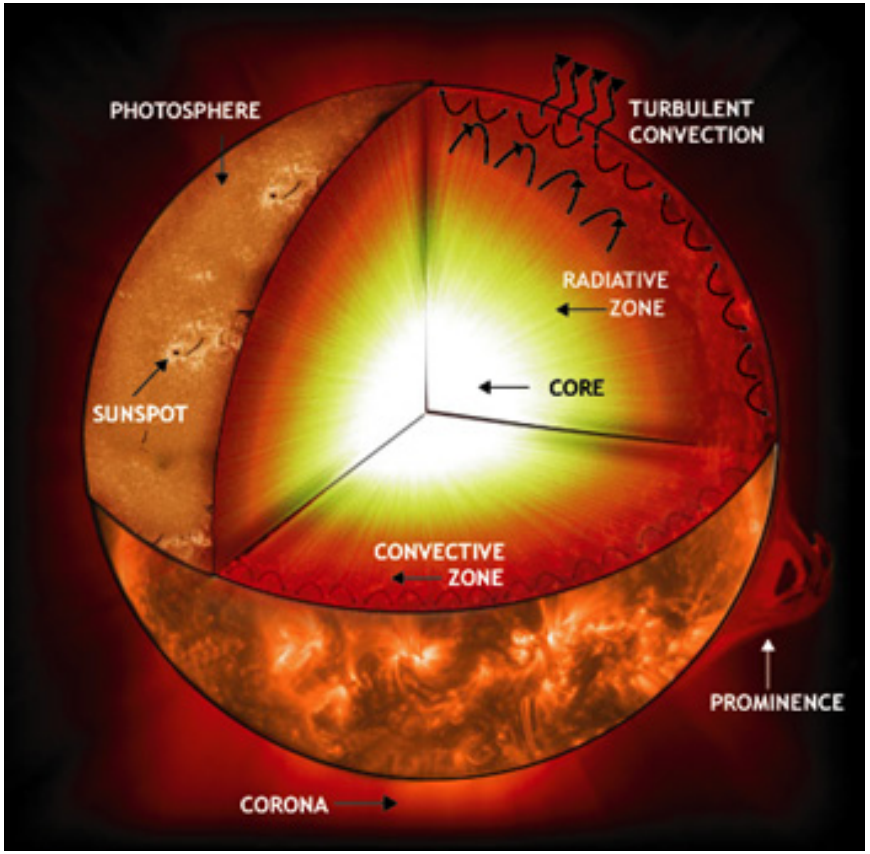
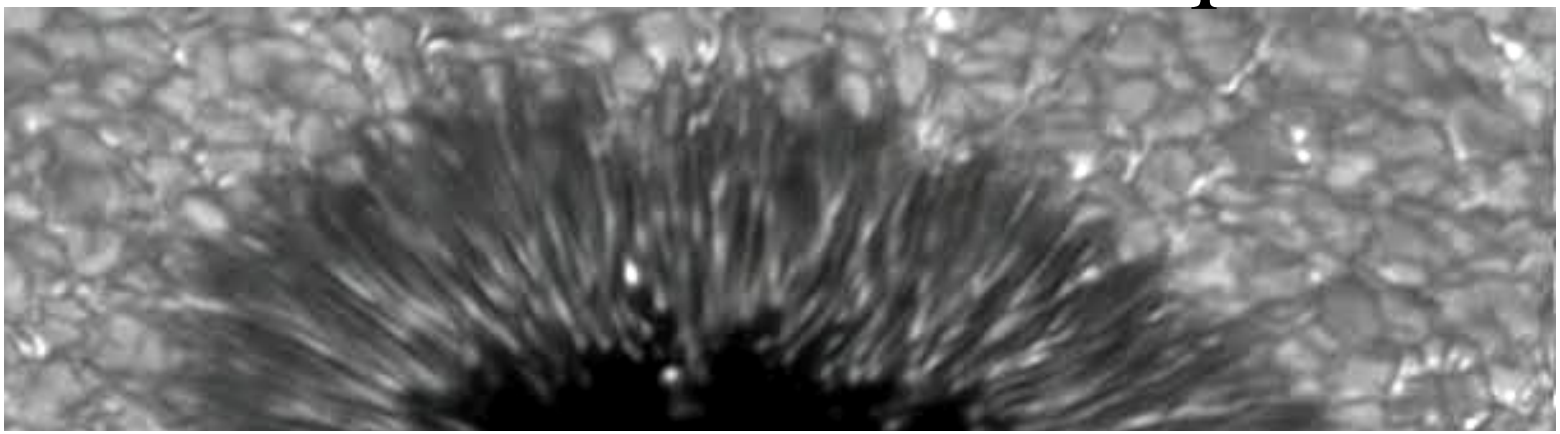
