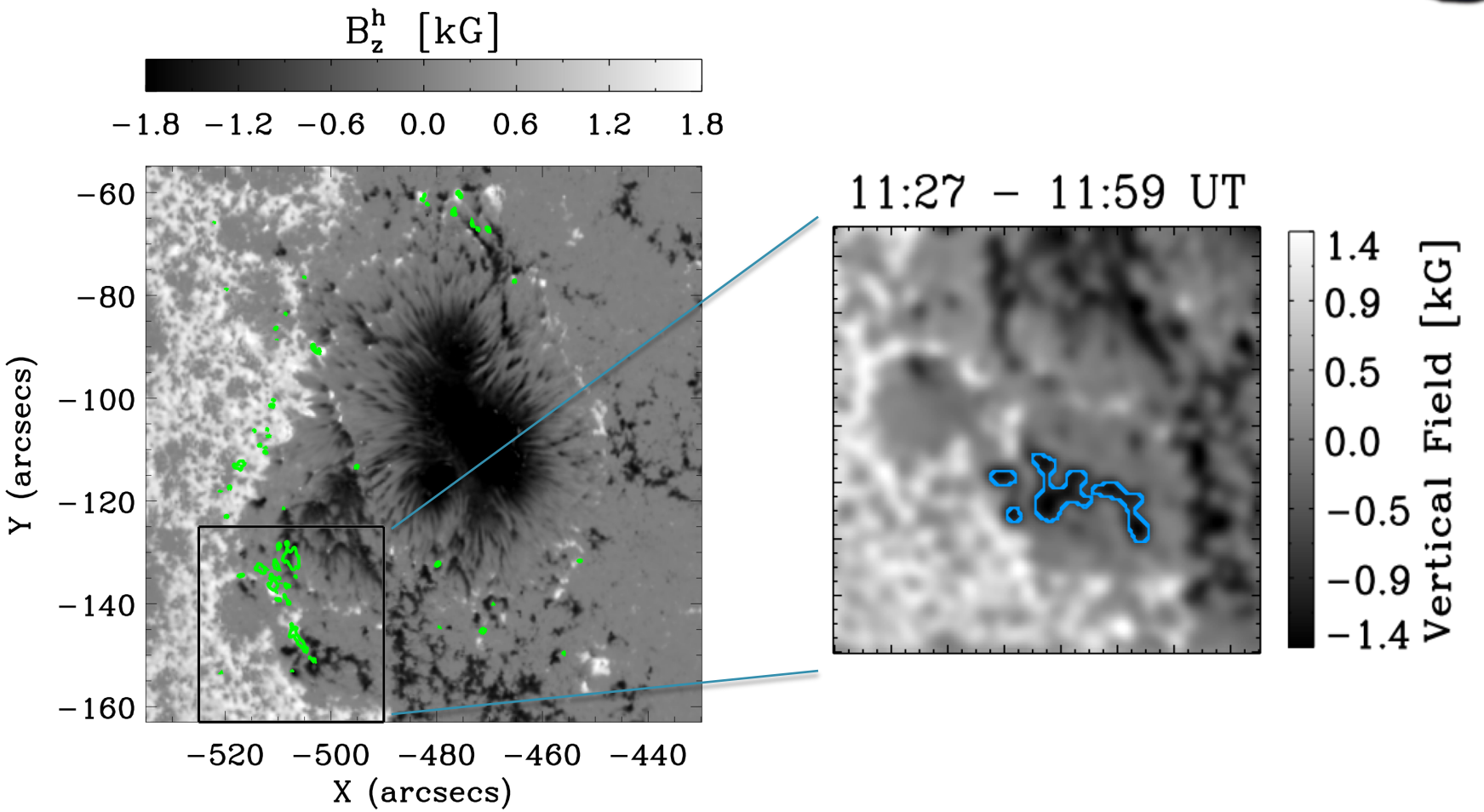
Sunspot Magnetic Geometry and Energy Changes associated with a Solar Flare.

