Correlations between spicules in the chromosphere and in the transition region

Alfred G. de Wijn (A.G.deWijn@astro.uu.nl)

Utrecht University, The Netherlands

in collaboration with B. de Pontieu and R. Erdelyi

Introduction

Typical temperatures: 5000-15000 K

Typical size: <1" diameter, 5-10" long

Typical speeds: 20 km/s

Typical periodicities: 5-6 minutes, 4-7 oscillations

Typical number: 4×10^5 on the sun

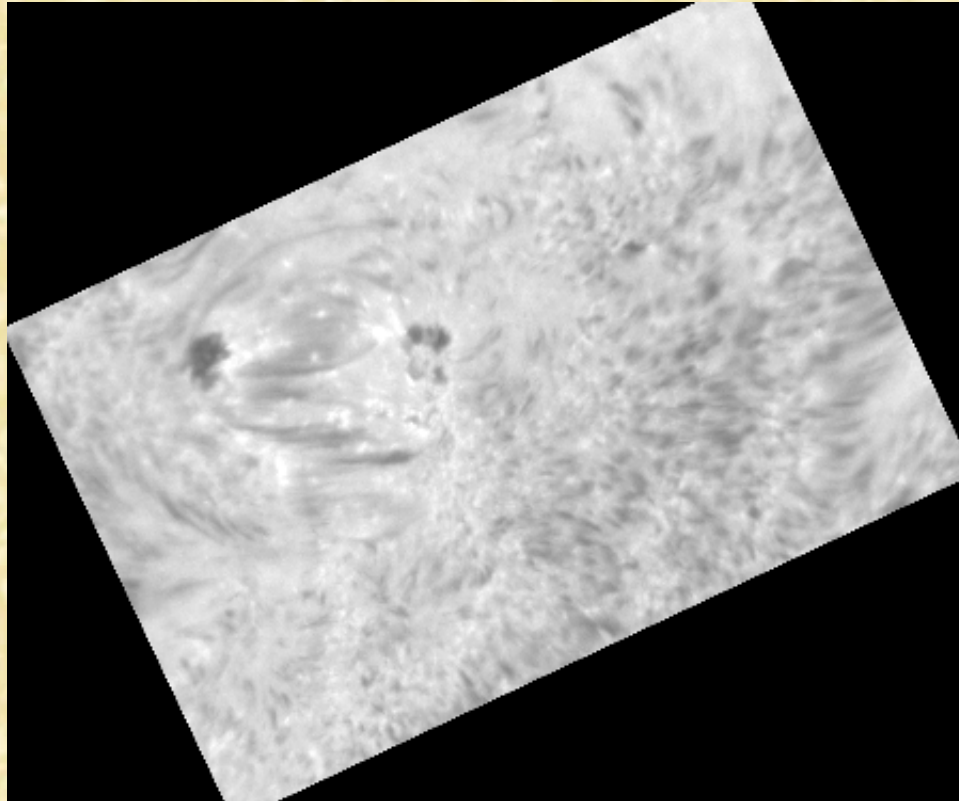Mass flux: 100 times more than the solar wind

