

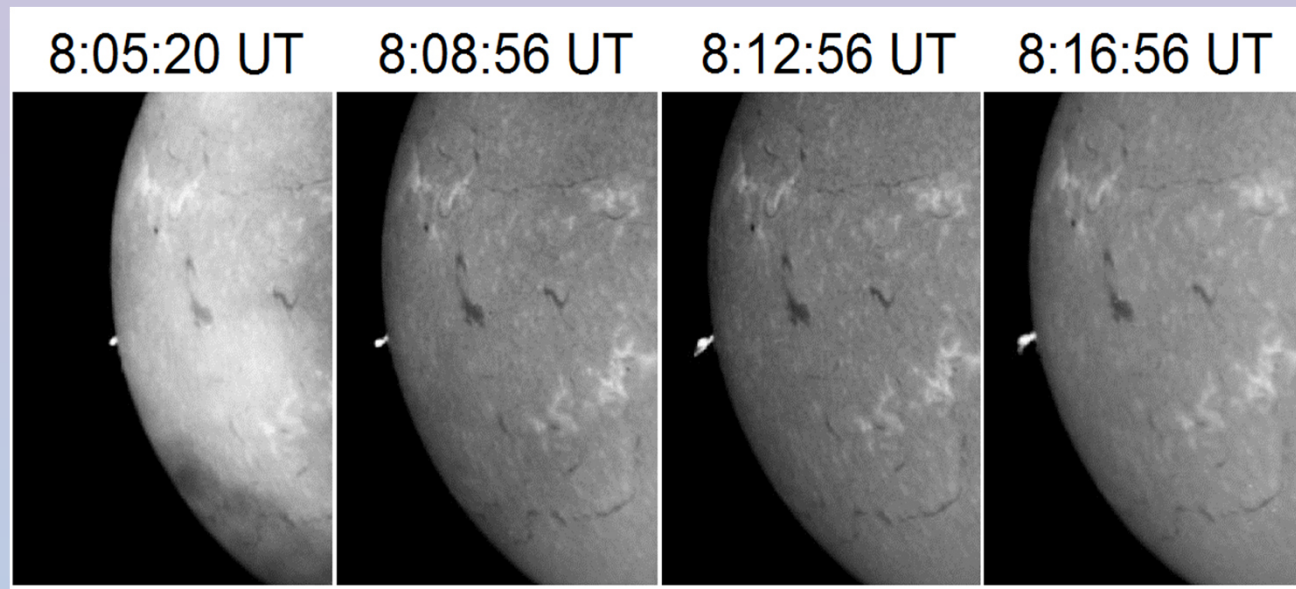
Magnetic fields and turbulent velocities in a limb solar flare by hydrogen, helium and ionized calcium lines

