Prominence and Coronal Magnetic Field

OKAMOTO J. Takenori
(NAOJ)

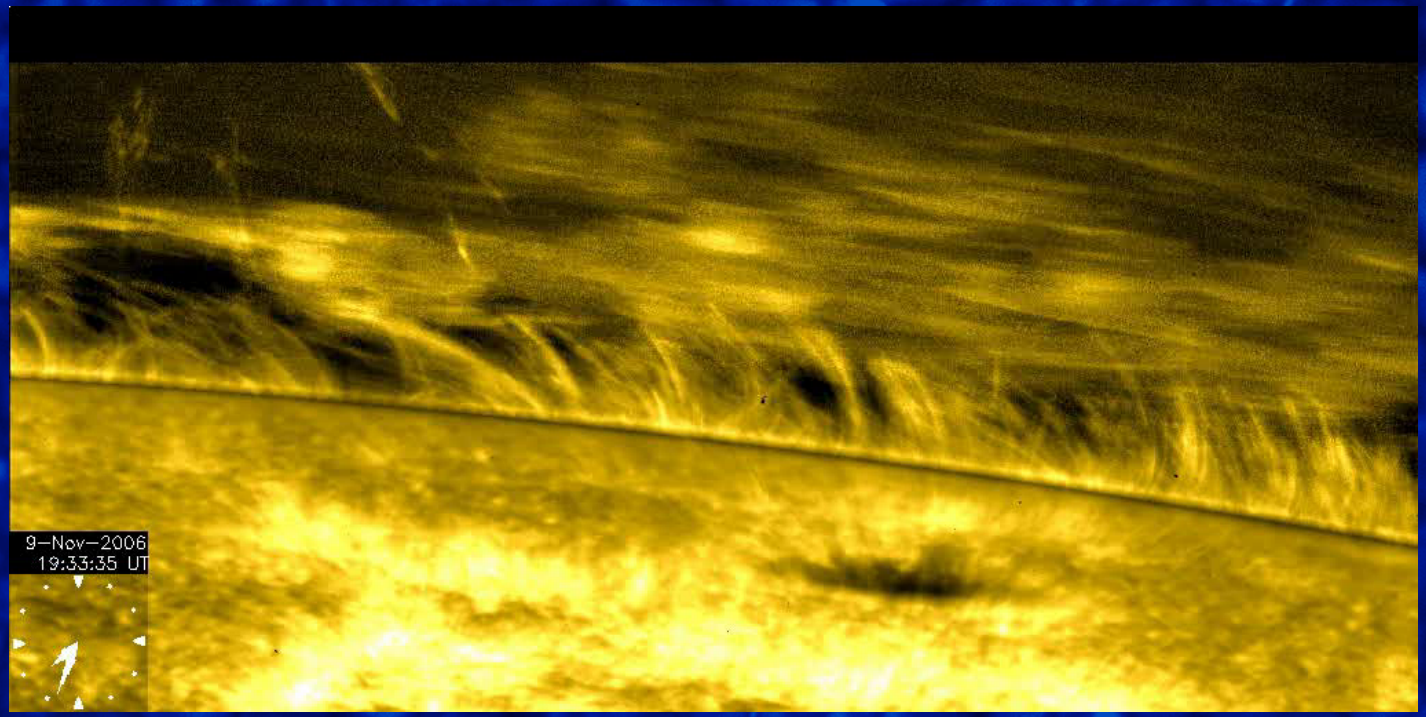
Coronal magnetic field

- Clarifying accurate coronal magnetic structure and strength
  - coronal heating mechanism quantitatively in accord with the magnetic configuration from the photosphere to the corona
  - triggering mechanism of flares and CMEs (i.e.) through interaction between coronal fields and emerging flux

Coronal seismology

- Signature of coronal Alfven (Alfvenic) waves in a solar prominence with a filtergraph movie

