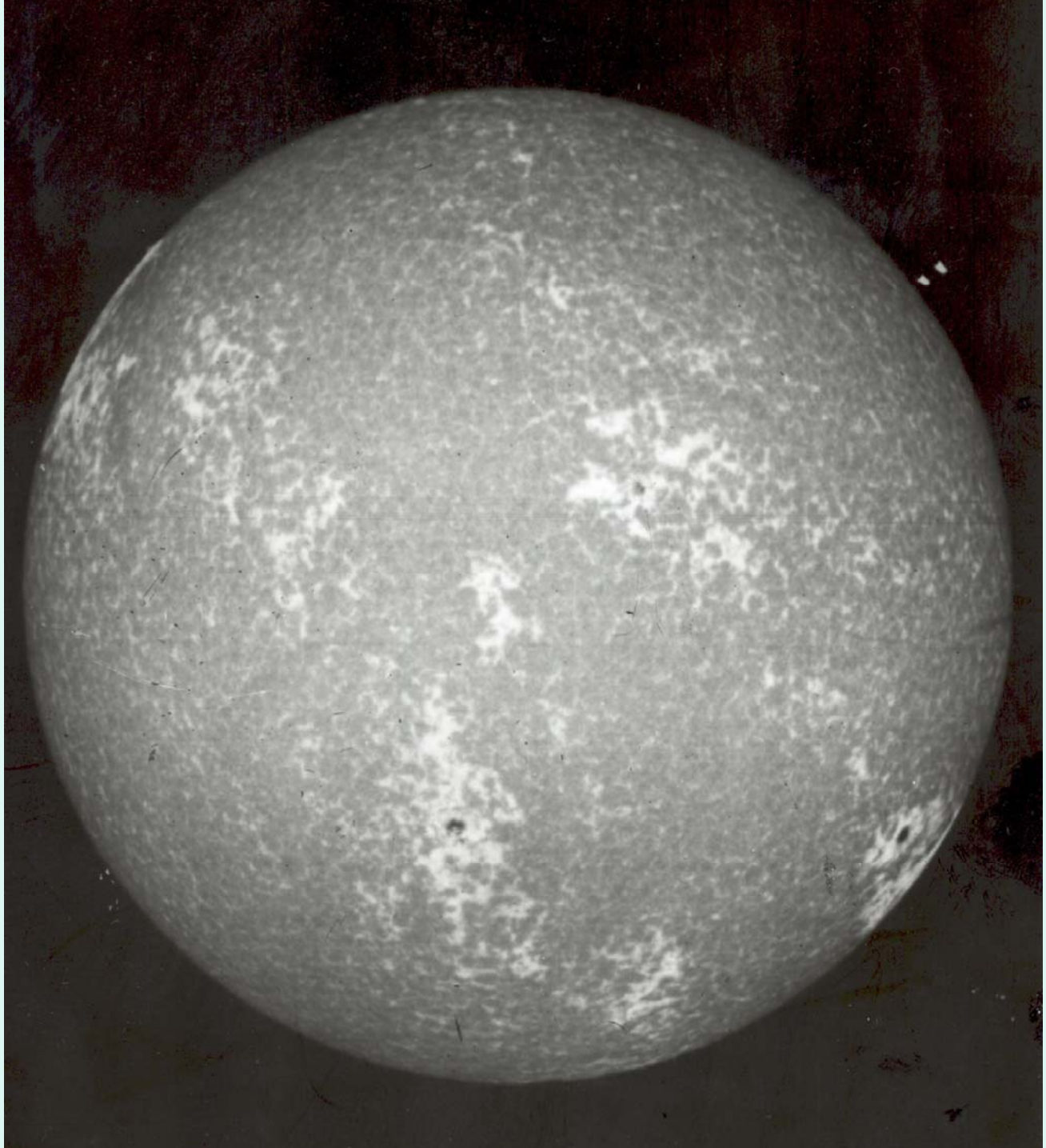
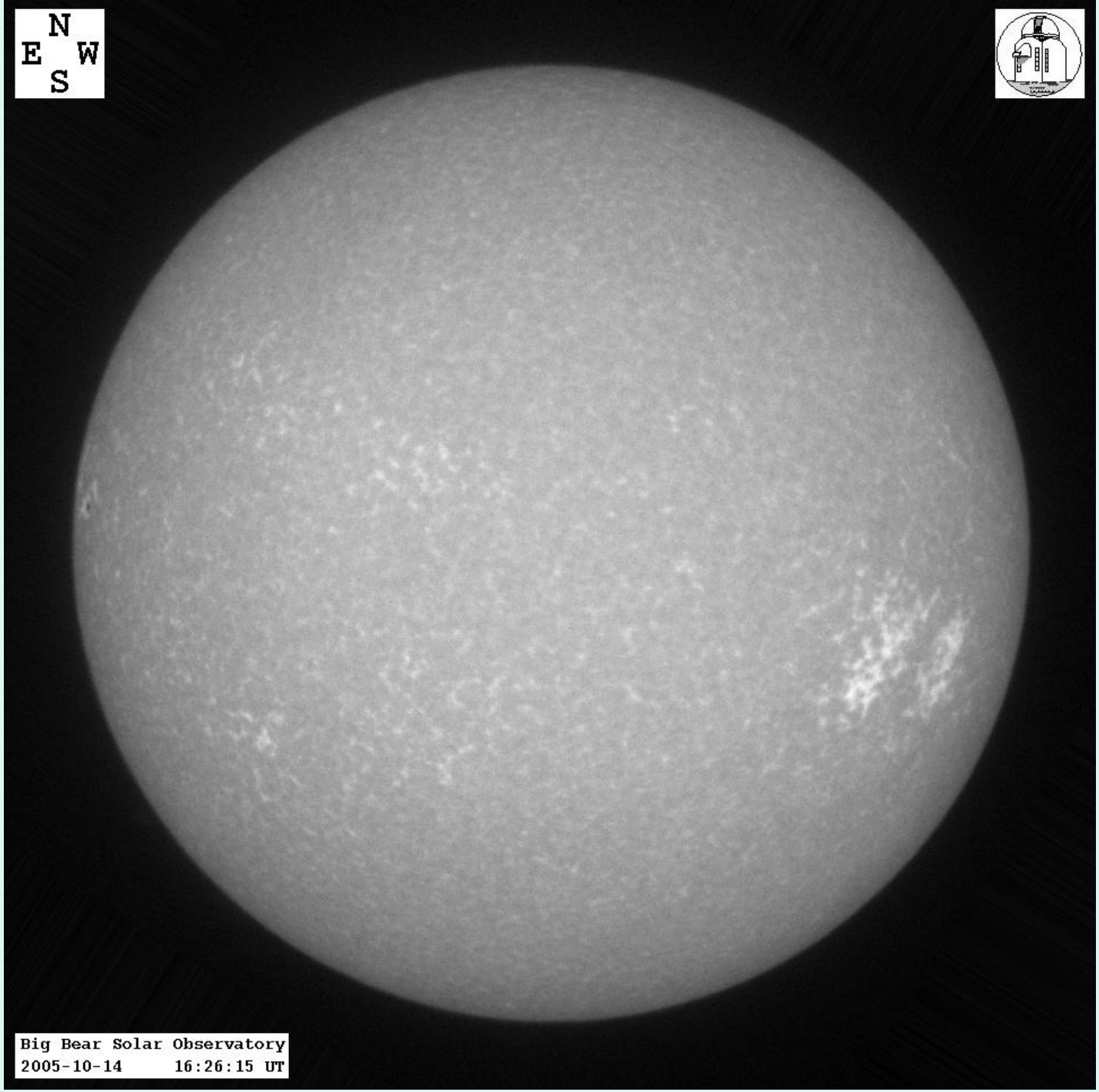
Chromospheric variations with the solar cycle phase as derived from Ca-K line profiles

