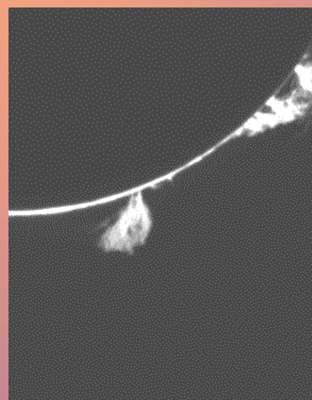
Working Group I: Solar

SESSIONS:

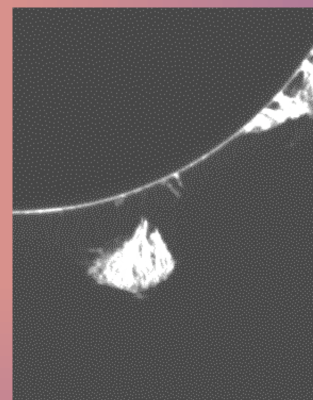
- **Filaments** (Mon. afternoon + Tues morning)
  - Activation through eruption
- **Sub-surface** (Wed. morning)
  - Understanding the magnetic connection between sub-photospheric layers and the solar corona
- **Coronal Holes** (Thurs. morning)
  - Reconciling observed and modeled coronal holes
- **Predicting Solar Cycle 24** (Thurs. afternoon)

Filament Session

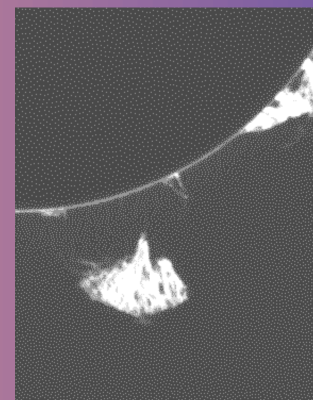
1709 UT



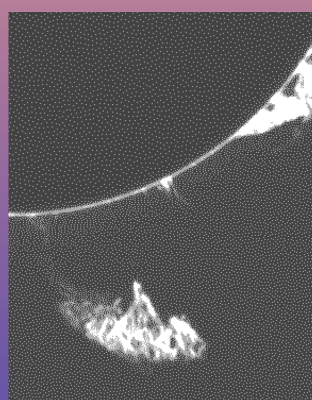
1752 UT



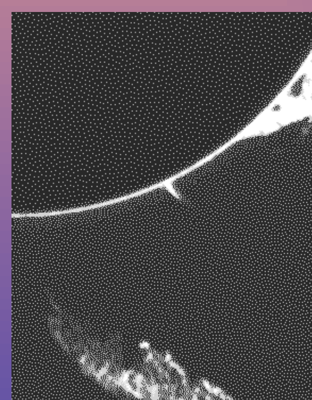
1800 UT



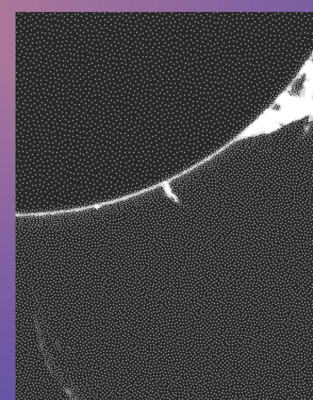
1810 UT



1819 UT



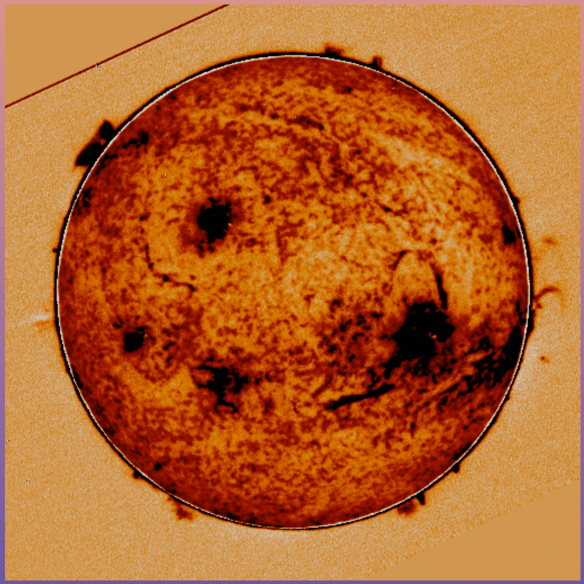
1828 UT



An Erupting Prominence Seen in MLSO Hα Limb Data on November 19, 1999

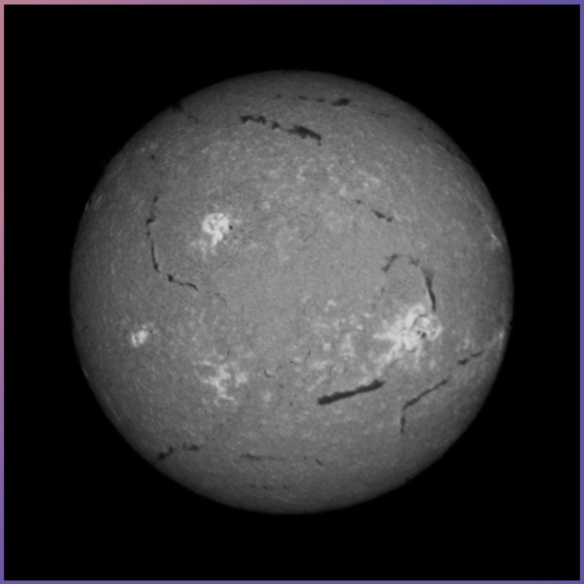
When viewed in absorption against the solar disk, prominences are called filaments