Observations

SST & TRACE from 8:03 to 9:08 on June 16 2003

- Hα line scans at -700, -350, +350, and +700 mÅ
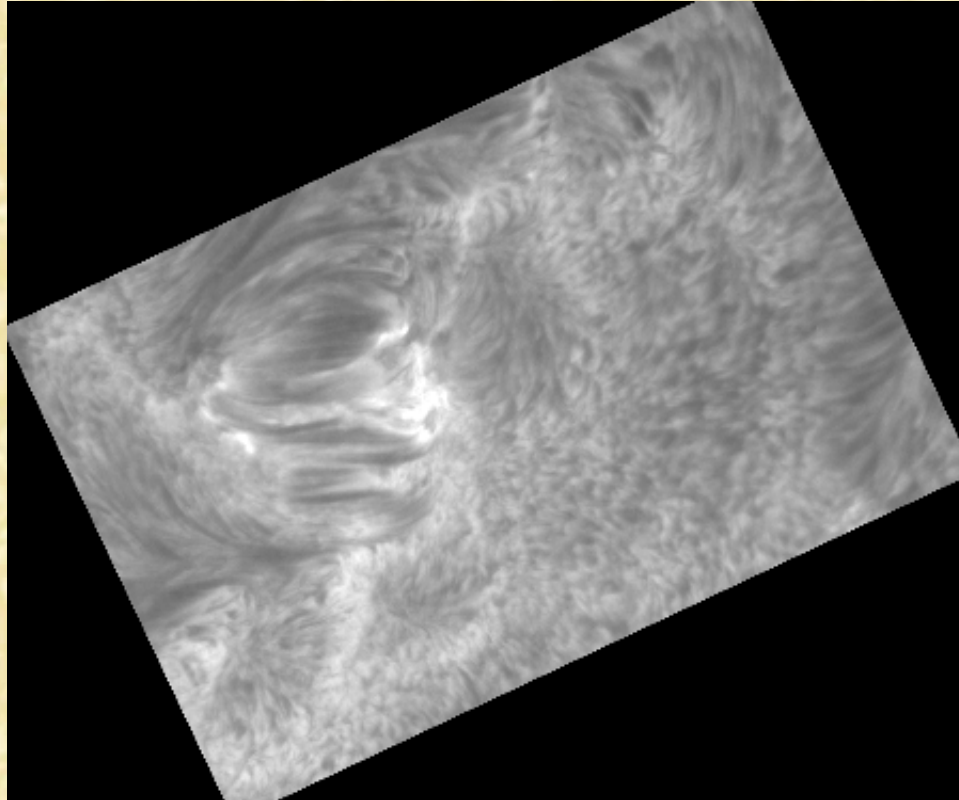- C IV constructed from UV continua at 1550, 1600, and 1700 Å