Jagdev Singh

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INTRODUCTION

- Bappu started to monitor Ca-k line profiles of the sun as star since 1972
- Livingston started to study sun as star in Ca-k line since 1976
- It was found that sun is a variable star if observed in chromospheric Ca-k line
- Keil started to study the sun in the similar way since 1983
- Livingston group proposed a three component model taking into account plage areas, Ca-k network and active network component considering extant limb darkening laws

- The observed line profile did not agree with computed profiles during the all phases of the solar cycle
- Therefore, a active network component was added to match the observed profiles during different phases of the solar cycle
- But the measurements of the line profile at the center of the sun indicated no variation in the Ca-k line profile with the phase of the solar cycle
- A active network component is expected to cause a variation in the line profile at the center of the sun with the phase of the solar cycle

- To resolve this problem we started to obtain Ca-k line profiles as function of latitude and integrated over the visible longitudes of the sun since 1986 on daily basis
- The plage free profiles at a given latitude during the different phases of the sun will yield information about the variation in the back ground flux and active component

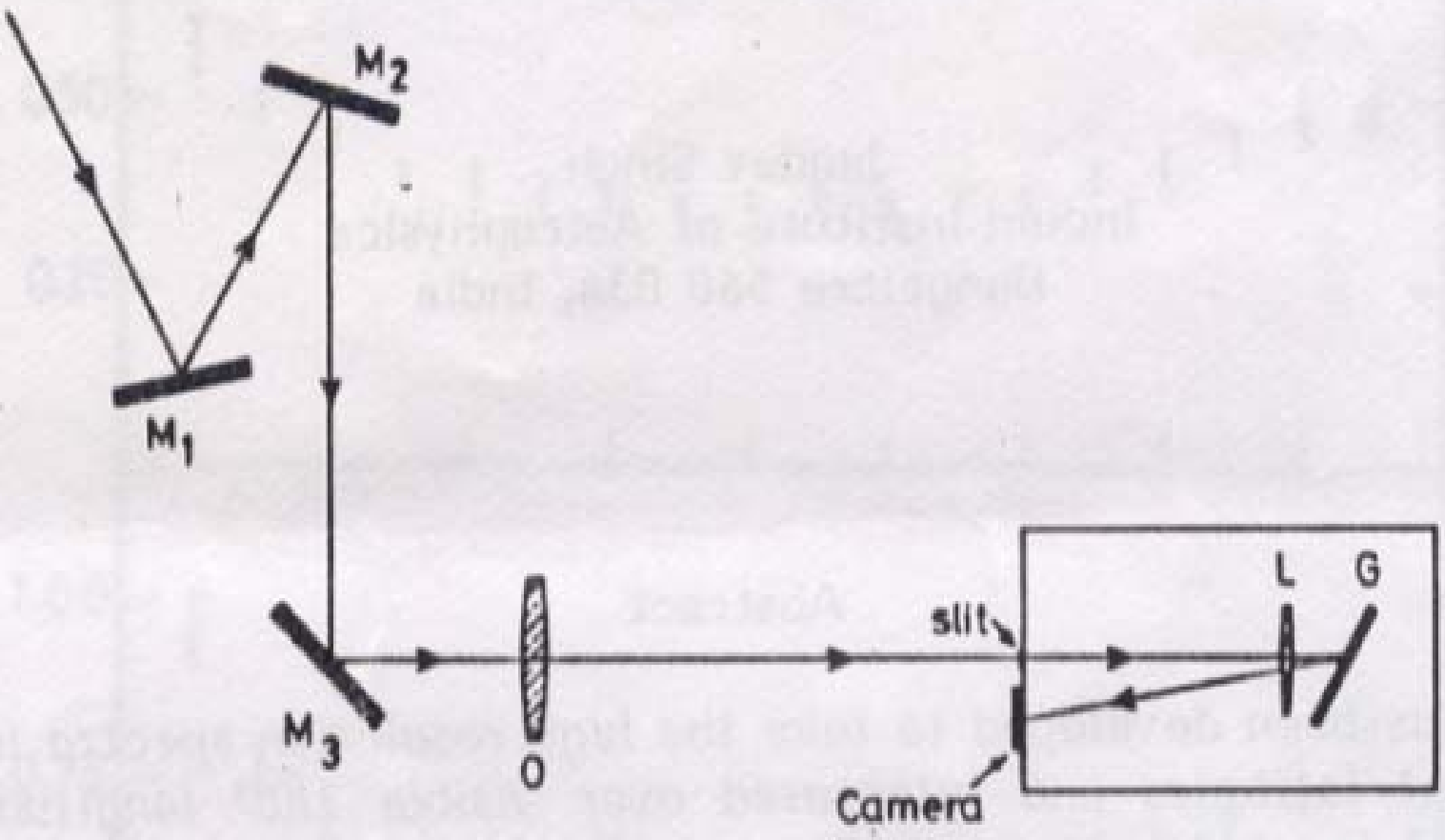


Fig. 1. Optical arrangement of Solar Tower telescope at Kodaikanal.