March 16, 2000
21:03 UT



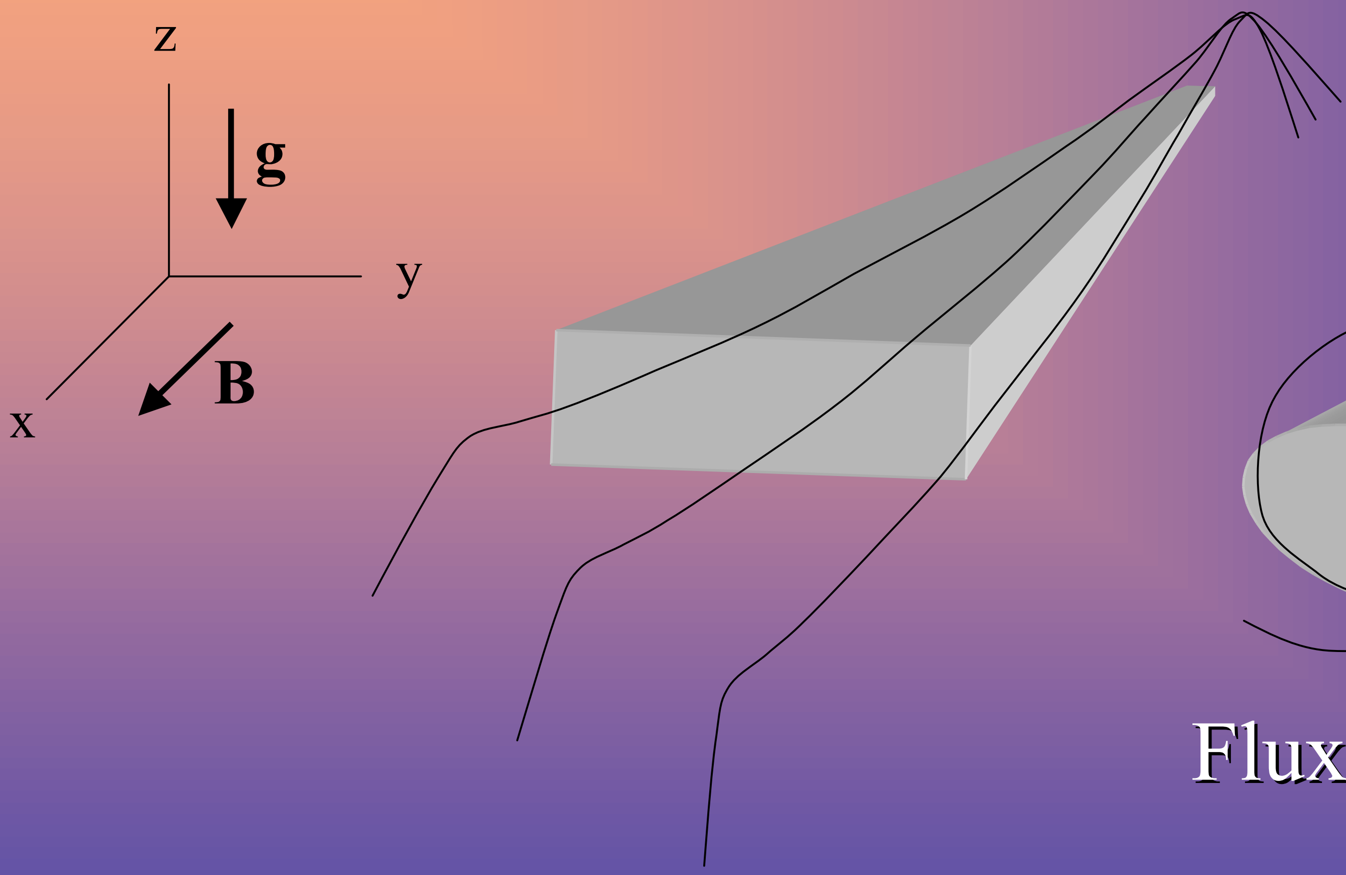
He I (1083 nm)

March 16, 2000
21:02 UT

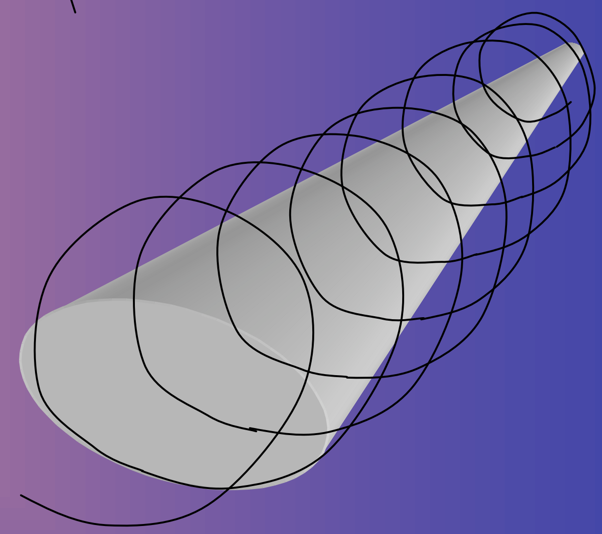


Hα (656 nm)

