# Polarity Inversion Line Applications

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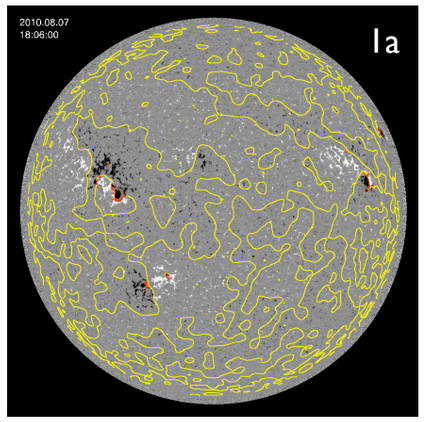
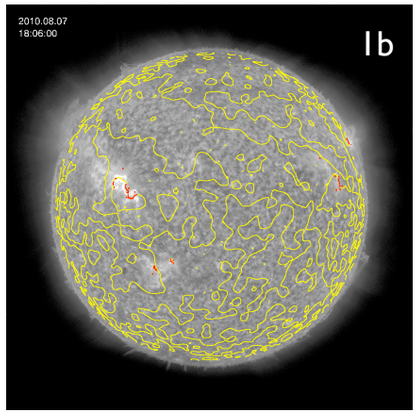
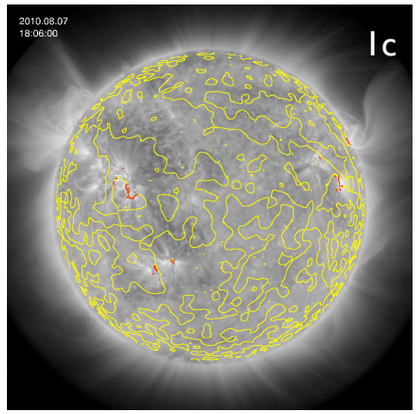
## Basic Applications

The polarity inversion line (PIL) module produces IDL .sav files that can easily be overlaid onto any solar image. These can be used to contextualize a wide range of solar observations in regards to the location of the PIL. (1a) HMI magnetogram (1b) AIA 304 (1c) AIA 171



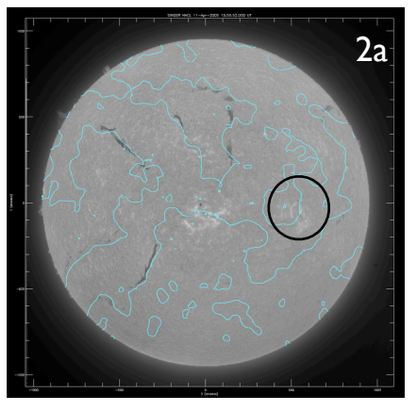



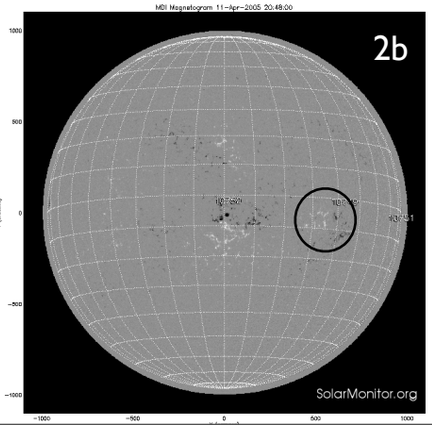




## Investigation: Filaments

The PIL as seen in (2a) generally has a good agreement with H-alpha filaments. Concerning the chirality of the filaments the PIL in relation to the magnetogram may be able to automatically identify what the chirality of the filaments *should be*.

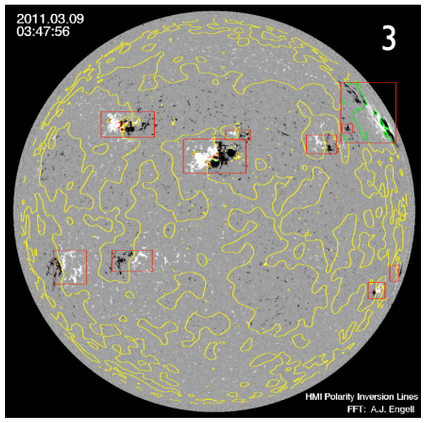
In the black circle in (2a) there is a small filament with a barb in the north entering into positive polarity as contextualized by the magnetogram in (2b) and a barb in the south entering into the negative polarity.