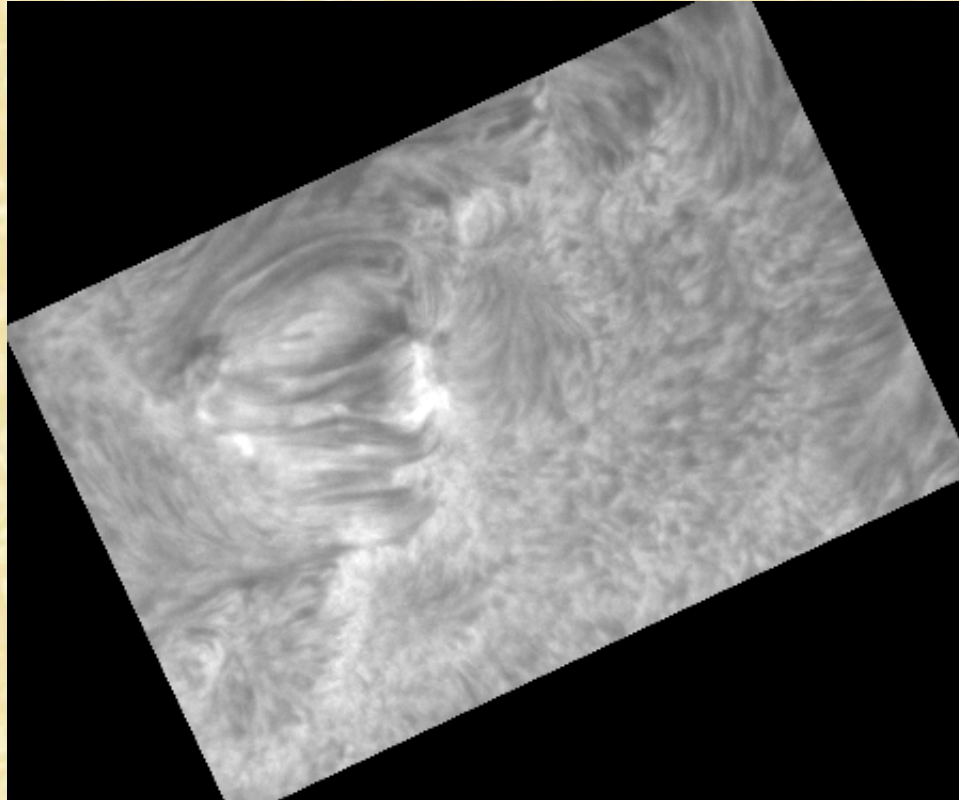TRACE from 8:00 to 12:00 on July 4 1999
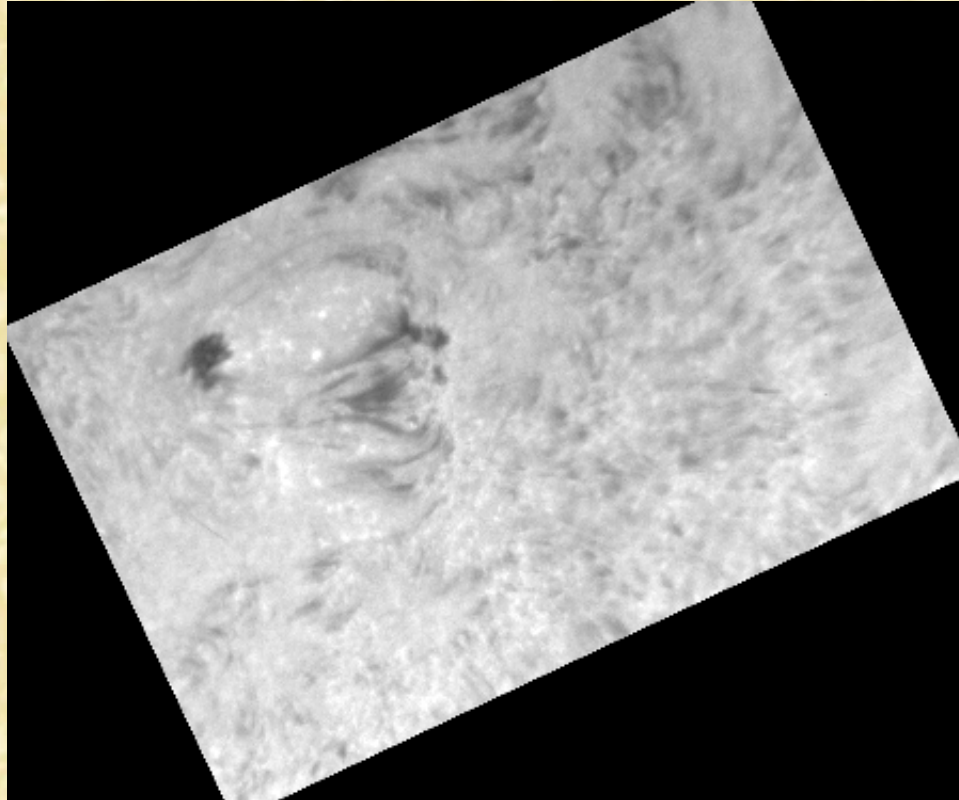
- 171 Å (Fe IX)
- Shows "moss"

