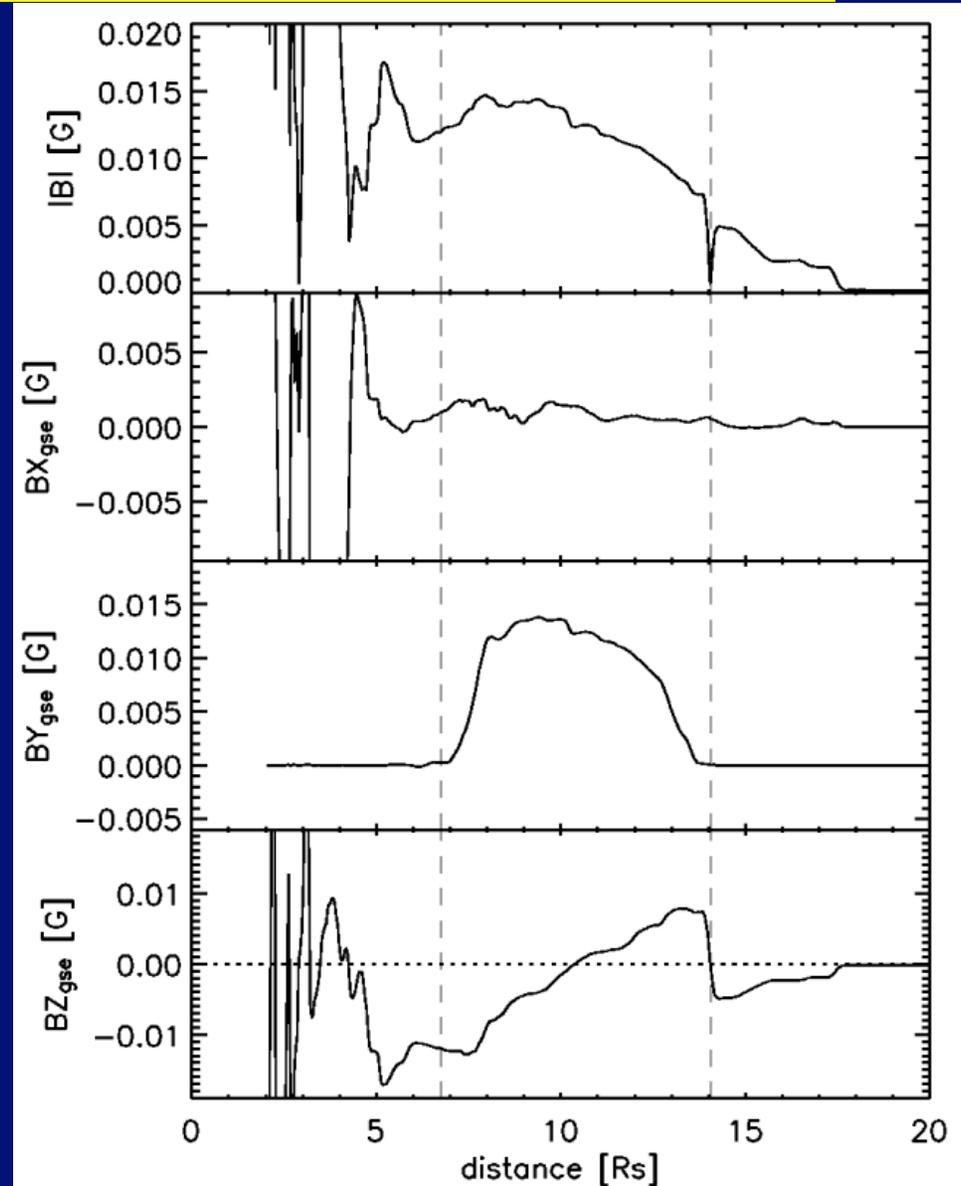
- No artificial symmetry about equator
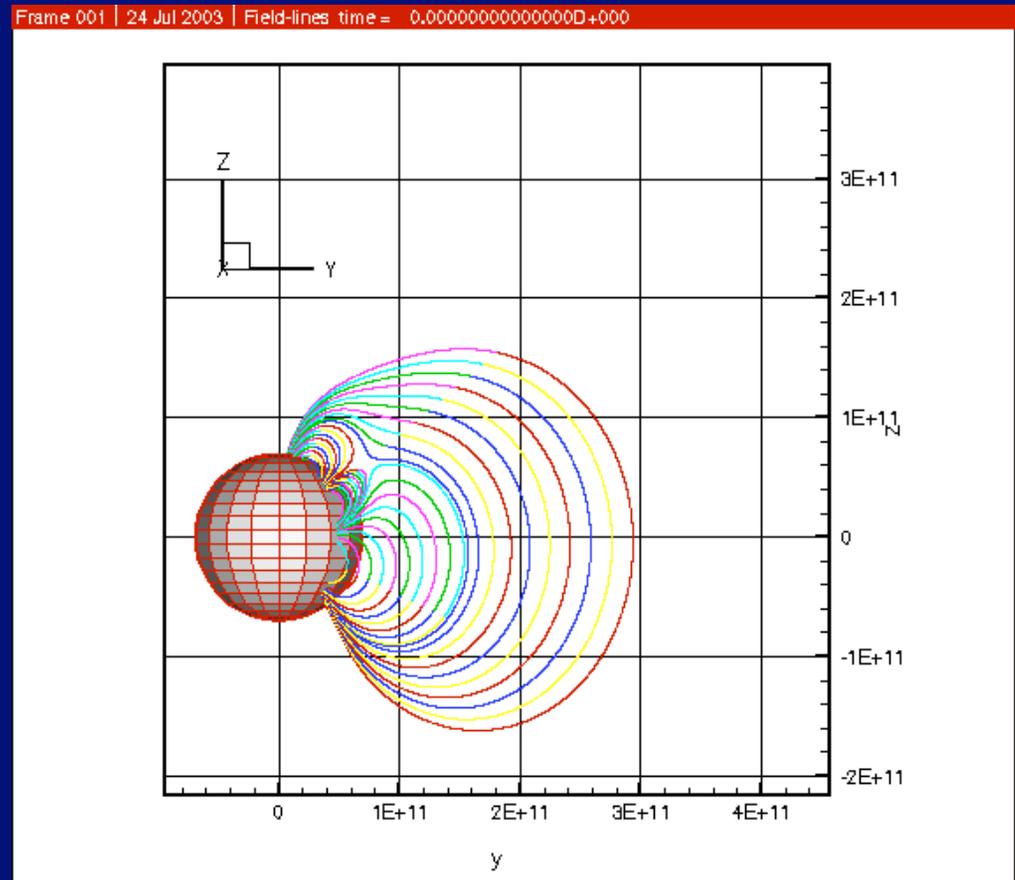
- Opposite polarity sheath around plasmoid
- Magnetic islands form between sheath and plasmoid
- May obtain non-flux rope structure by 1 AU
- Need 3D simulations