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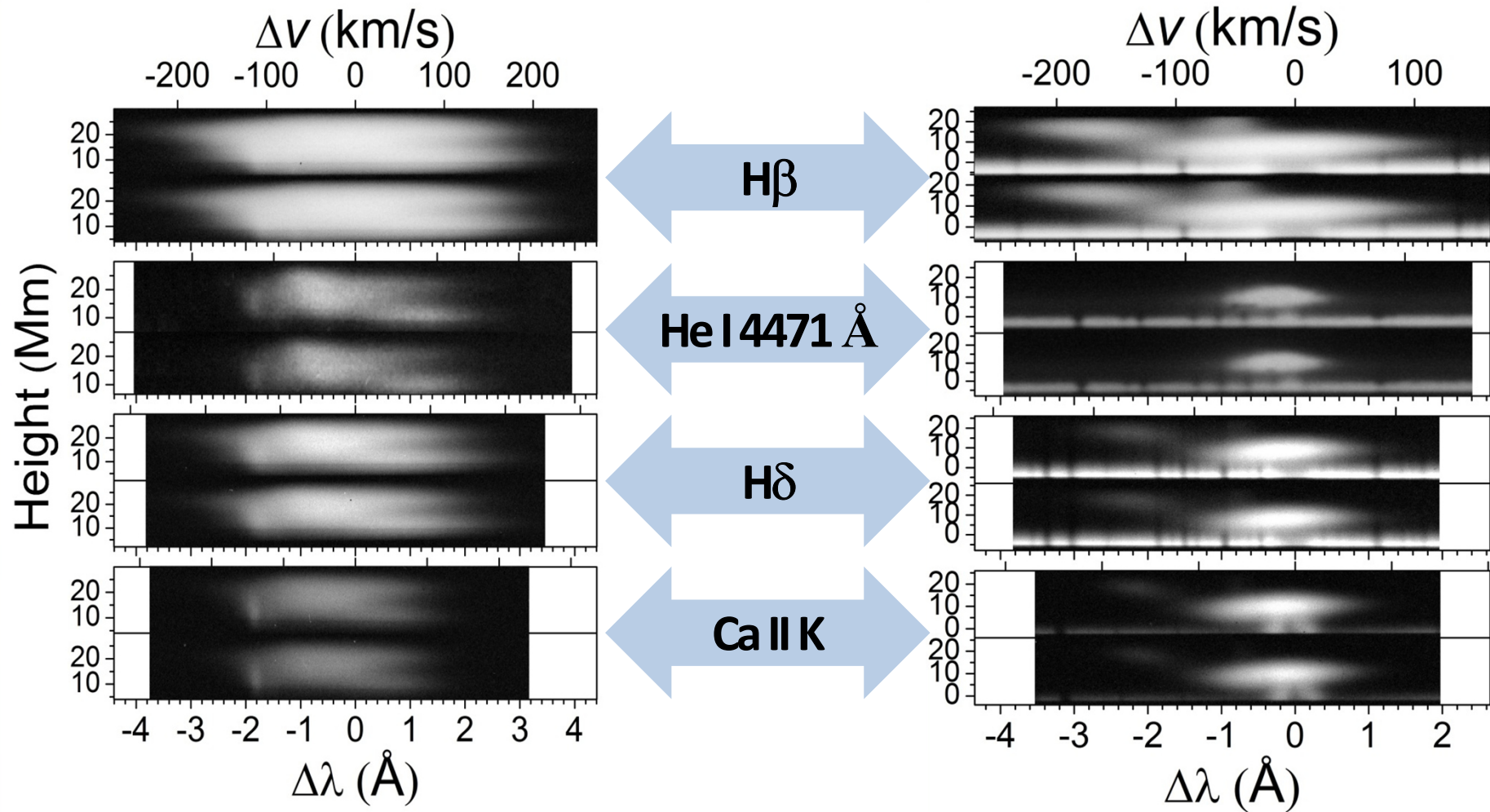
The flare under study