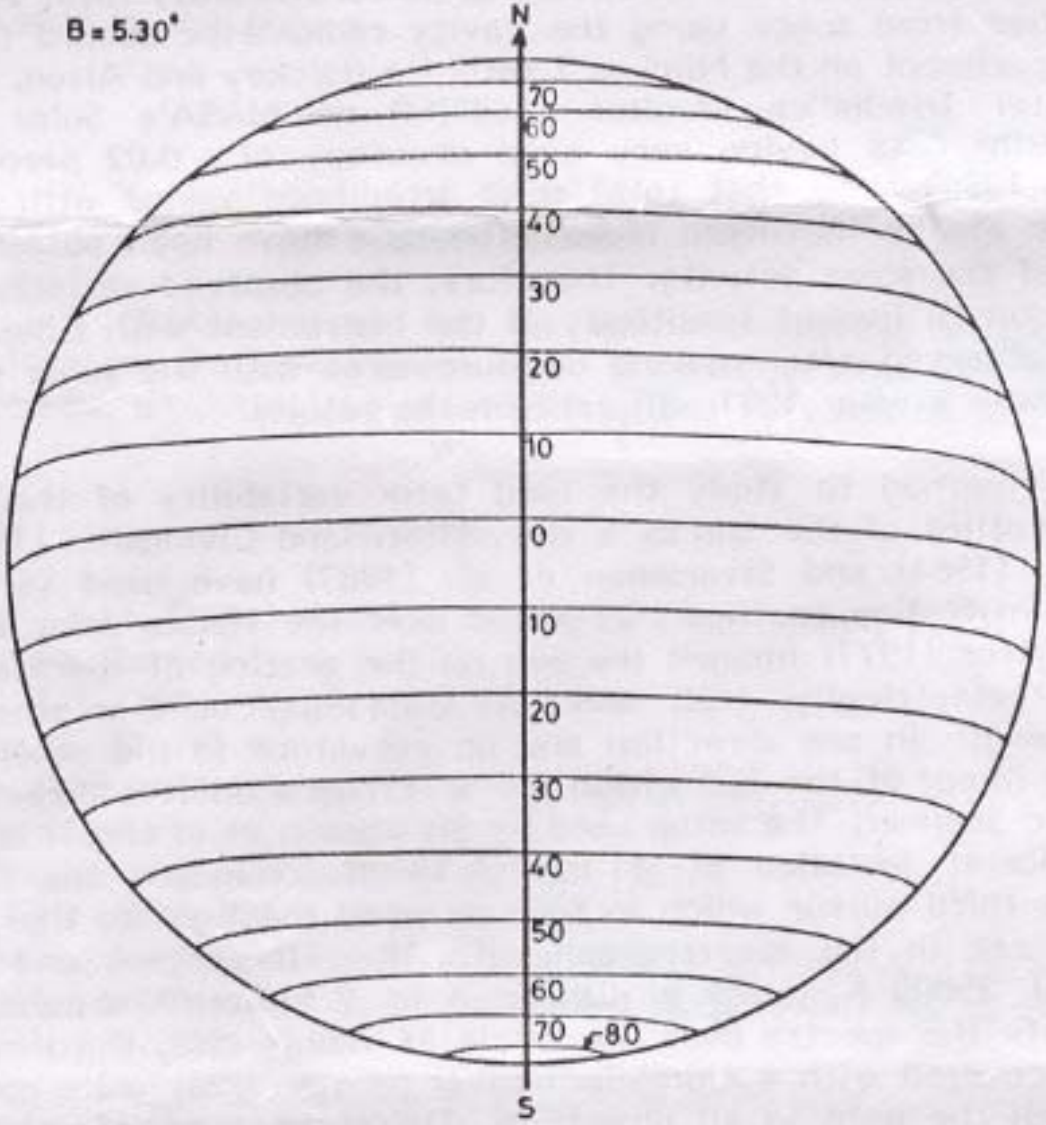


Fig.2. A typical Sun chart prepared for making the observations.