Magnetic Structure Predicted by Breakout
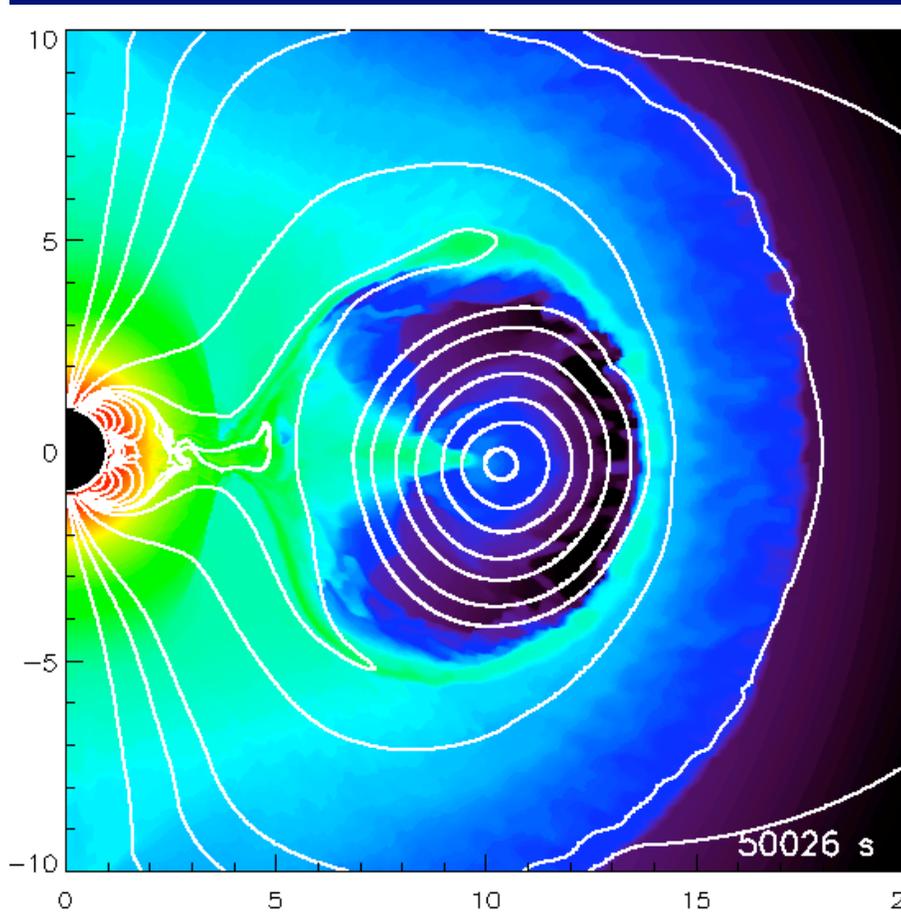
Field and plasma density, Lynch et al