The development of the limb solar flare of 1981 July 17



- Spectral lines: Ca II K, H δ , He I 4471.5 Å and H β

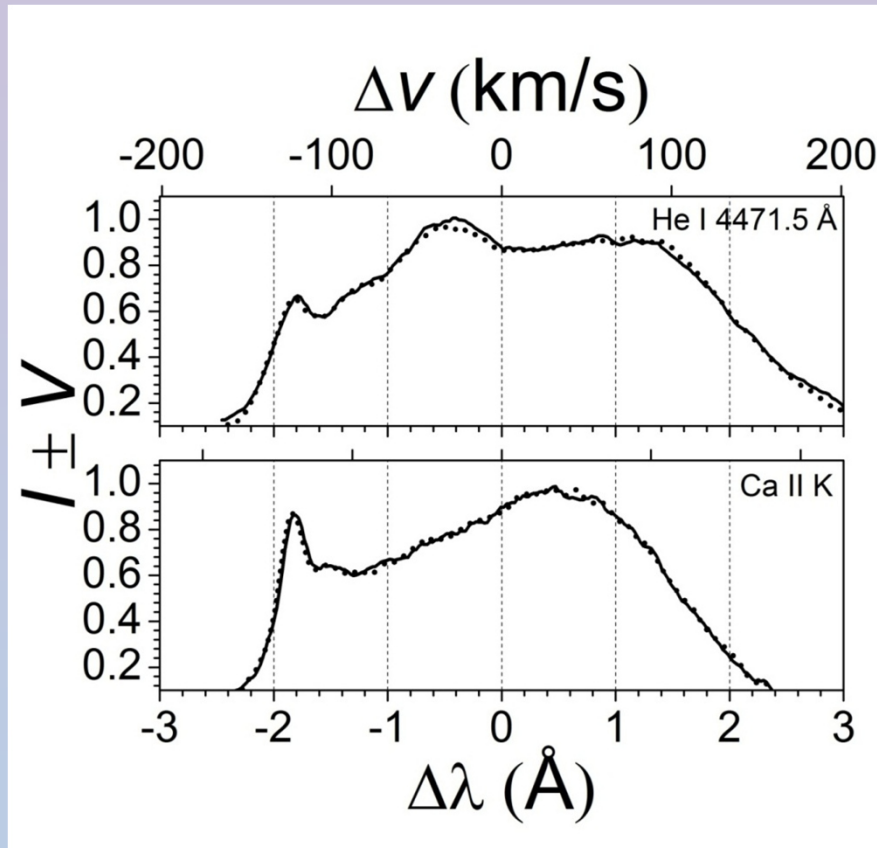
Observations



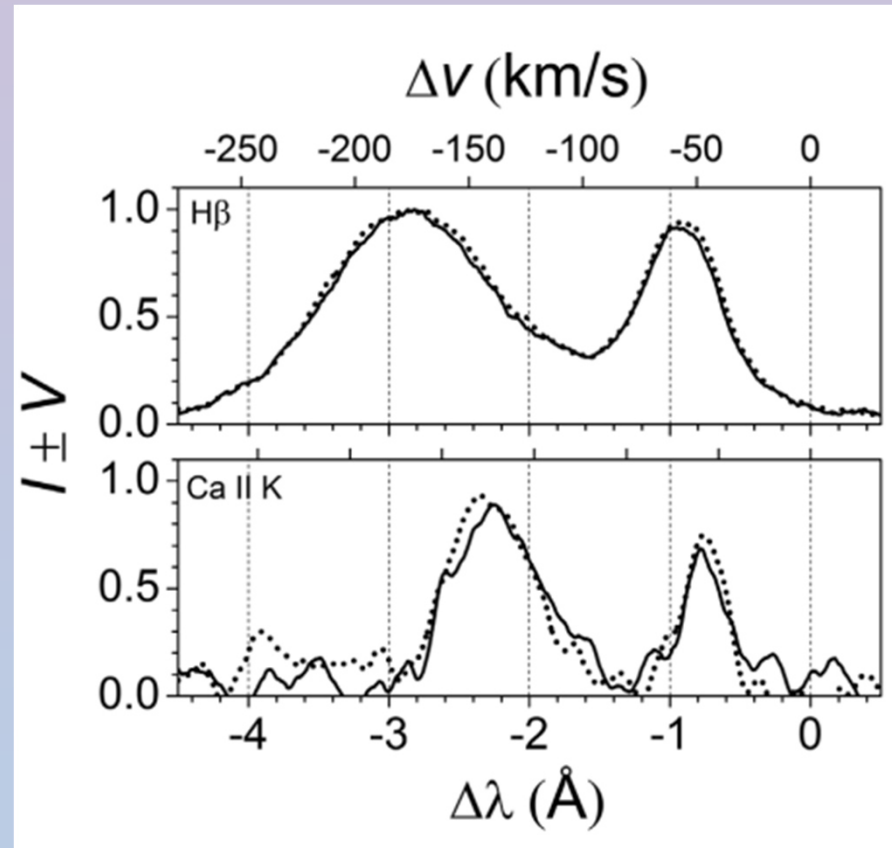
08:17 UT

08:33 UT

Spectral line profiles

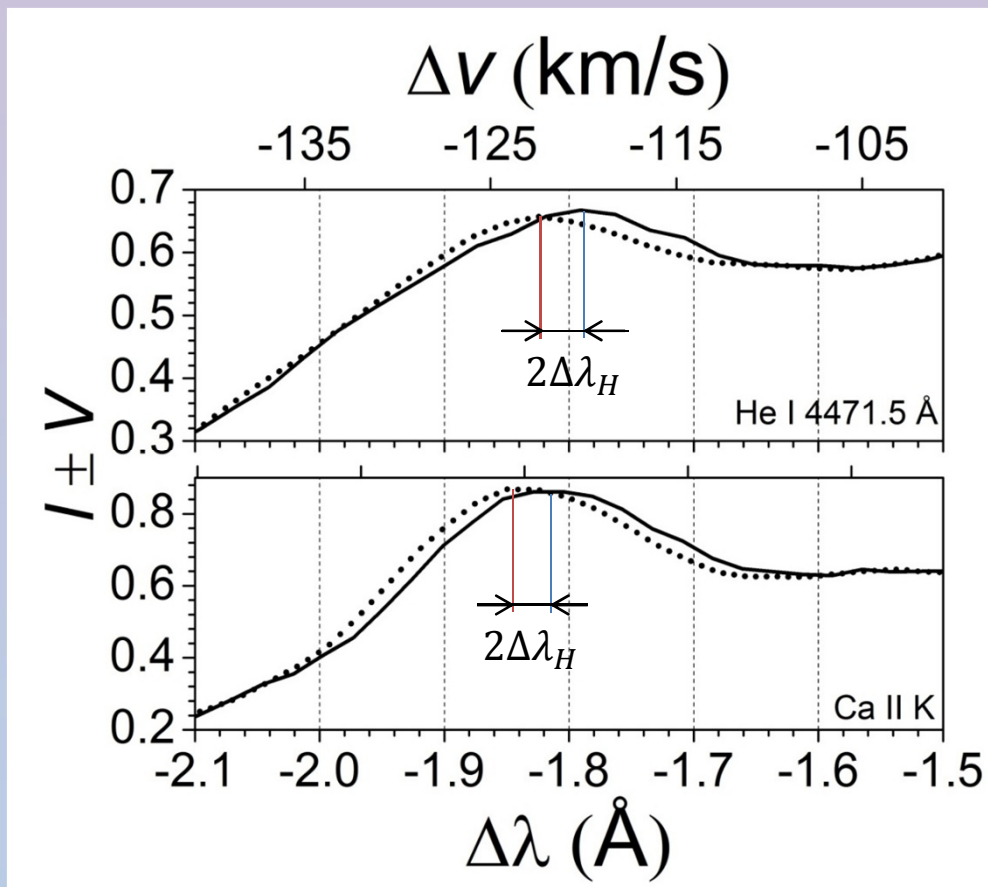


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Magnetic fields

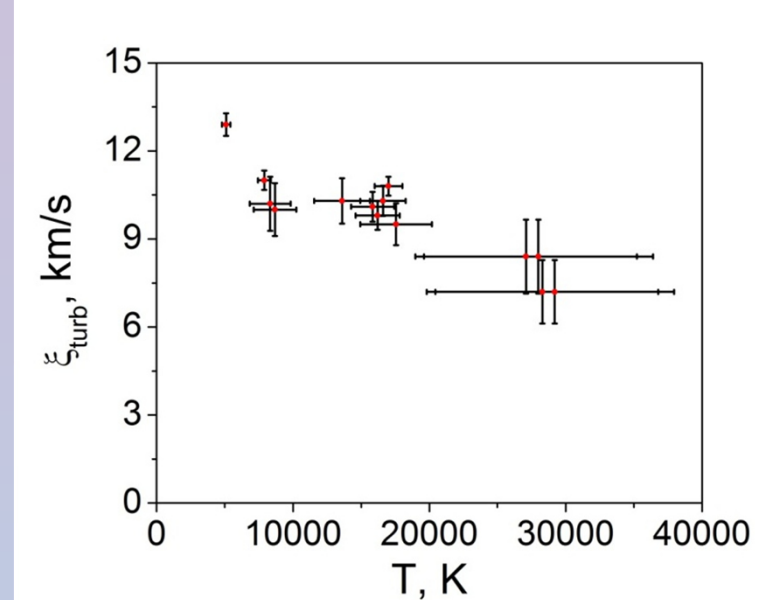
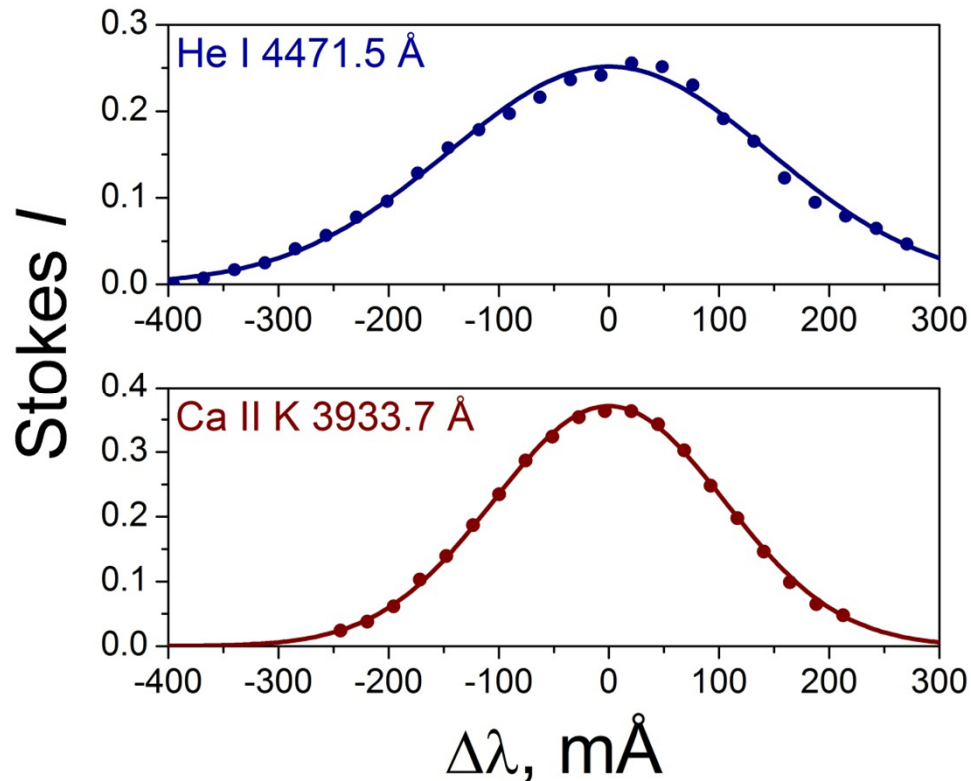


Line	Height (Mm)	B_{eff} (G)
Ca II K	10.0	2900 \pm 120 (N)
	12.3	1200 \pm 115 (S)
	14.6	150 \pm 120 (S)
	16.9	750 \pm 130 (S)
He I 4471 Å	12.3	300 \pm 140 (S)
	14.6	1500 \pm 200 (S)

- Very strong magnetic fields (up to about 3 kG).
- Significant inhomogeneity of the magnetic fields.

$$\Delta\lambda_H = 4.67 \times 10^{-13} g_{\text{eff}} \lambda_0^2 B_{\text{eff}}$$

Turbulent velocities



$$\Delta\lambda_D = \frac{\lambda_0}{c} \sqrt{\frac{2kT}{m} + \xi_{\text{turb}}^2}$$

- Anti-correlation between temperature and turbulent velocity.
- Possible indication of very strong magnetic fields (magnetic broadening).

Conclusions

- On 17 July 1981 narrow emission peaks with widths of only 0.25–0.35 Å were observed in the limb solar flare.
- The magnetic fields in the flare at heights of 10–15 Mm above the photosphere reach up to about 3 kG.
- The revealed certain anti-correlation between temperature and turbulent velocity can indicate the existence of very strong magnetic fields of mixed polarity up to 7–8 kG.