Prominence Support

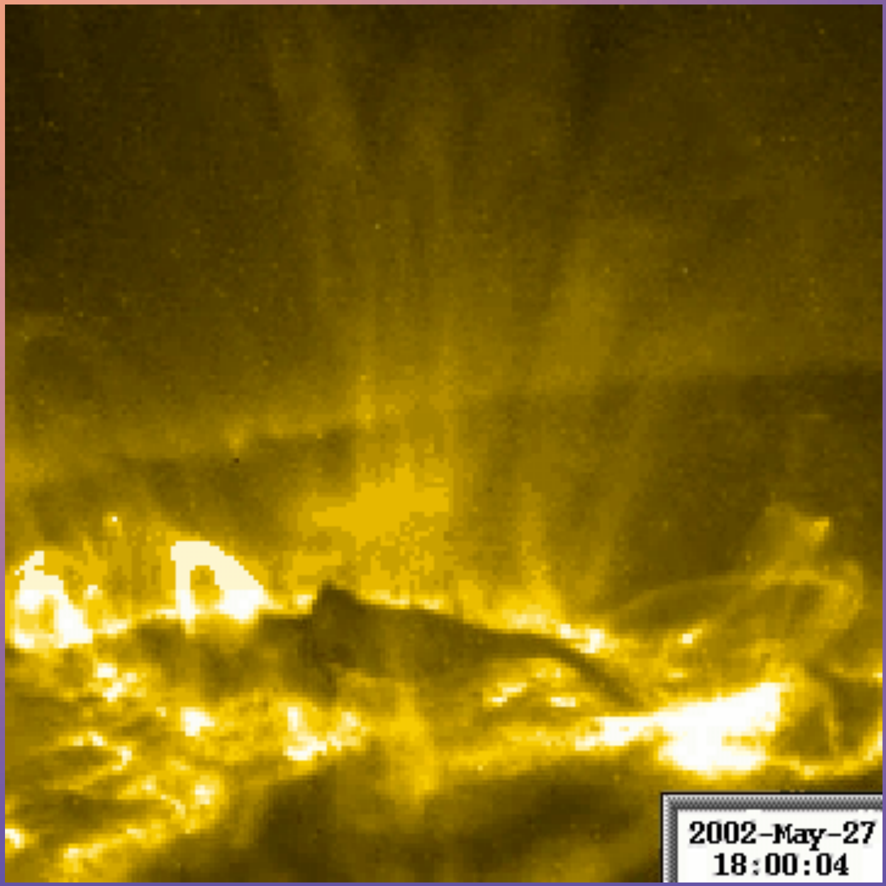


Dip Model



Flux-rope model

Filament dynamics – the motivation behind this session



TRACE Fe XII (19.5 nm)

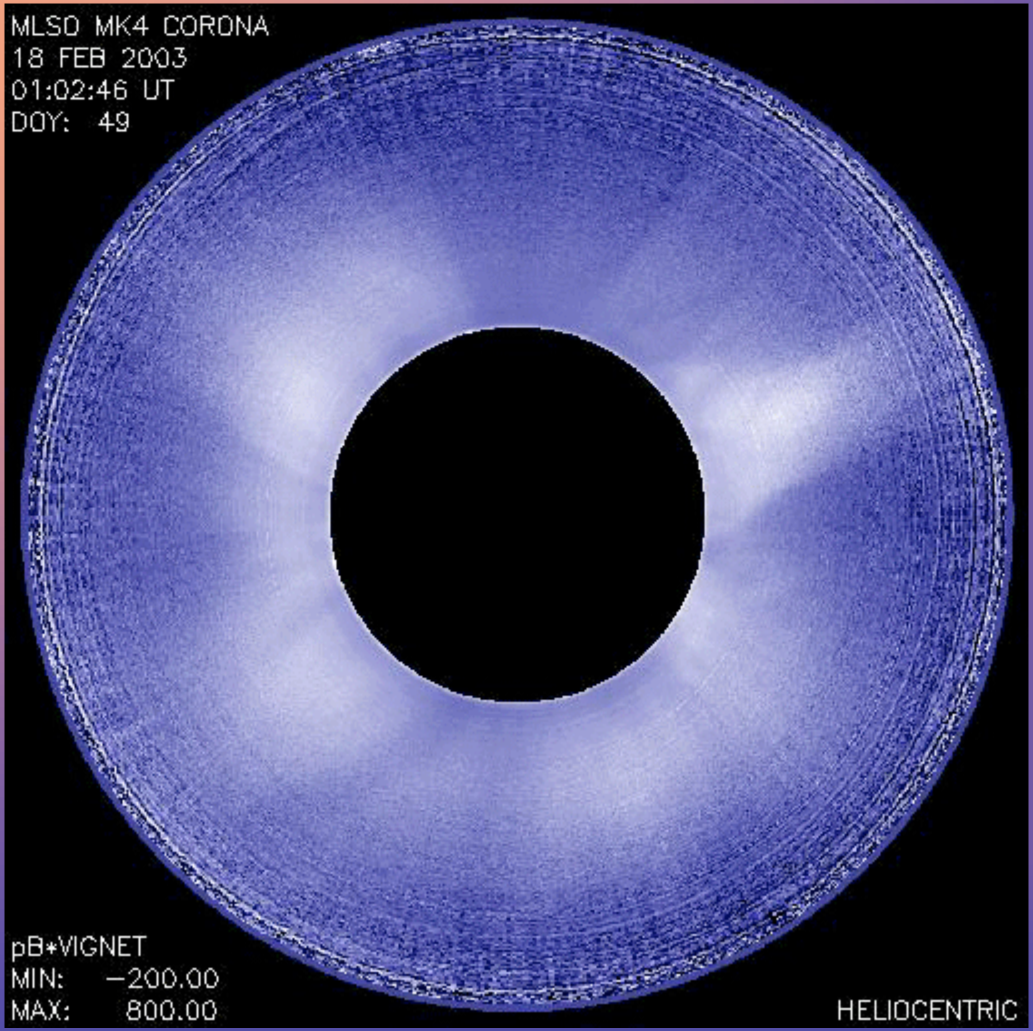
FILAMENT ACTIVATION (Mon. afternoon)