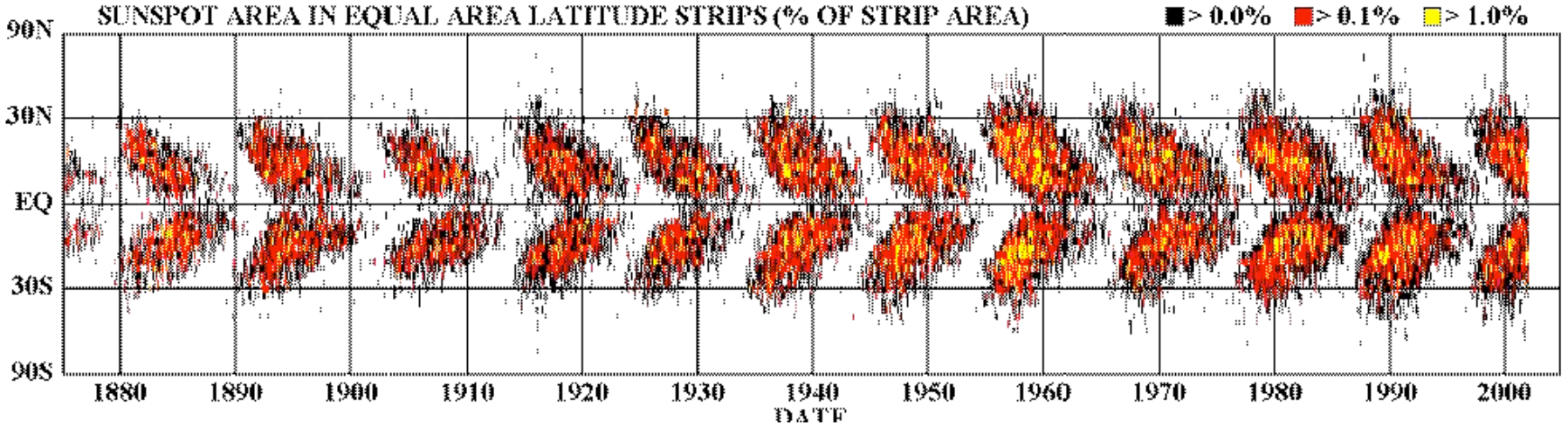
Types of Space and Astrophysical Plasmas