< 1,000 km



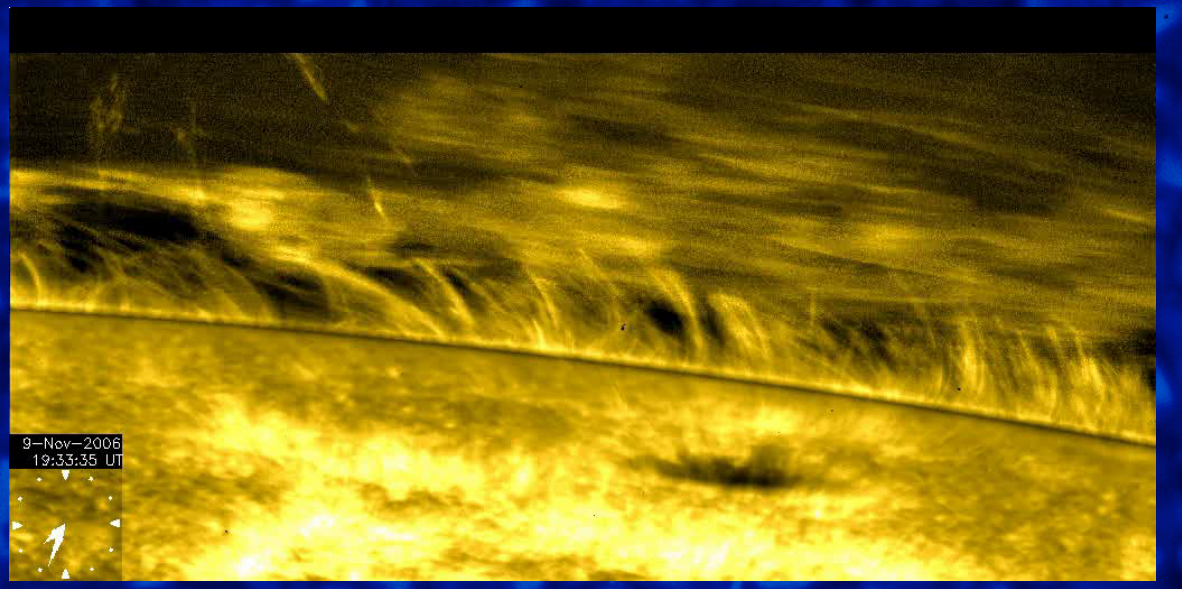
10,000 km

Okamoto et al. 2007, Science

Indirect measurement of magnetic field strength

- λ_{Alfven} > 250,000 km, *period* ~ 240 sec
- V_A >1,050 km/s
- plasma density $n \sim 10^{10}$ cm^{-3} (assumption)
- B > 50 G
- Poynting flux = $\rho v V_A^2 > 2.0 \times 10^6$ ergs/cm^2/s

$$V_A = \frac{B}{\sqrt{4\pi\rho}}$$



10,000 km

Okamoto et al. (2007)

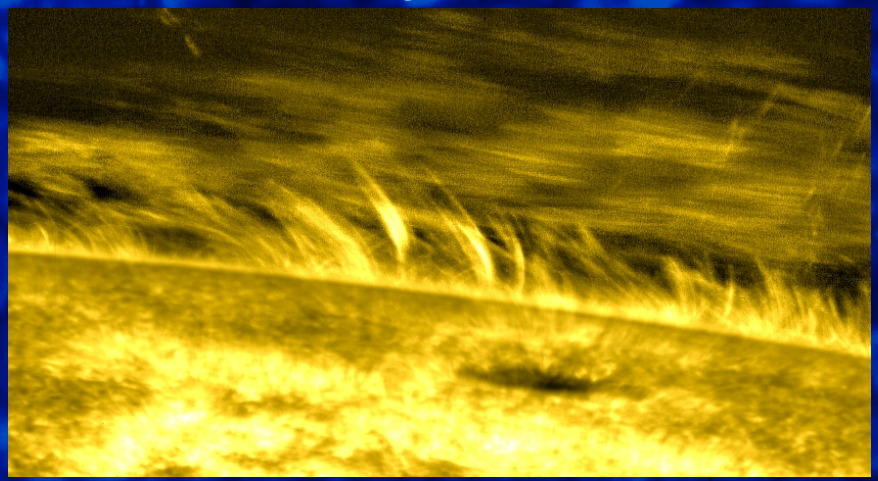
Coronal magnetic field

- Clarifying accurate coronal magnetic structure such as strength
  - coronal heating mechanism quantitatively in accord with the magnetic configuration from the photosphere to the corona
  - triggering mechanism of flares and CMEs (i.e.) through interaction between coronal fields and emerging flux
- Indirect measurement with coronal seismology
  - subject for Hinode and collaboration with ground observatories
- Direct measurement of coronal field
  - coronagraph, 20” (SOLARC; e.g., Lin et al. 2004)
  - Hanle-Zeeman effect in prominences, 2” (DST/ASP; e.g., Casini et al. 2003)

Prominence

- Good tracer of coronal magnetic fields
- Fine complex structures revealed with high-resolution observation < 0.5” ≪ usual atmospheric seeing
- Unclear magnetic field configuration even with Hinode

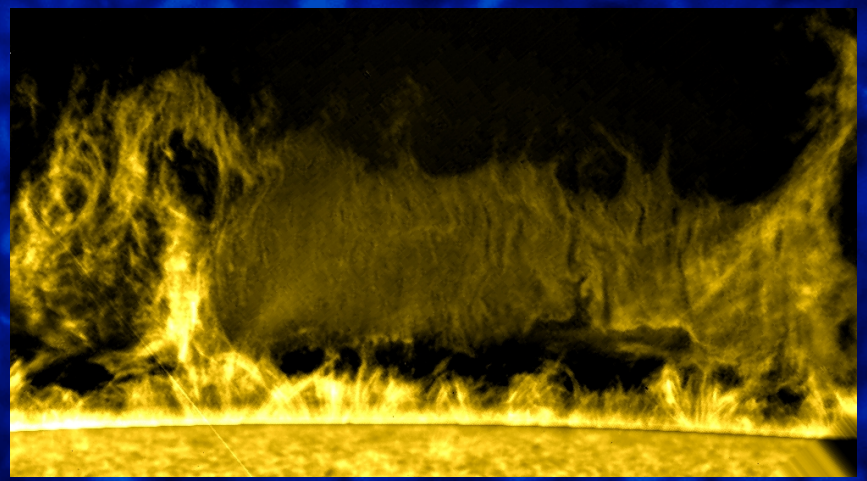
Active region prominence



(roughly horizontal)

Okamoto et al. (2007)

Quiescent prominence



(vertical ???, LOS ???)

Berger et al. (2008)

Direct observation of prominence magnetic fields

- High-resolution chromospheric observation considered Hanle effect
  - Lyα, He D3 5876Å, …
  - Mg II 2800Å, Na 5896Å, other chromospheric lines
- Long-term evolution of magnetic structures
  - “prominence” is not built in a day
  - advantage from space for prominence study
- Rapid evolution
  - change of prominence fields during flare/CME onsets
  - real-time operation like ground-based observation

Summary

- Next : Chromospheric magnetic field
  - ~0.2” is required in chromospheric observation.
  - But, too large mirror is not accepted. FOV covering active region size is necessary.
  - (50cm of SOT was quite reasonable)

Viva, Plan B !