Sophie A. Murray, D. Shaun Bloomfield,
Peter T. Gallagher

Astrophysics Research Group, Trinity College Dublin

Hinode Vector Magnetograms



- Previous work on this region found pre- and post-flare changes in photospheric vector magnetic field parameters in flux elements surrounding the primary sunspot [Murray et al, Sol. Phys., 2012]

3D Extrapolations

- $\nabla x\ \mathbf{B} = \alpha\ \mathbf{B}$

- Potential:

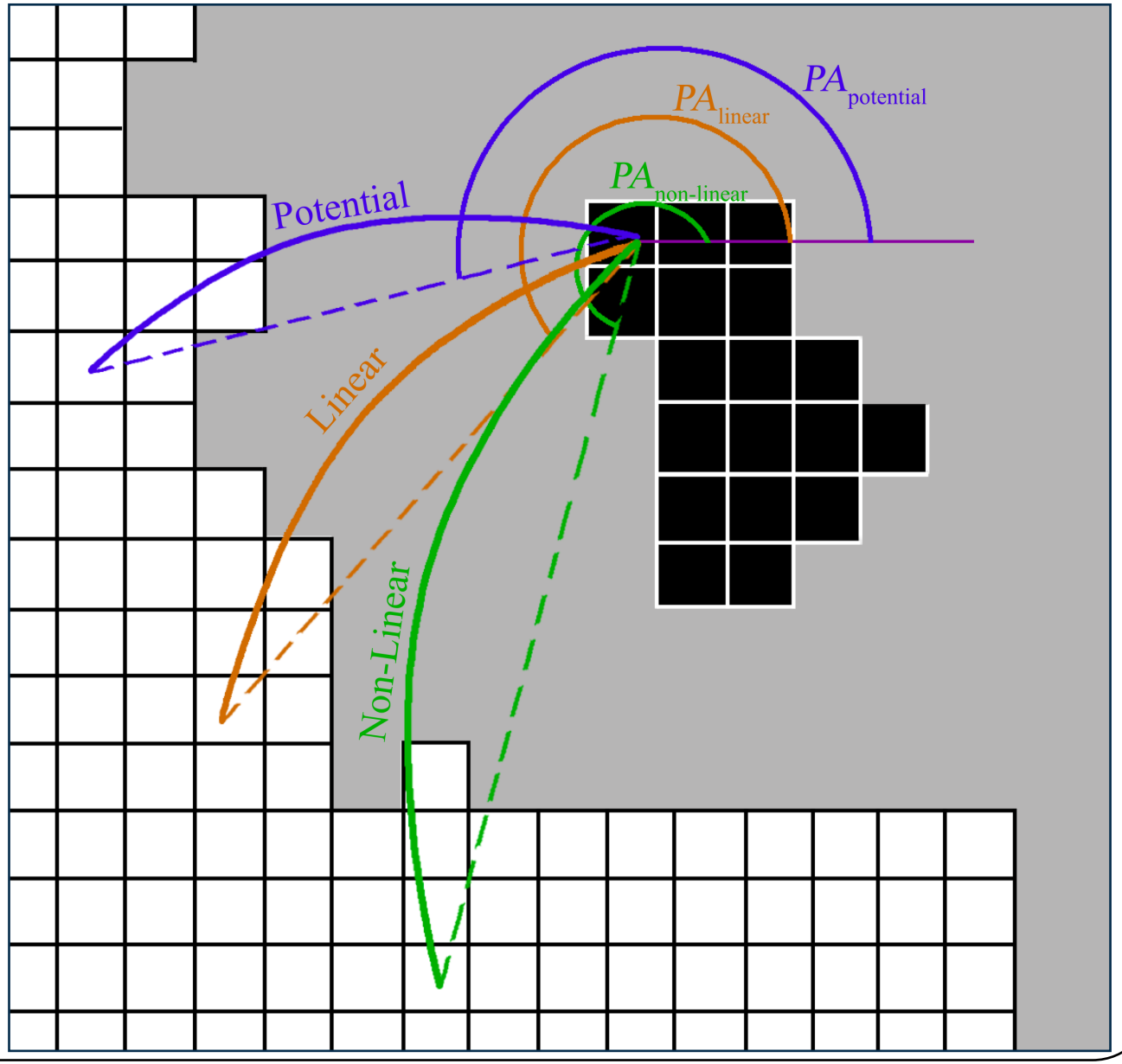
  $\alpha = 0$

- Linear:

  α = constant

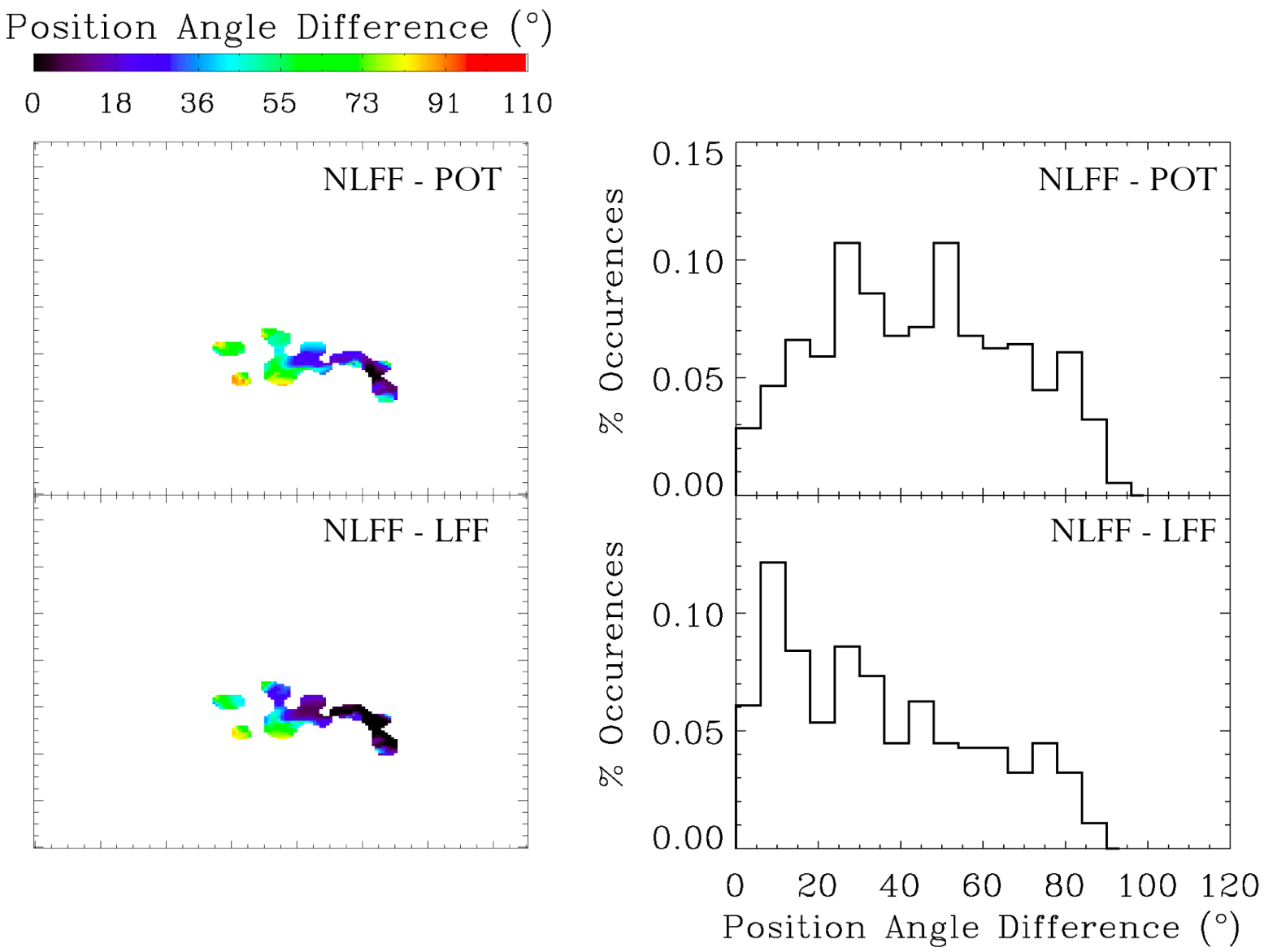
- Non-Linear:

  $\alpha = \alpha(x,y,z)$

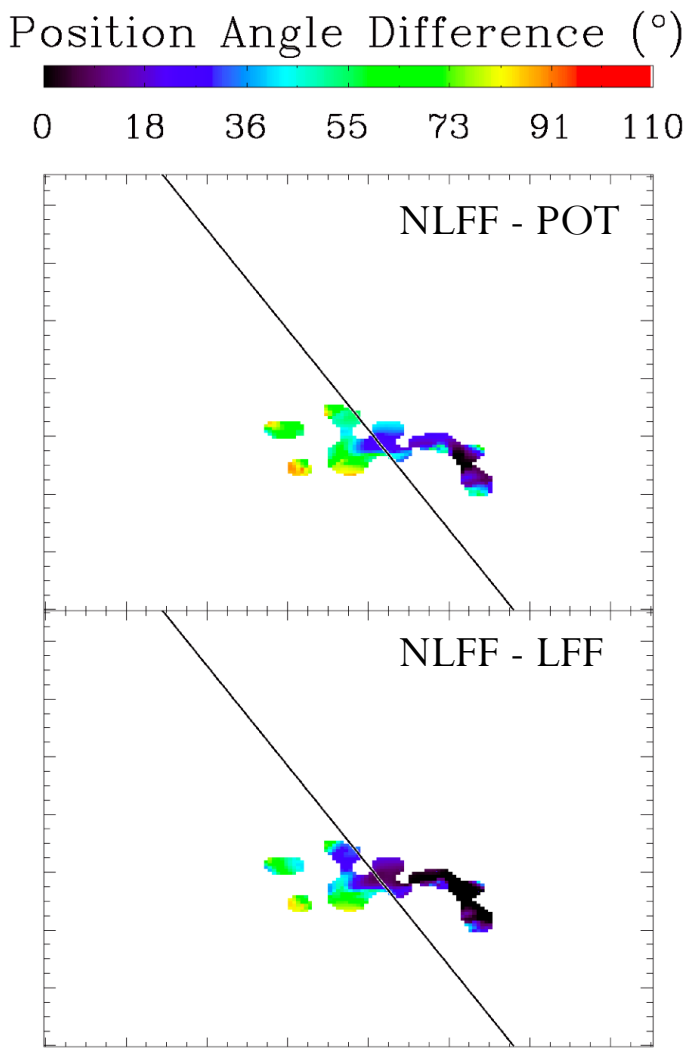


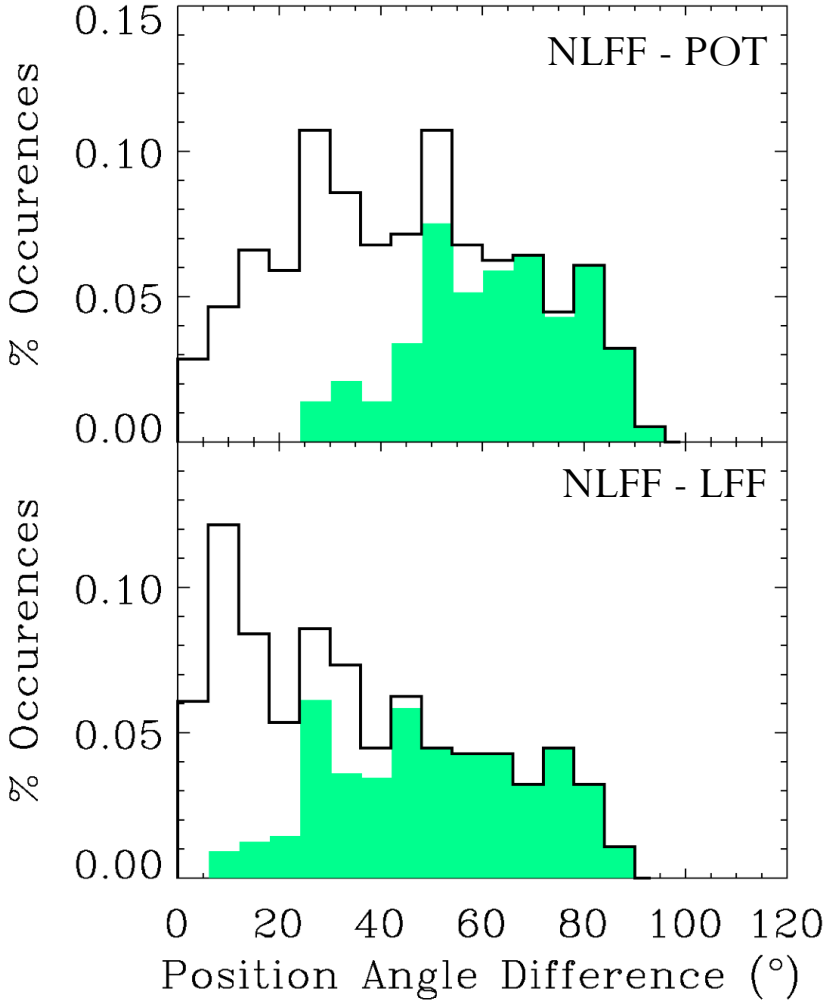
Wiegelmann (2004)