- Flow-dominated
  - Stellar interiors
  - Accretion disks
- Magnetically dominated
  - Stellar corona
  - Magnetospheres
- Intermediate state
  - Stellar winds
  - Interstellar media



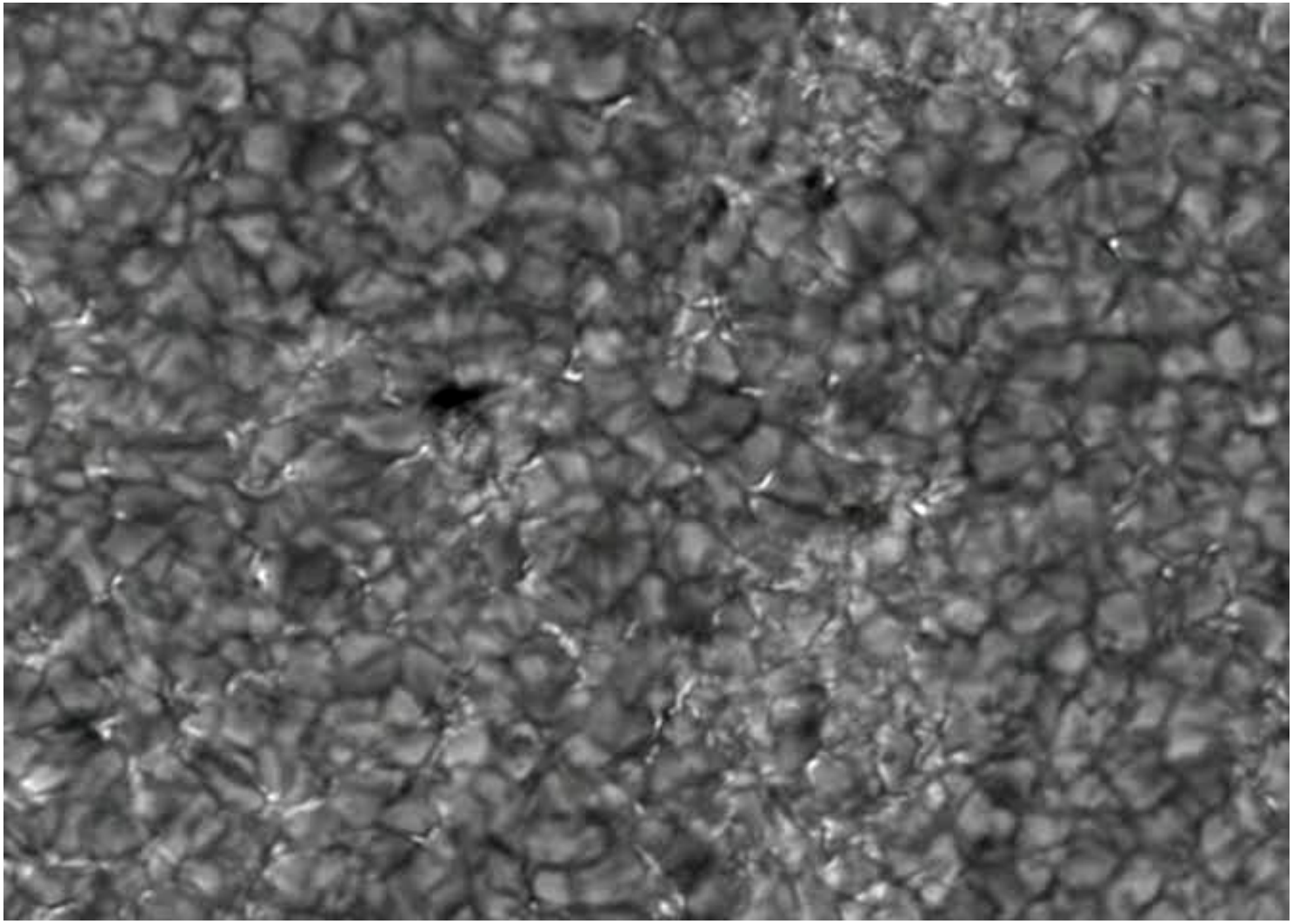
Sunspots (50,000km) Are Magnetic and Moves Towards Solar Equator





- What happens to these sunspots?

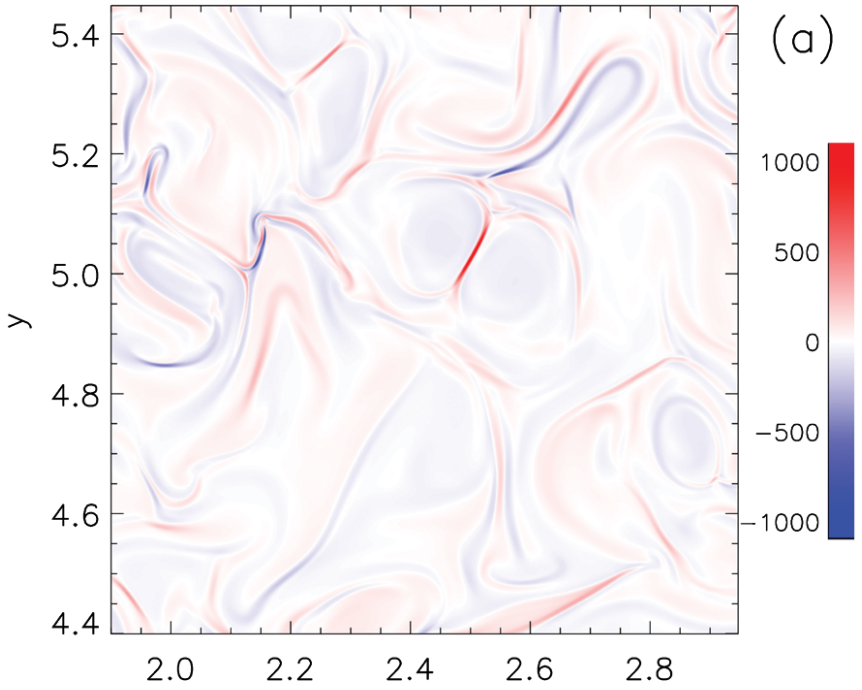
Granulation (1,000km)