Invited Speakers: Sara Martin, Judy Karpen

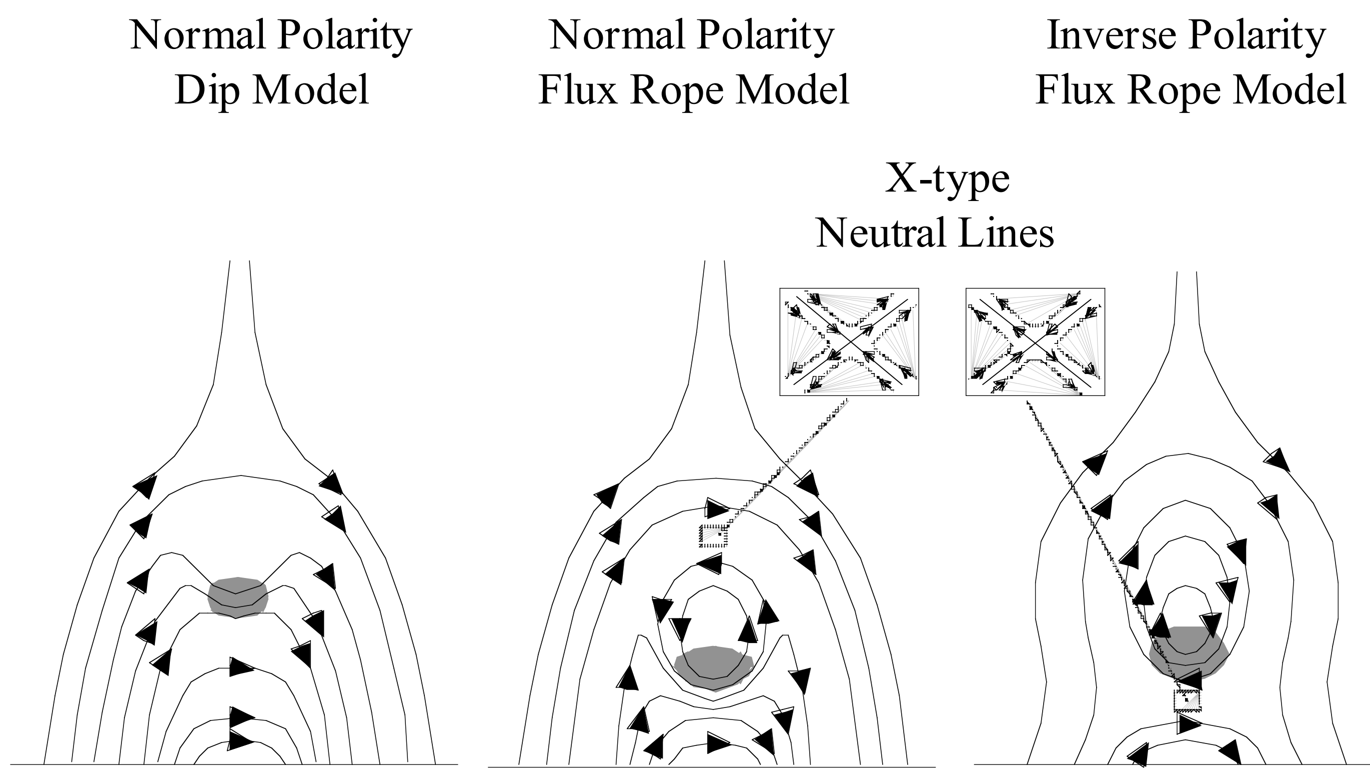
Sara Martin: "Filament and Prominence Activation"

Judy Karpen: "Prominence Dynamics: the Key to Prominence Structure"