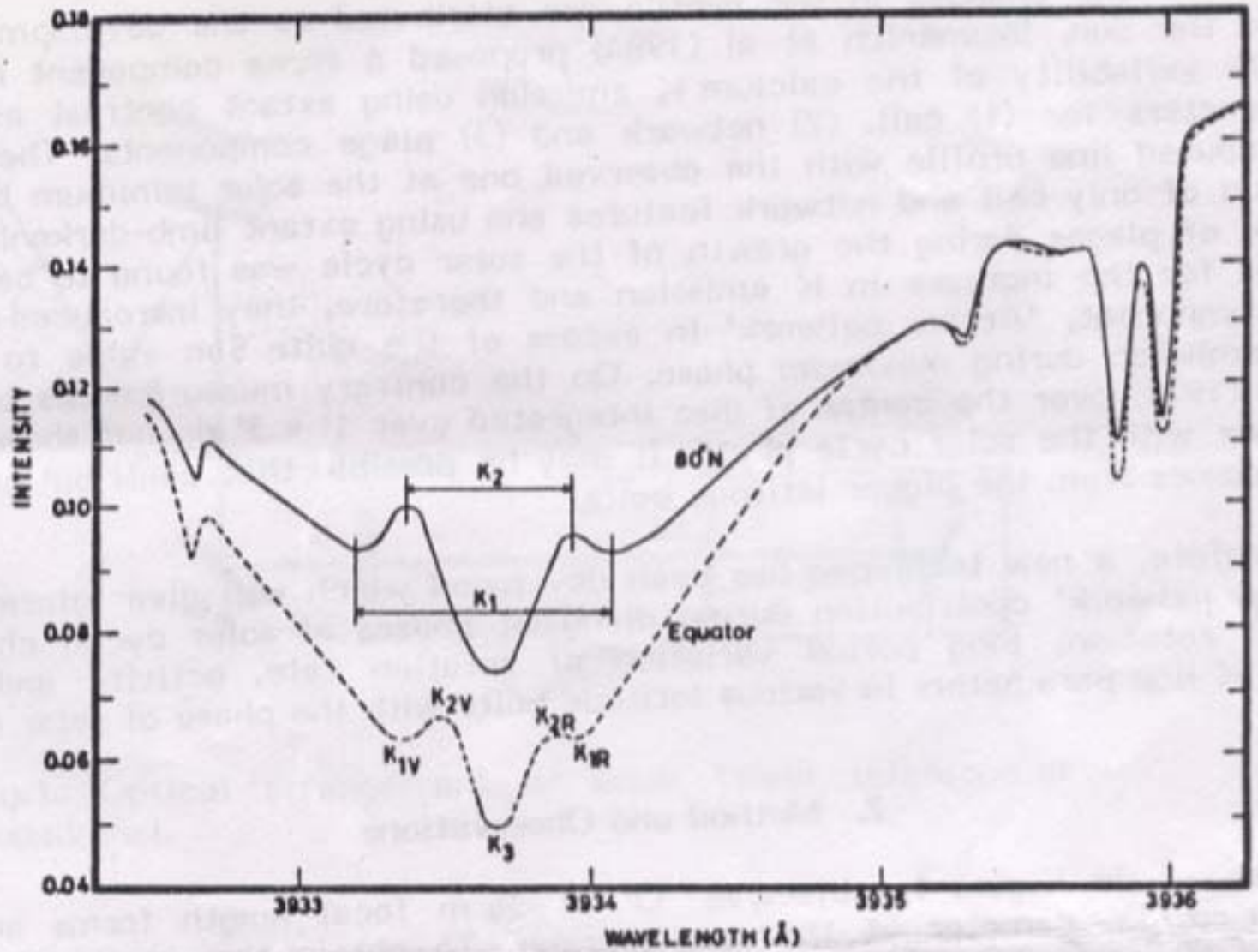


Fig.3. Typical calcium K line profiles obtained on Jan.1, 1986 at the solar equator and 80 N and integrated over the visible 180 longitude. The various K line features are marked