Footpoint Position Angle



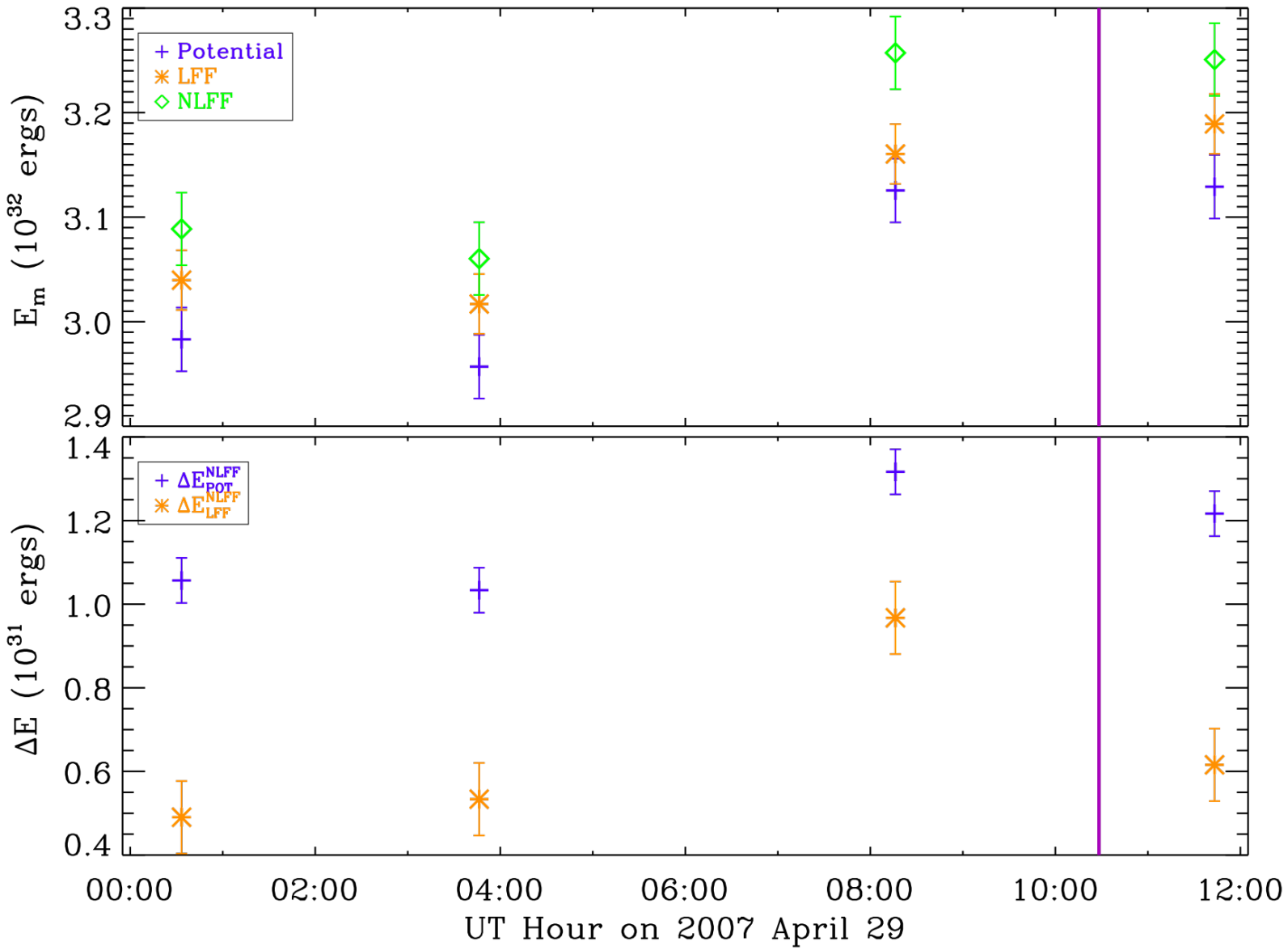
Footpoint Position Angle





Free Energy

$$E_{\rm m} = \int_V \frac{B^2}{8\pi} dV$$



Summary

- Expected difference in traced loops for all three extrapolation types (e.g. NLFF field more twisted due to non-uniform electric currents).
- E_m and ΔE_m values increase ~ 6.5 – 2.5 hours before the flare.
- Magnetic energy values do not completely return to pre-flare 'quiet' values, suggesting the field has not completely relaxed.
  - More flaring possible (another B-class flare 3 hours later).

somurray@tcd.ie