Association with Coronal Mass Ejections



Simple 2D prominence models



ERUPTION w/emphasis on topology

(Tues. morning)

Invited Speakers: Sarah Gibson, Aad Van Ballegooijen

Sarah Gibson's talk "Filaments as Flux Ropes: the Evidence Before, During, and After Eruption"

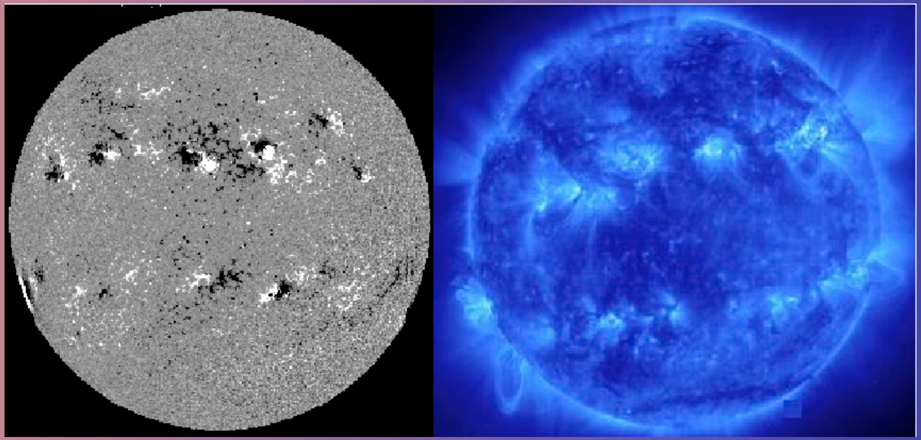
Aad Van Ballegooijen's talk "Formation and Eruption of Filament Flux Ropes "

Sub-surface session

Bill Abbett (Wed. morning)

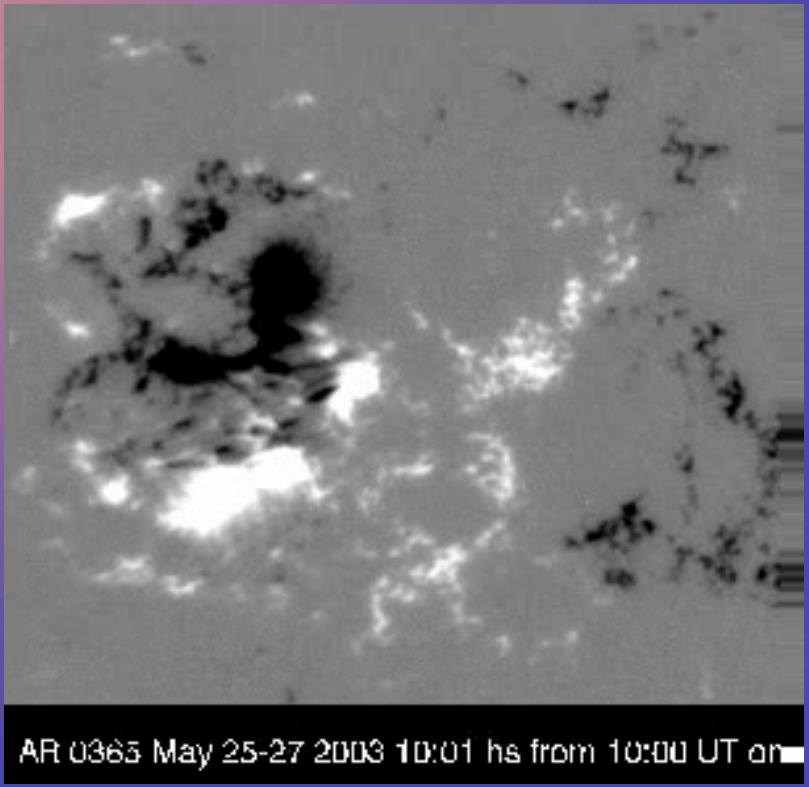
UNDERSTANDING THE MAGNETIC CONNECTION BETWEEN SUB-PHOTOSPHERIC LAYERS AND THE SOLAR CORONA

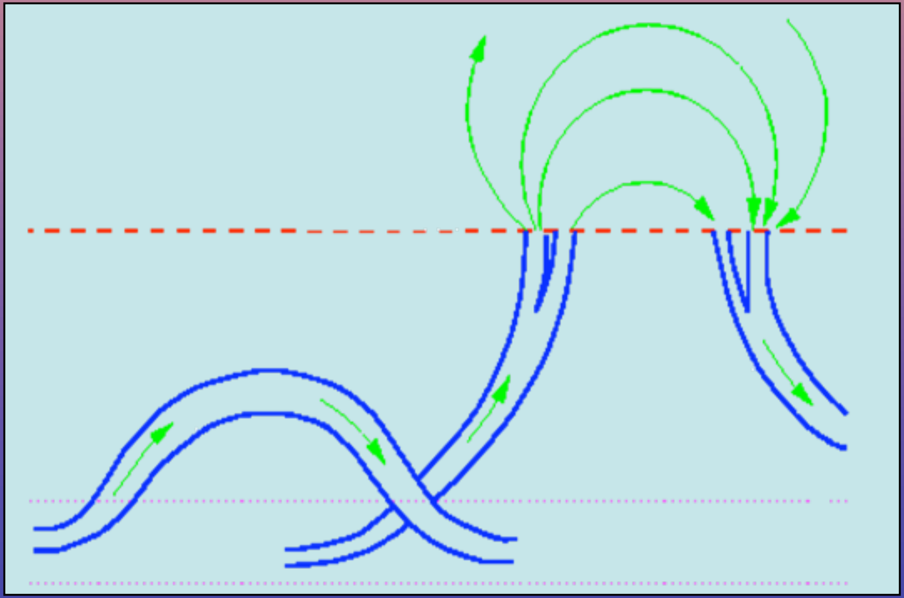
What is the dynamic, energetic, and magnetic connection between magnetic fields below the photosphere, those observed at the visible surface, and those inferred from observations of the corona?