in standard K line rotation.

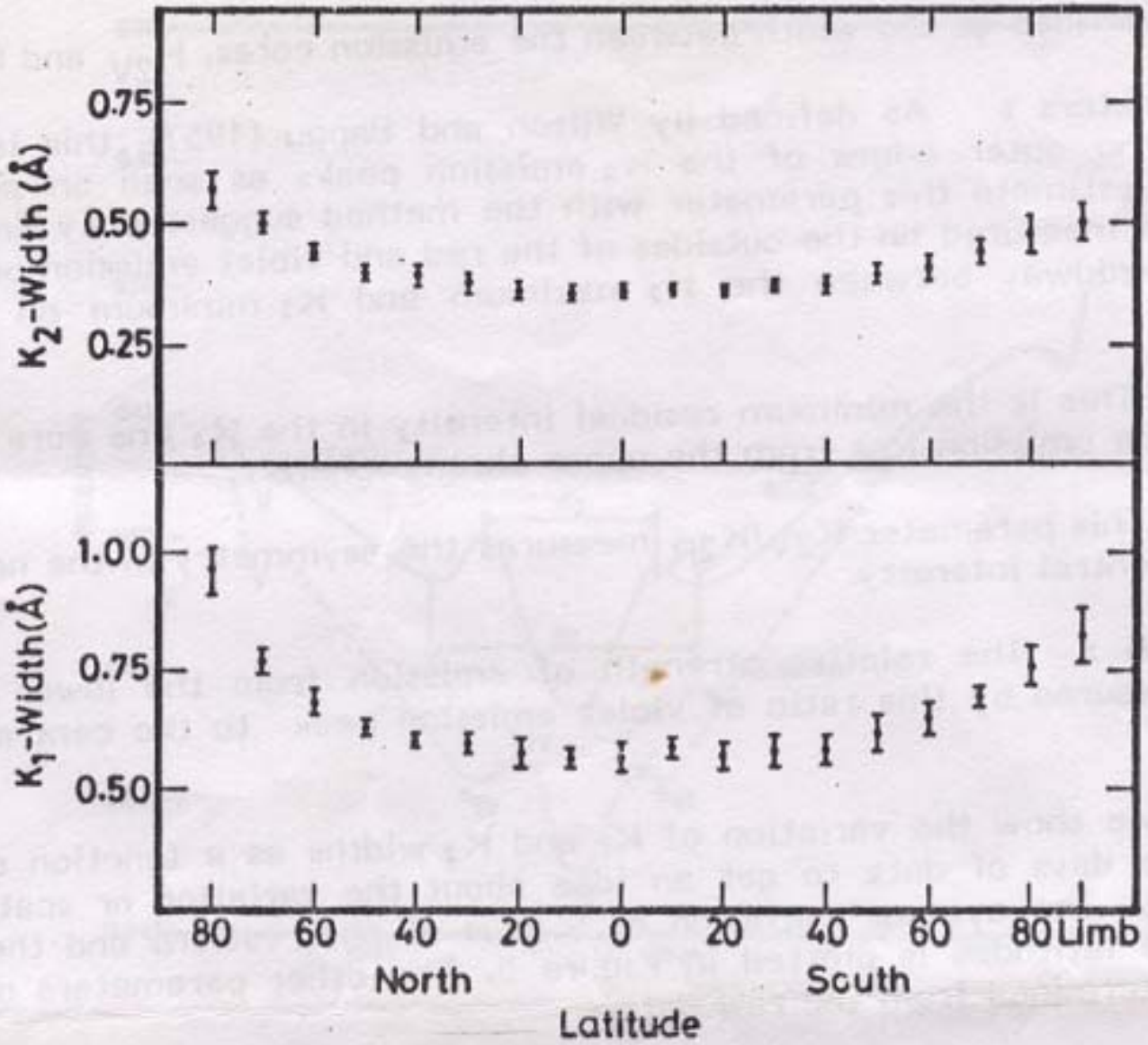


Fig.5. Average values of K_1 and K_2 widths for 6 days of data as a function of latitude. The standard deviation of each value is also shown.