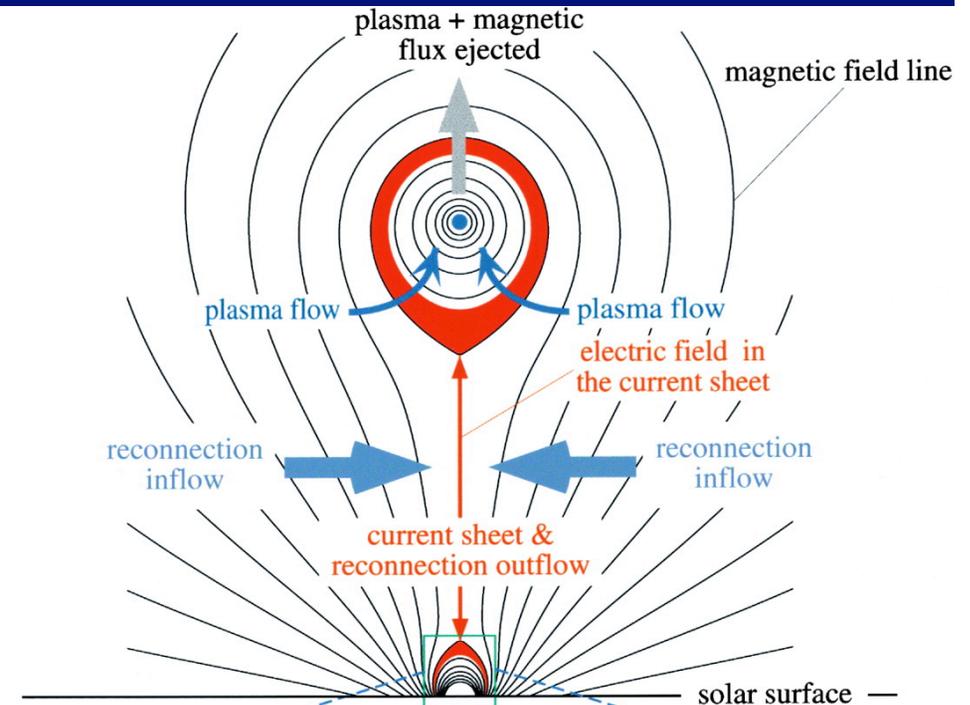Breakout may yield "complex" plasmoid structure (Linker poster)
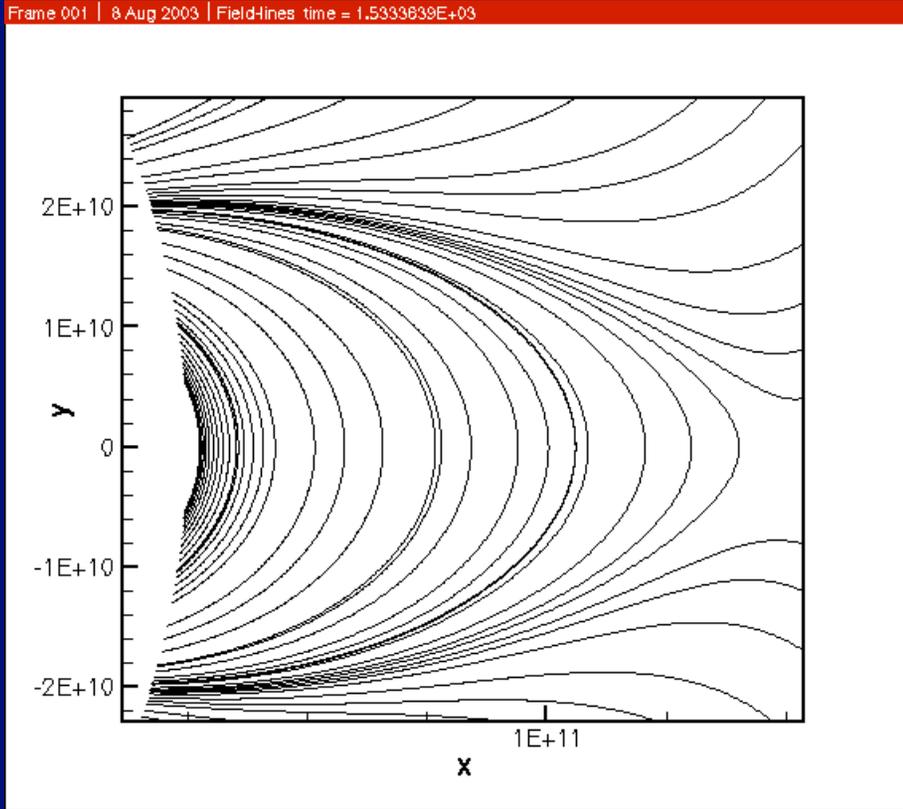