What drives the emergence of active region magnetic fields, and how do magnetic structures threading the convection zone, photosphere, transition region and corona evolve as active regions decay?

A timeseries of line-of-sight magnetograms for a complex active region (V. Abramenko)

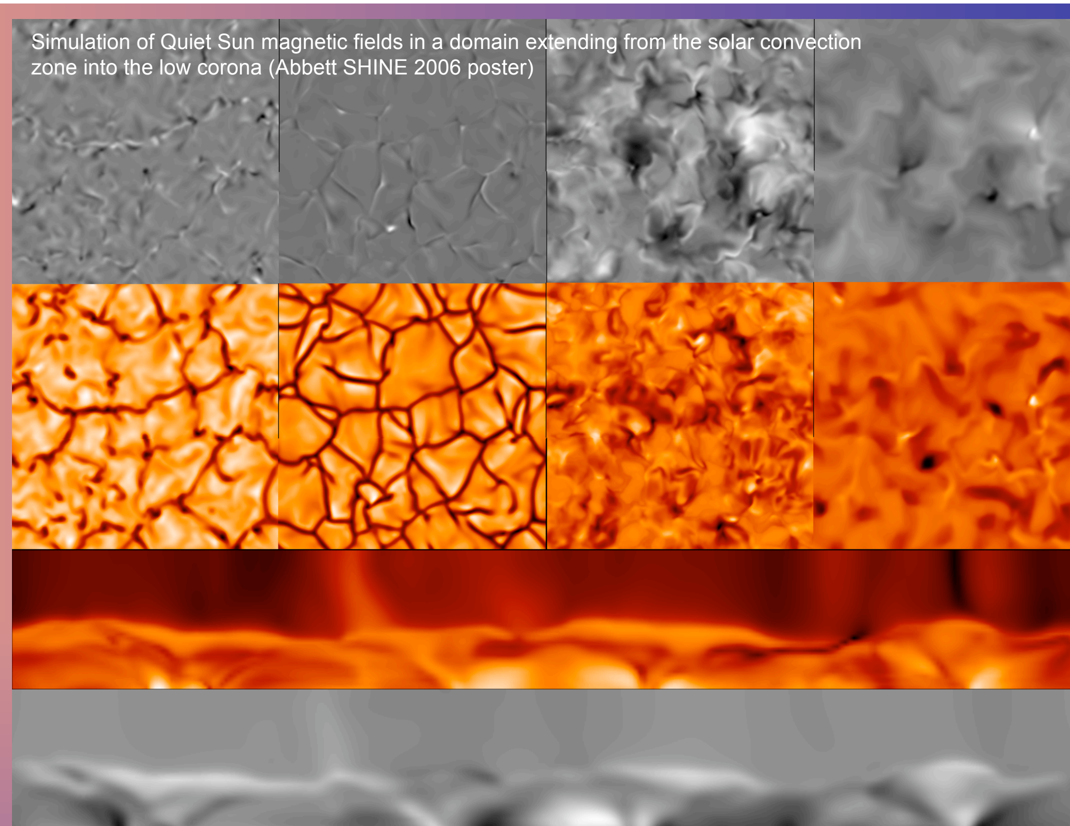




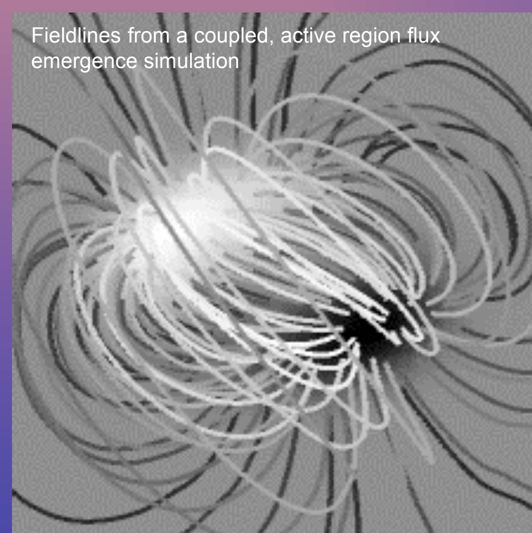
How can we best use models and observational data to understand in a quantitative way the physics of the combined convection-zone to corona system? What data is available, and how well do the latest theoretical and numerical models match up?

These are some of the questions we will address in the WG1 session entitled “**Understanding the magnetic connection between sub-photospheric layers and the solar corona**”.