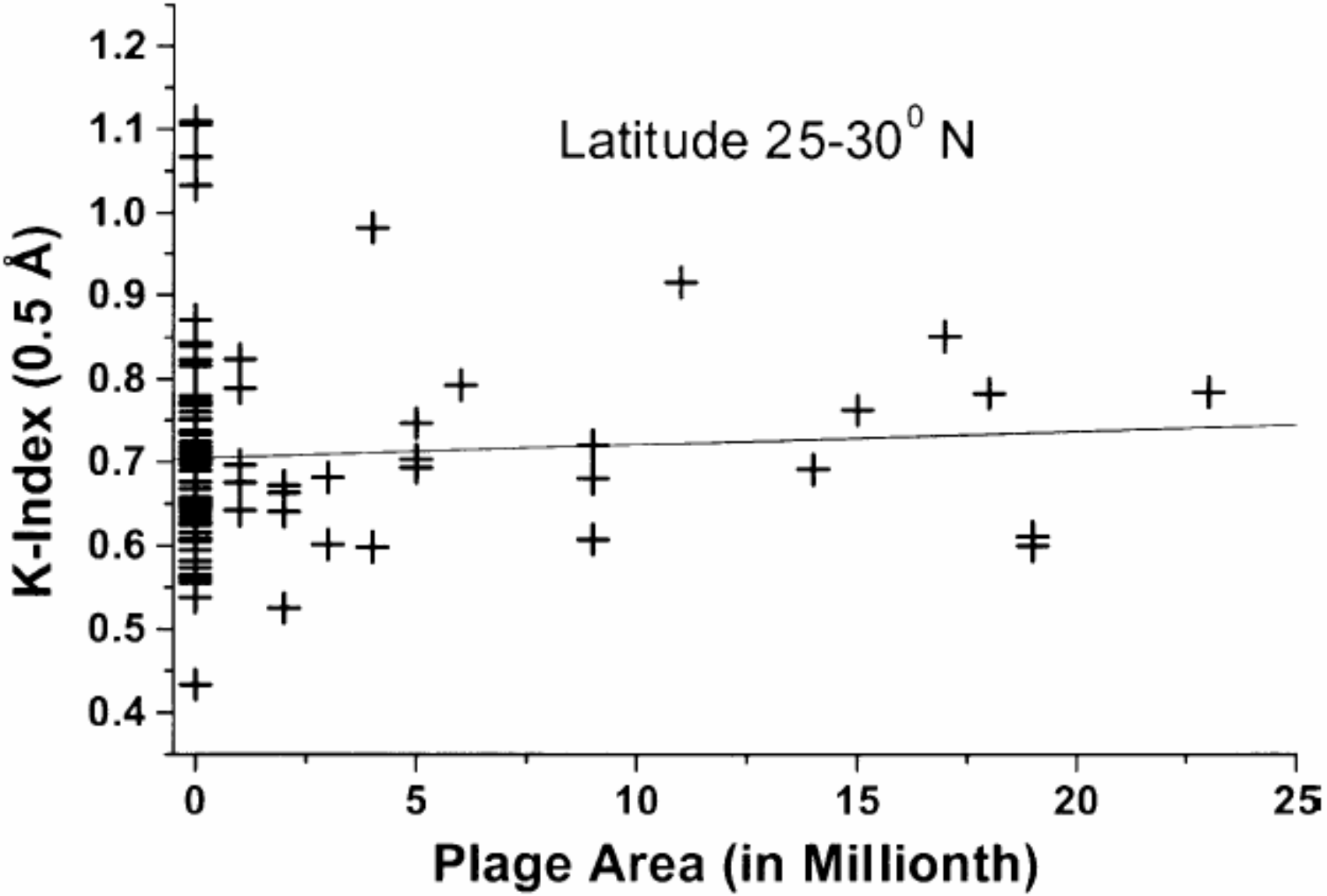


Fig. 1. Plot of Ca-K index (0.5 Å) versus plage area for 1986.