Hα – 700 mÅ sample
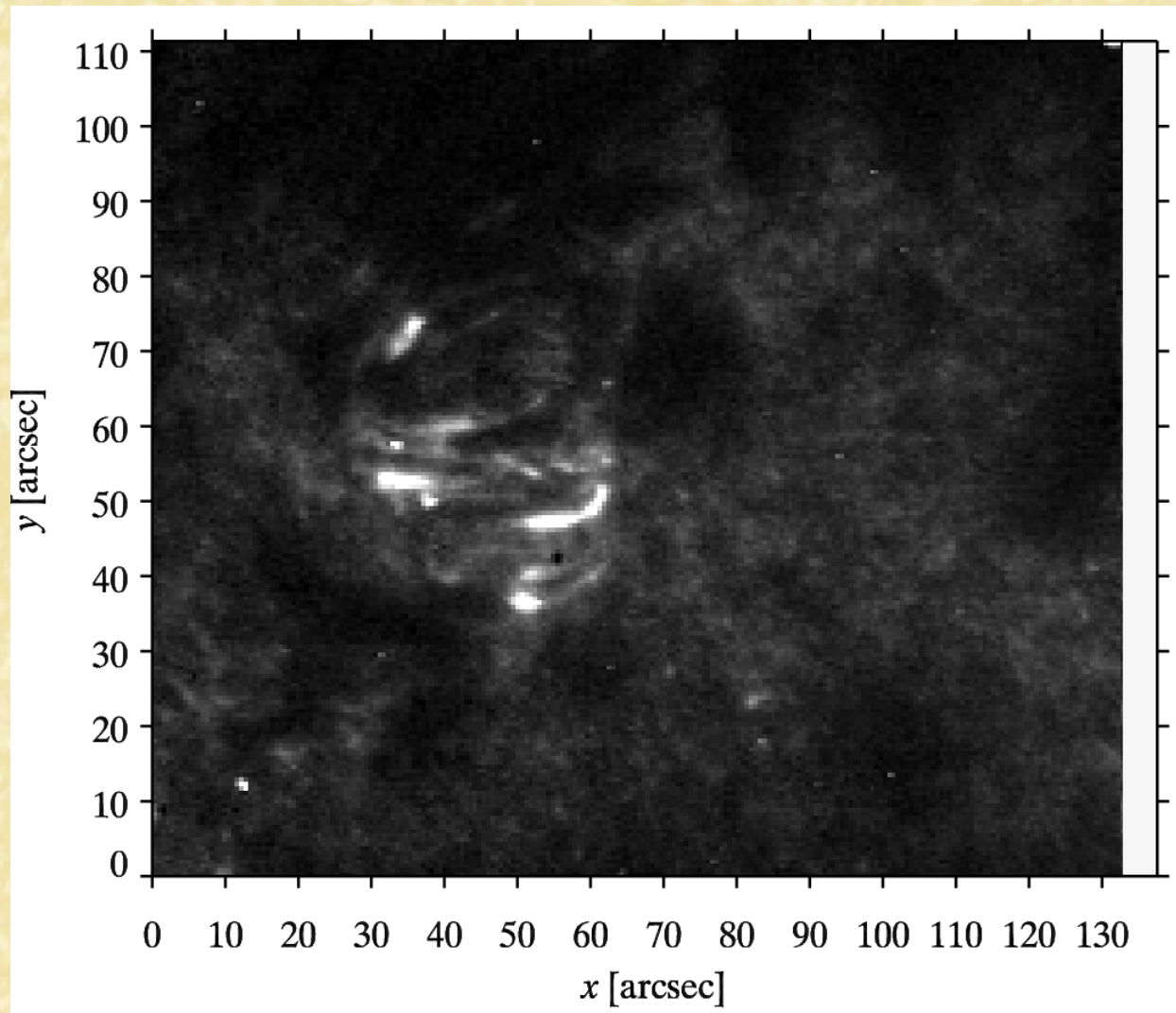
Hα – 350 mÅ sample

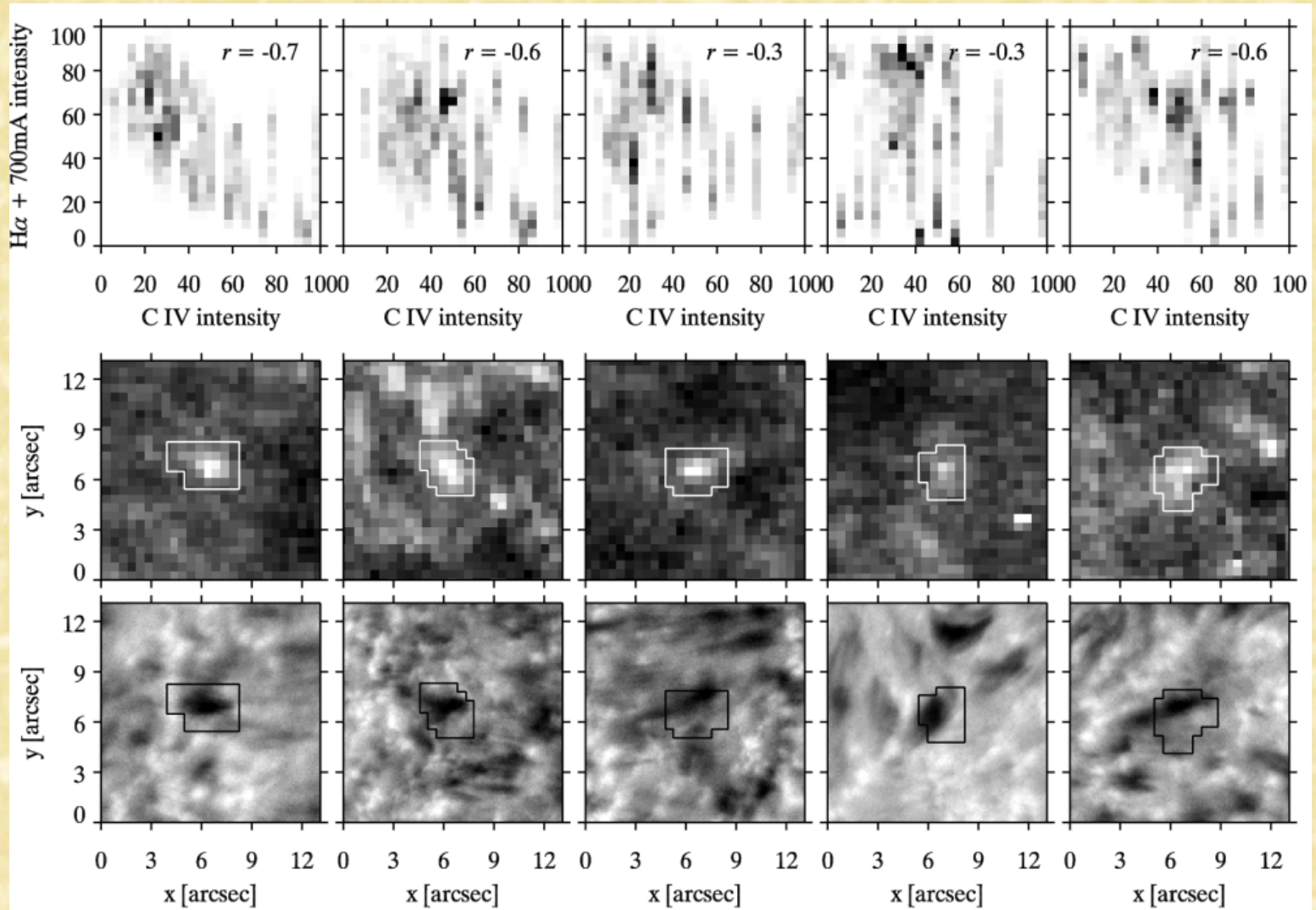# Hα + 350 mÅ sample

Hα + 700 mÅ sample

C IV construct sample

