A SINGLE-CHANNEL POLARIMETER

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ABSTRACT. We have developed a single-channel photopolarimeter to measure polarization ~ 1%, with an accuracy of 0.1% or so. Laboratory tests show that the performance of the instrument is as per the requirements.

1. INTRODUCTION

At Kavalur Observatory, we have started, among other programs, a program of polarimetric observations of stars with rotating extended atmospheres (Peraiah 1976), and study of members of very young ($\leq 10^6$ years) clusters and associations. This paper reports the design and performance of the polarimeter developed for such investigations.

2. INSTRUMENT

A schematic lay-out of the polarimeter is shown in fig. 1. The basic design is similar to that of Hall and Mikesell (1950). In this instrument the light is chopped at 125 Hz using a Pockels cell. This is, then, analyzed with an HNP'B polaroid sheet which is rotated about

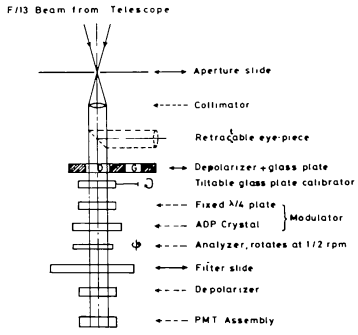

Figure 1. Optical arrangement of the polarimeter

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the axis of the incident light at 1/2 rpm. Thus, in two minutes, the entire polarization curve is recorded. Phase-sensitive detection is used to detect the signal which is recorded on a strip chart recorder. The phase-sensitive amplifier is tuned at 125 Hz, with a band width of approximately 10 Hz. The filter slide carries the standard U,B,V,R,I filters.

Though the instrument can be calibrated for degree of polarization and position angle by observing the standard stars, a thick microscope cover glass plate has been incorporated as a calibrator to check the interval consistency of the instrument.

2.1 Method of observation

Step i The calibration plate is set at 0°, the first depolarizer removed from the light path, and signal is recorded for one rotation of the analyzer.

Step ii The depolarizer is introduced in the light path and step (i) is repeated.

Step iii Now, the glass plate is tilted by a pre-determined amount and the signal is recorded.

Step iv To record the signal due to sky alone, step (ii) is followed.

The degree of polarization and position angle are determined by comparing the signal in step (i) with that in step (iii) after applying corrections due to steps (ii) and (iv).

2.2 Performance of the instrument

A set of results, obtained in the laboratory with an uncooled 1P21 tube, is shown in fig.2. It is clearly seen that the instrument can easily detect ~0.35% polarization at a light level corresponding to approximately 10th magnitude.

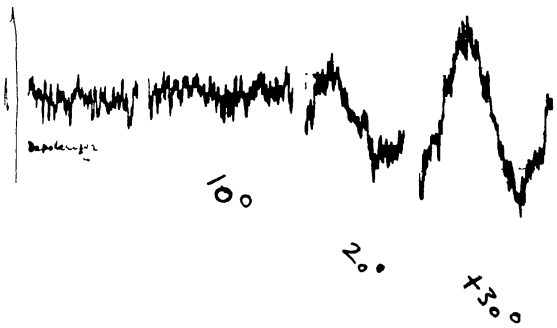

Figure 2. Signal at different angles of the calibrator

3. CONCLUSIONS

The laboratory tests show that the performance of our polarimeter is as per the requirements of the planned observations. With the introduction of improved electronics, already under development, we hope to be able to achieve a sensitivity and accuracy of 0.1%, or better.

4. ACKNOWLEDGEMENTS

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