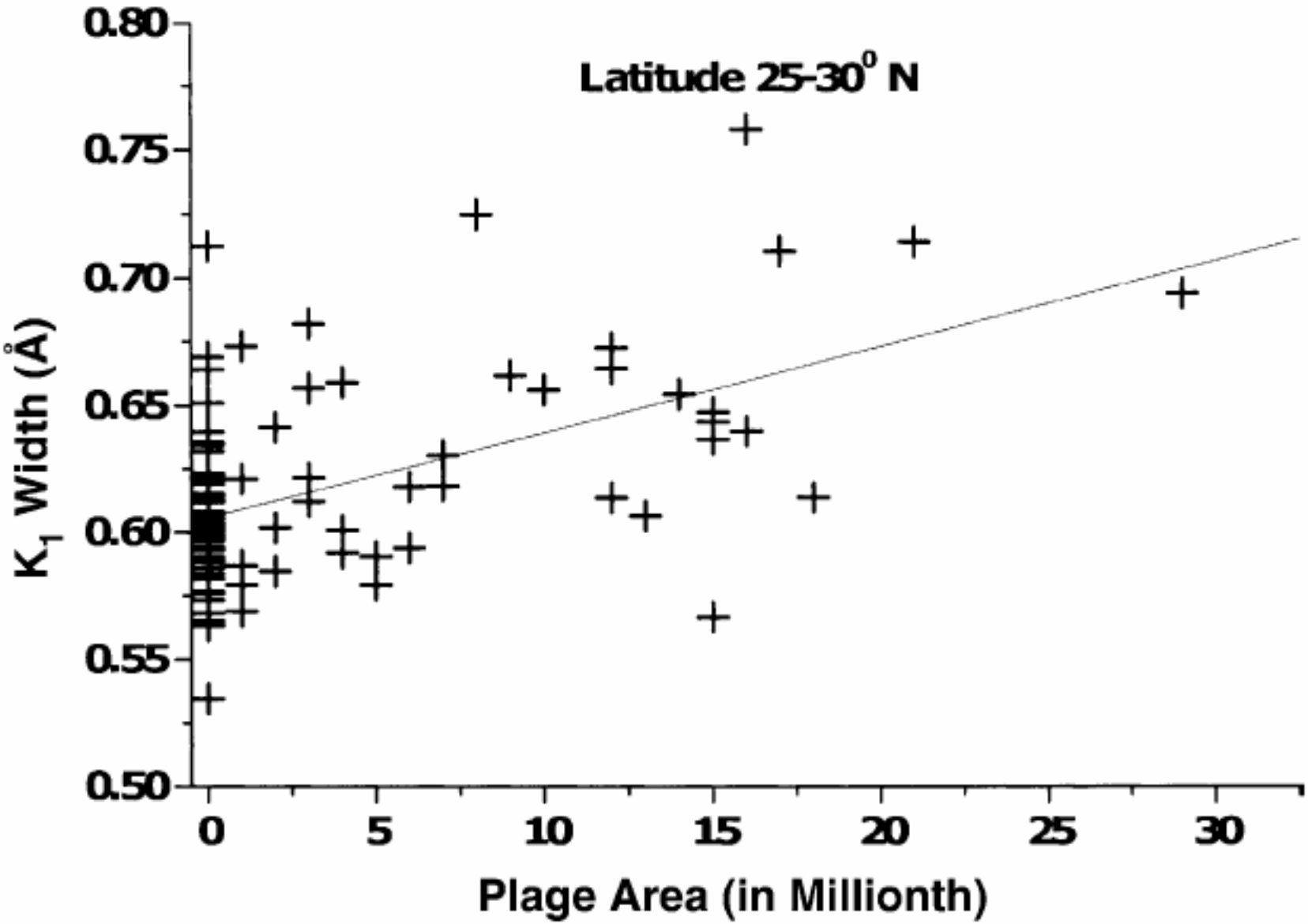


Fig. 2. K_1-width of Ca-K line versus plage area for 1986.

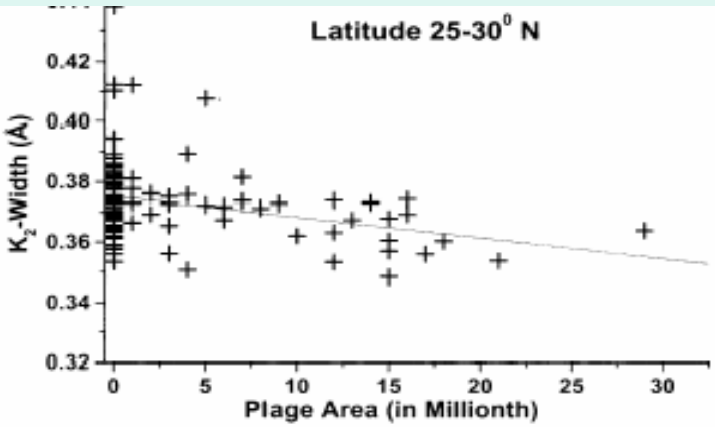
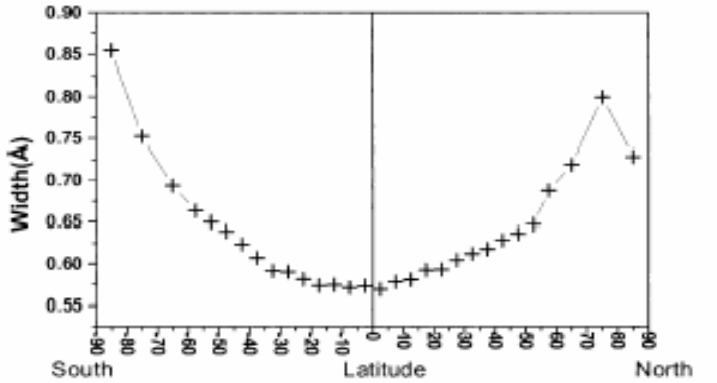