Pearson correlation coefficients
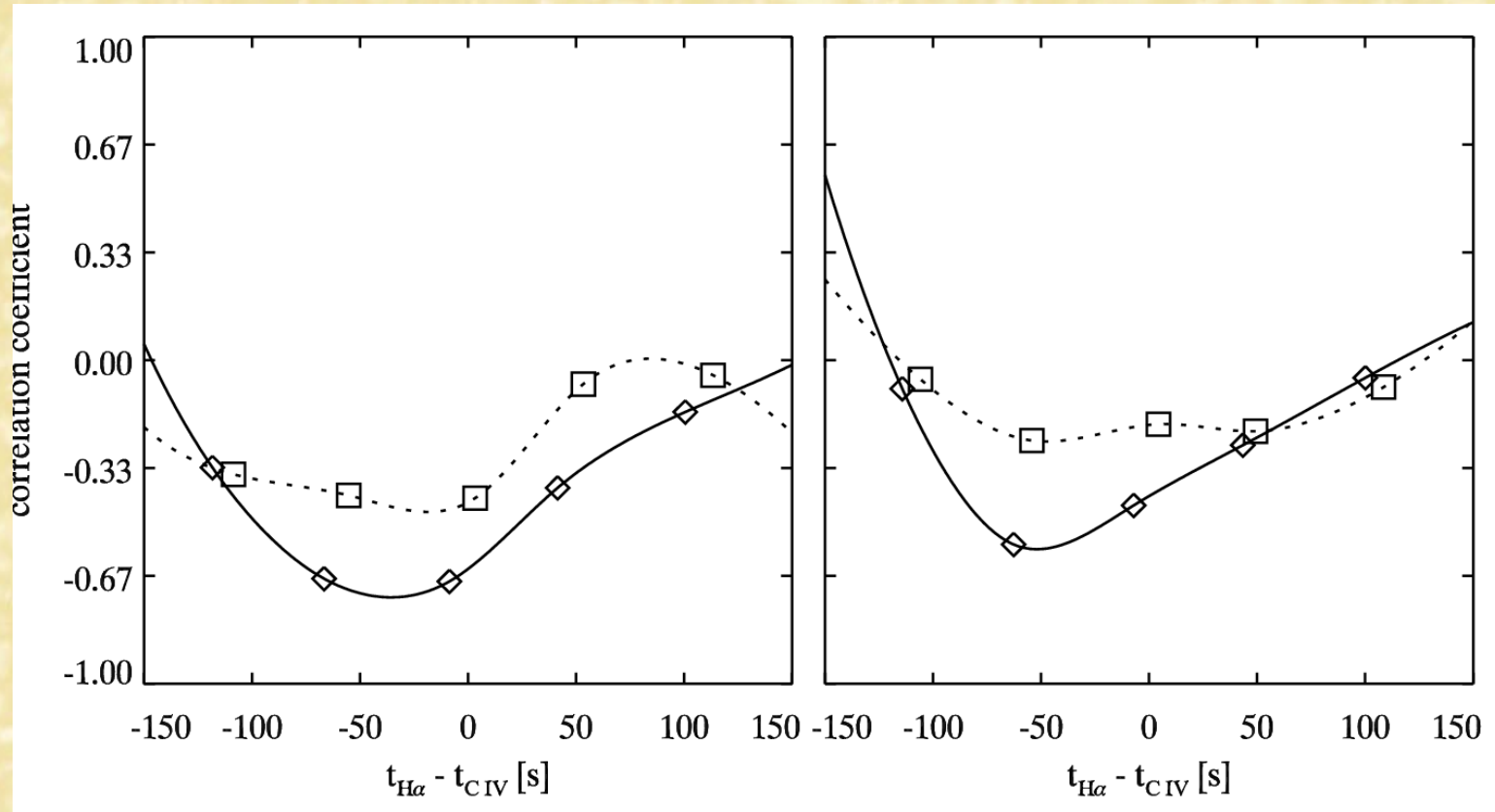
Correlation coefficient r is given by

$$r = \frac{\sum d_1 d_2 - \sum d_1 \sum d_2}{\sqrt{\sum d_1^2 - \left(\sum d_1\right)^2} \sqrt{\sum d_2^2 - \left(\sum d_2\right)^2}}$$

- If d_1 and d_2 are linearly related, $r = \pm 1$
- If there is no linear component in the relation between d_1 and d_2, $r = 0$