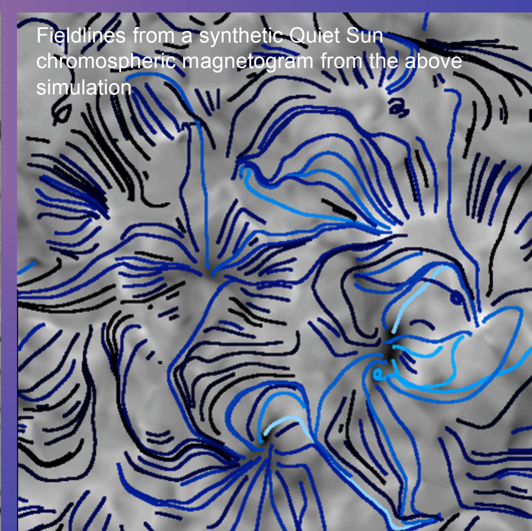
We are pleased to have both Karel Schrijver (LMSAL) and Fernando Moreno-Insertis (Instituto de Astrofisica de Canarias) giving invited reviews in this session!



Simulation of Quiet Sun magnetic fields in a domain extending from the solar convection zone into the low corona (Abbett SHINE 2006 poster)



Fieldlines from a coupled, active region flux emergence simulation



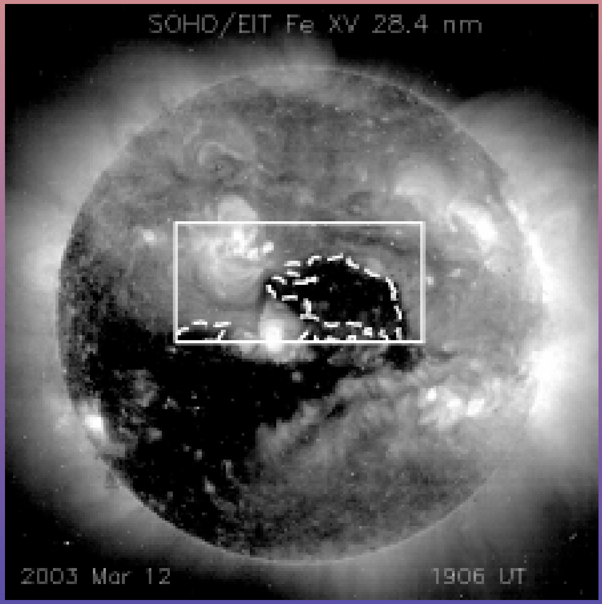
Fieldlines from a synthetic Quiet Sun chromospheric magnetogram from the above simulation

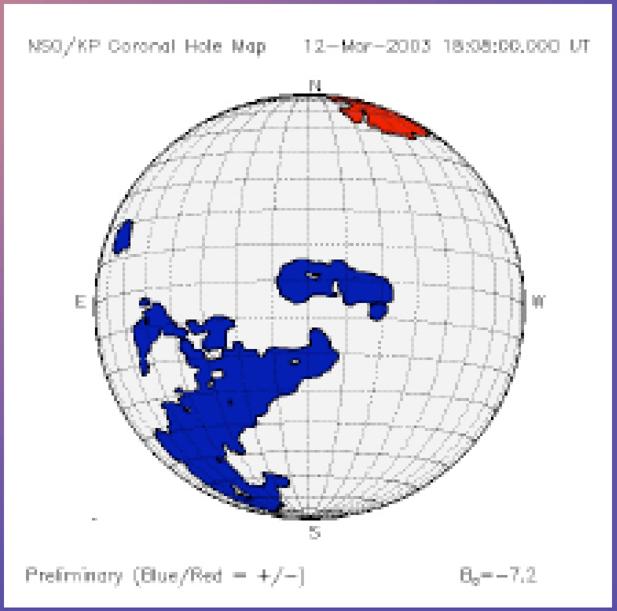
Coronal Hole Session

Me (Wed. morning)

RECONCILING OBSERVED AND MODELED CORONAL HOLES

Images from Carl Henney's talk





Modified EIT figure from Malanushenko and Jones (2004)

Types of Coronal Holes:

Polar:

Equatorial:

Generally large and long-lived

Transient:

Appear suddenly near the location of a CME, typically forming in less than 1 hr and fading within 1-2 days

Why study coronal holes?

They are the source of high-speed streams and possibly slow wind……

→ CHs play an important role in the nature and structure of the solar wind/heliosphere

Coronal Hole Observations

Invited Speakers: Giuliana deToma, Carl Henney,

Giuliana deToma: "Observations of Coronal Holes in Different Wavelengths and the Associated Problems"

Carl Henney: "SOLIS/VSM Coronal Hole Estimation Maps"

-- this talk will focus on He I (10830 nm) and

automation of coronal hole finding schemes

Coronal Hole Modeling

Invited Speaker: Roberto Lionello

"Modeling of Coronal Holes"

-- How the Wang & Sheeley and Fisk models deal with reconciling quasi-rigid rotation w/ the differential rotation of the photospheric magnetic flux underneath