Fig. 3. K_2-width of Ca-K line versus plage area for 1986.



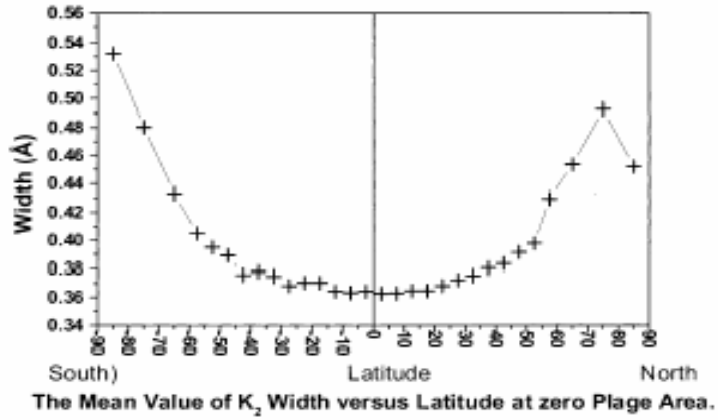
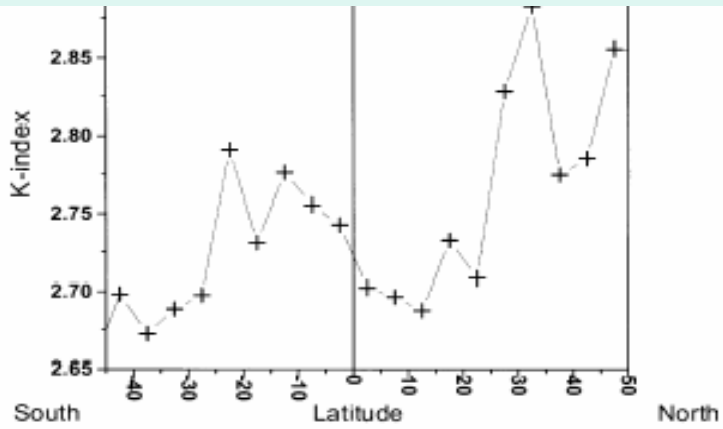


Fig. 4. Plot of K_1 and K_2 width of Ca-K line as a function of latitude.



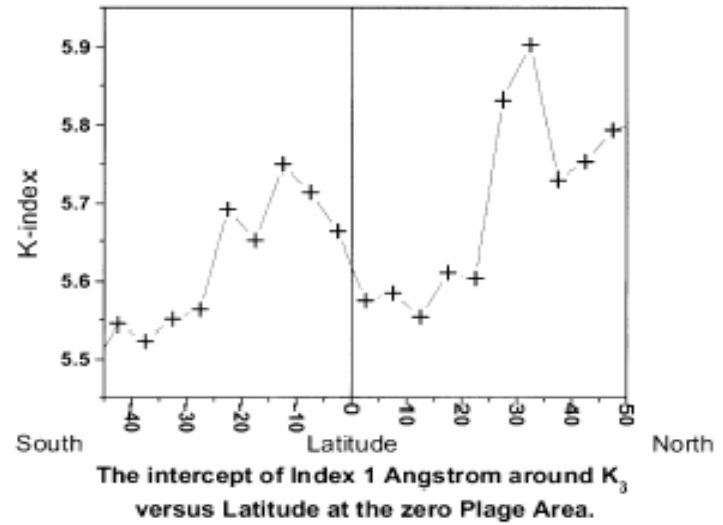


Fig. 5. Ca-K line index due to network as a function of latitude.

Advantages of this technique

- The sunspot and related activity yields information in the 10 – 40 latitude belts. This method will provide information about the variations in the polar regions
- Yield information about the variation in the back ground flux and active network component
- Provide information about chromospheric rotation rate, differential rotation rate and its variation with time
- The observed variation in Ca-k line profiles over the long periods will yield detailed view of the activity and magnetic flux movement
- We plan to analyse all the data obtained since 1986 which will yield detailed information about these features

- Only one year data has been analyzed
- About 20 years data need to be analyzed
- The results obtained will yield series of papers

THANK YOU