C IV vs Hα

C IV vs Hα

Average time delay ~30 s
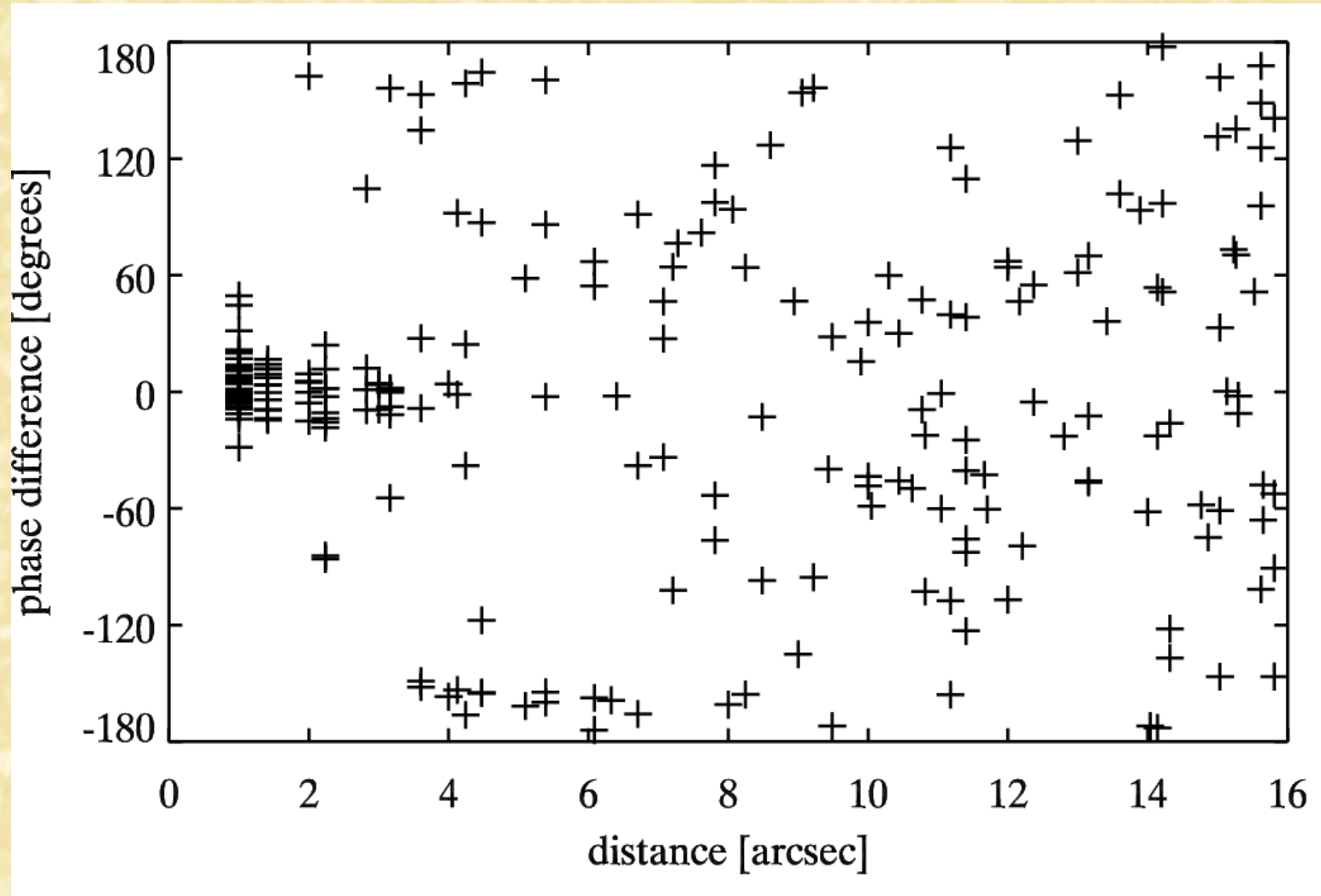
Moss oscillations

Are known to be related to spicules/mottles

Find positions with significant oscillations with periods between 250 and 450 s for longer than 20 minutes

For co-temporal oscillations, compute the average phase difference and distance

  – Use cross-power averaging

Phase difference vs distance

Summary

Some spicules emit C IV some time after appearing in redshifted Hα

Neighboring (d < 5") moss oscillations have small phase difference

Future work

- Investigate phase difference in spicule oscillations in Hα
- Study the spicule heating source
  - Cross-field conduction? (Athay 1990)
  - Radiation heating?