Magnetic structure along equatorial radius

Plasma Structure Predicted by Breakout

Sheared Arcade (breakout, tether-cutting) vs. Flux Rope Models

Frame 001 | 8 Aug 2003 | Field-lines time = 1.5333639E+03

plasma + magnetic flux ejected

magnetic field line

plasma flow

plasma flow

electric field in the current sheet

reconnection inflow

reconnection inflow

current sheet & reconnection outflow
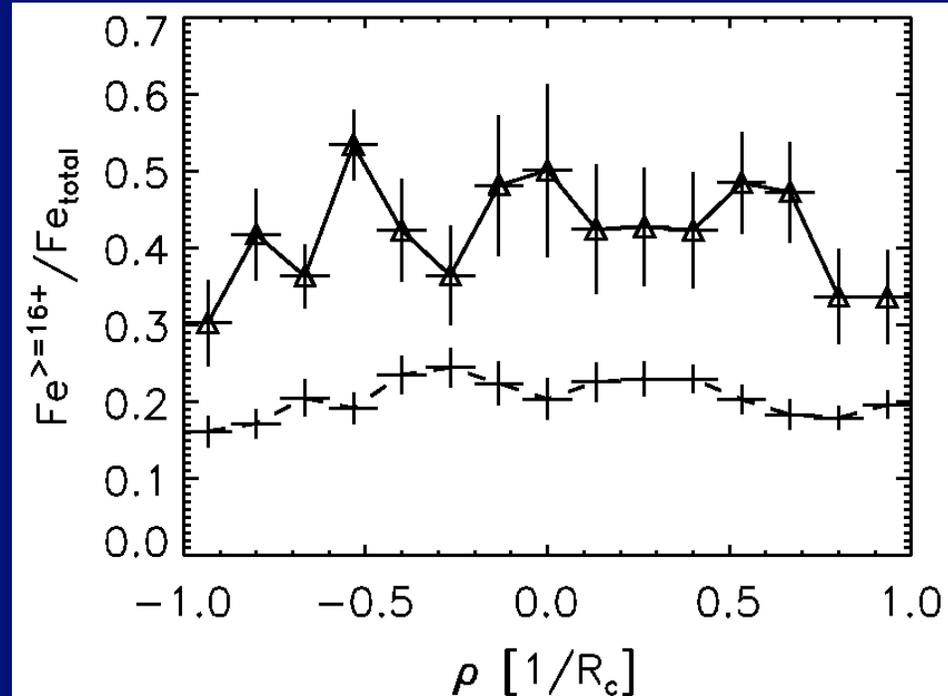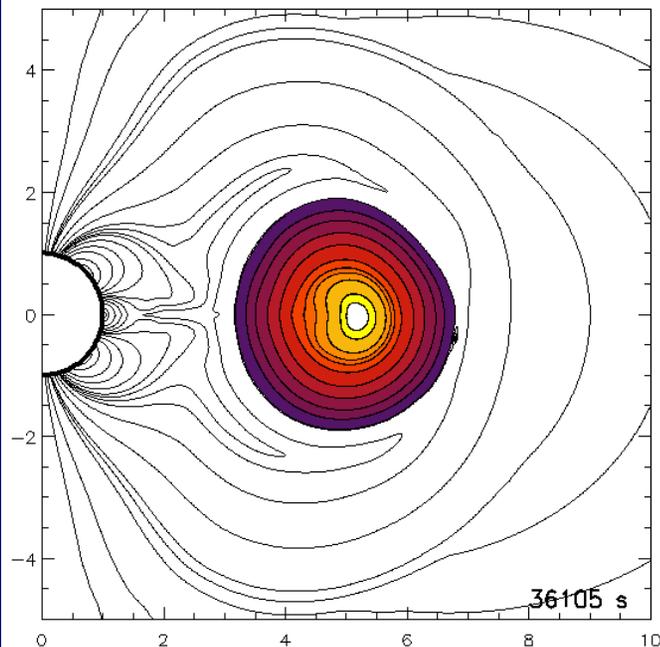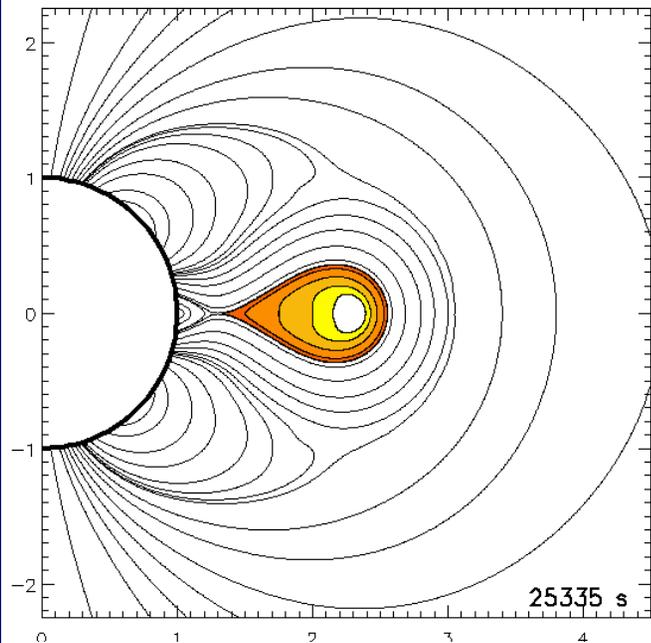
solar surface —

From Lin et al

- Flux rope forms as a result of flare reconnection
- Hot in middle

- Flux rope forms *before* onset of flare reconnection
- Cool in middle

Plasma Structure Predicted by Breakout

- Temperature decreases outward from axis of plasmoid
- Appears to agree with ionization state results from Lynch et al

CONCLUSIONS

- Breakout model does produce complex magnetic structure in the eruption
  - May be able to obtain non-flux rope ICMEs, (need 3D)

- Breakout model should produce flux ropes with maximum temperature on axis
  - Clearly different than flux cancellation models

- Will need detailed Sun – 1 AU 3D simulations to test models decisively