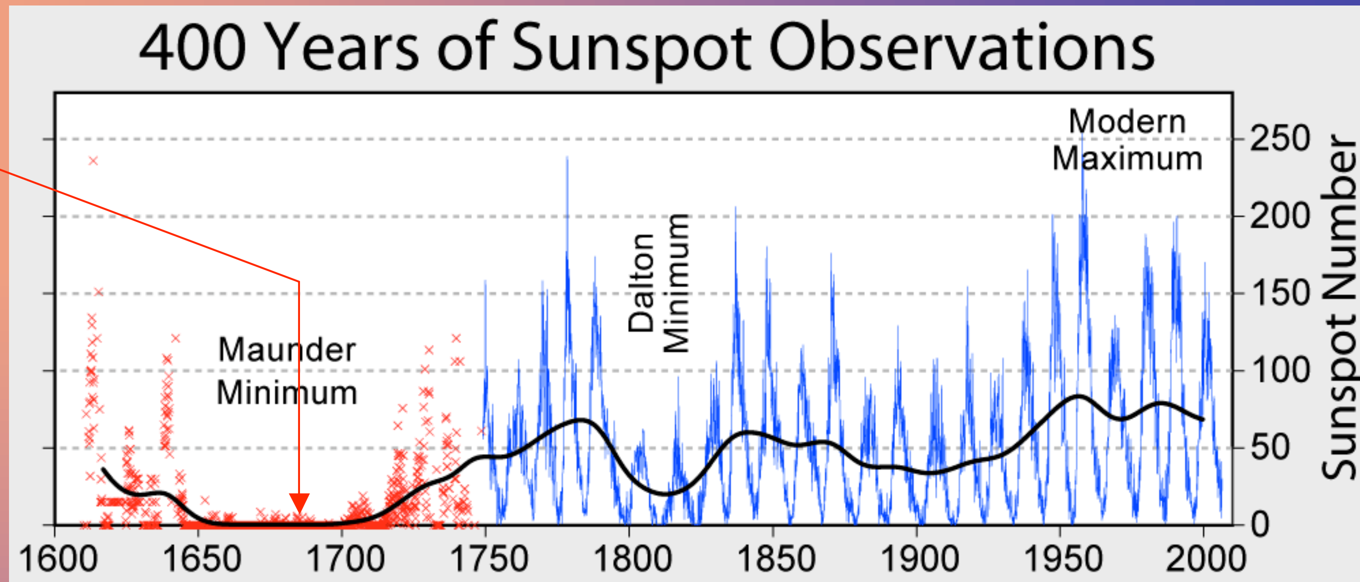
-- Will present results obtained with a computational MHD code that self-consistently models the corona and the solar wind and calculates the response of CHs to the evolution of the photospheric magnetic flux

Predicting Solar Cycle 24

Ian Richardson (Thurs. afternoon)

Predicting the Size of Solar Cycle 24

London Frost Fair, 1683



The size of the ~11 year sunspot number cycle varies with time. Observations back to ~1600, show e.g.,:

- Relatively large cycles during much of the 20th century;
- A ~ 100 year variation (Gleisberg cycle);
- The "Maunder Minimum", corresponding to the "Little Ice Age", suggesting a link between solar activity and climatic conditions.

Why try to predict cycle 24?

Understand fundamental solar processes that link the core dynamo/subsurface/photospheric phenomena;

Implications for terrestrial climate/space assets over the next decade; solar contribution to global warming

How?

Predict future from past behavior, e.g, identification of quasi-periodic features in recorded solar activity levels;

Identify proxies during solar minima that may correlate with the size of the next maximum (e.g., field strength in polar coronal holes; geomagnetic activity)

Models based on physics of the solar dynamo/sub surface processes using recent cycles as input conditions.

Examples of Predictions of Cycle 24 (Cycle 23 = 120.8)

- D. Hathaway (**strong cycle**): fast meridional circulation speed in cycle 22 leads to a strong cycle 24.
- ***M. Dikpati, G. de Toma, and P. A. Gilman (Rz = 157-181 (flux-transport dynamo-based tool, sunspot area, and number)).**
- G. Ali et al., (**Rz = 145** (2011-2012)): spectral analysis and neuro-fuzzy (!) modeling.
- ***K. H. Schatten (Rz = 100±30): The Sun's polar field serves as a predictor of solar activity based on dynamo physics.**
- P. Lantos (**RImax 108.4**) based on the skewness of the previous cycle.
- J-L. Wang et al,, (**Rz = 83.2-119.4**): statistical characteristics of solar cycles.
- Kane, R. P. (**Rz= 105**): regression analysis of sunspot number and geomagnetic activity.
- S. Duhau (**Rz= 87.5±23.5**): non-linear coupling function between sunspot maxima and aa (geomagnetic) minima modulations.
- ***L. Svalgaard et al., (Rz = 75±10): solar polar magnetic field strength at sunspot minima.**
- Badalyan et al., (**Rz not exceeding 50**): statistical characteristics of solar cycles.
- G. Maris, et al., (**low**): flare energy release during the descendant phase of cycle 23.
- M. Clilverd et al., (**weak cycle**): variation of atmospheric cosmogenic radiocarbon.

(From http://www.lund.irf.se/rwc/cycle24/)

*** Speaking at this meeting**