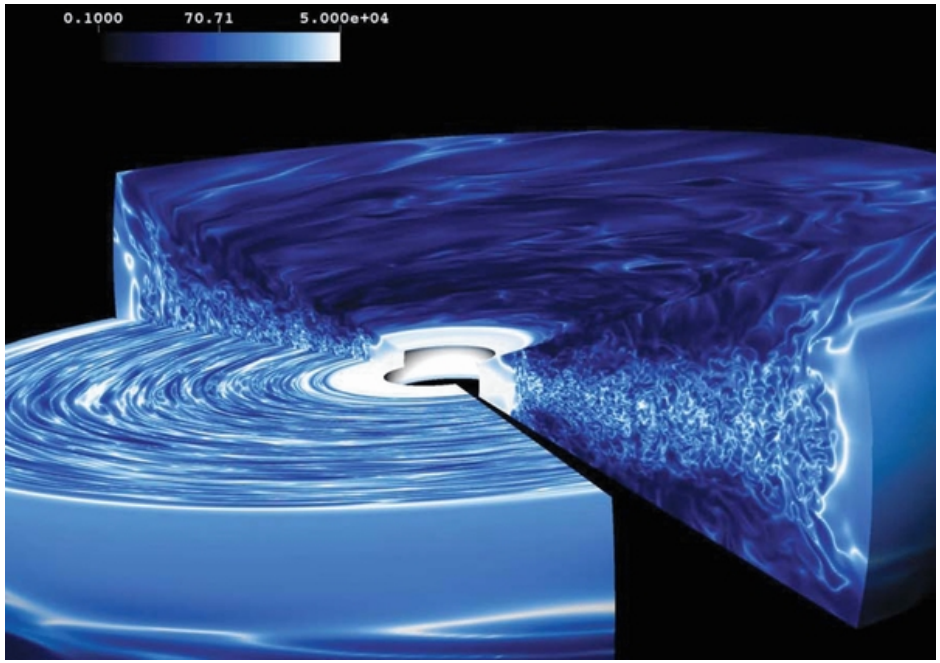


- What happens to these smaller magnetic fields?

Magnetic Reconnection is An Important Dissipation Mechanism Likely for All Types

- What happens to these current sheets in MHD turbulence?
- Magnetic field amplifies during MRI-driven accretion. What saturates magnetic field growth?





Servidio et al. (2009)

Flock et al. (2011)

First HED reconnection gathering at Rochester, Feb 2012

Discussions

- Topics
  - Characterize reconnection region structure, rate compare with sim
  - Particle acceleration (what decides spectra) (vs shock)
  - Radiation-mediated reconnection (need to think about signature)
  - 3D effect (jet generation from torus?)
  - GG field and/or relativistic effects
  - Plasma size and S dependences (plasmoids etc.)
  - Biermann effect (can be experimentally determined?)
  - MHD vs 2-fluid effects in HED plasmas (2-fluid for sure?)
- Teams
  - Astro theory & simulation
  - MRX
  - OMEGA/OMEGA-EP Lasers
  - SG Lasers

- Consensus: majority of participants agreed on particle acceleration as the topic for the immediate next step
- Next meeting to be held at Princeton

This Gathering

- Local field pile up: larger effects than expected
- Importance of global quantities: magnetic helicity transport and MRI-turbulence
- Biermann Battery: 2-fluid vs kinetic effects, can be studied more directly?
- Self-generated vs externally imposed
- Hall reconnection signatures: out-of-plane fields and in-plane electric field can be measured?
- Vorticity evolution similar to B evolution: measurement signatures?
- Reconnection vs shock vs plasma collision
- Reconnection in shocks and shocks in reconnection
- ES shocks or double layers, unimportant?
- Particle acceleration? Jets?
- Nonlocal heat transport (mean-free-path > T gradient)
- Effects of plasma transport phenomena
- Transport modified by B field, leading to new plasma dynamics
- Importance of pressure anisotropy

Possible Coordination and Collaborations

- Physics
- Flow-driven vs magnetic-driven
- Diagnostics
- Theory/Simulations