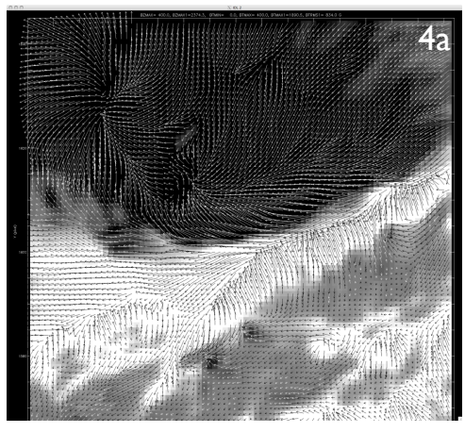

## Advanced Applications

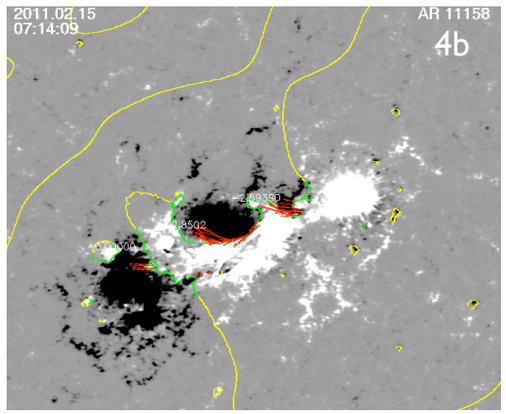
Included in the .sav files are the bouding boxes of Stanford's HMI Active Region Patch (HARP) program (3). They work more effectively than the NOAA identified ARs. Also included are the HMI magnetogram cutouts of the HARP locations




Included as metadata, the PIL contains photospheric magnetic field gradient throughout the entirety of the full-disk. Within the HARPs the PIL also contains information about the potential field gradient.

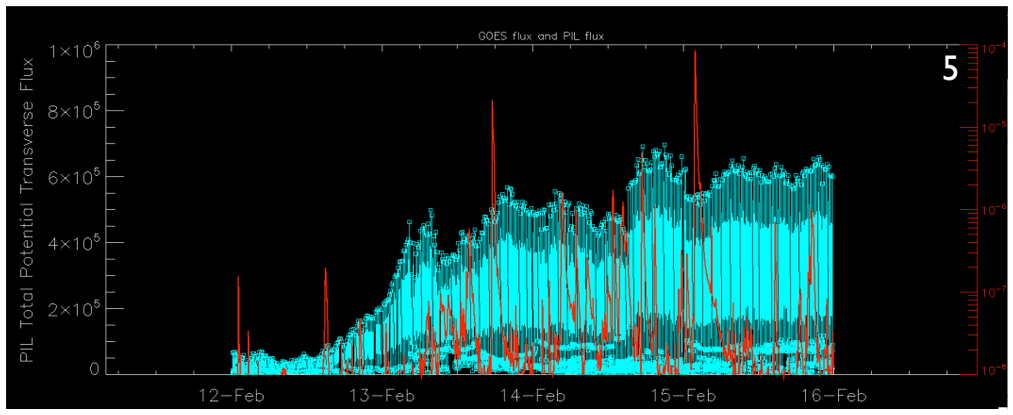
With the arrival of vector magnetograms (4a) it is possible to construct vectors along the PIL. This allows, for instance, a quantitative measurement of the shear along the PIL. This is illustrated in (4b).




## Predictive Applications

The advanced applications above give way to utilize the PIL metadata for predictive capabilities of solar eruptions. To the right (5) is a plot of the total potential transverse flux in blue (potential field gradient). Plotted in red in the GOES X-ray flux. PIL predictive capabilities have been investigated by Falconer (2008) and Schrijver (2007) using MDI magnetograms.




## Future Applications

Related to solar eruptions are the formations of flux ropes and/or filaments. In decaying ARs this may be possible by measuring the moments of the magnetograms in conjunction with the location of the PIL to constrain the amount of flux cancellation.