Dissertation on

The Study of Time Variation of Cosmic Rays with narrow and wide angle telescopes at Ahmedabad

presented

by

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for the degree of

DOCTOR OF PHILOSOPHY

of the

Gujarat University

October 1990

Physical Research Laboratory

Ahmedabad

SUMMARY

A study of the time variation of meson intensity was made by the author at Ahmedabad ($\lambda = 13.0^{\circ}$, sea level) with narrow angle telescopes during the period January 1957 to May 1959, and with a wide angle telescope during the period October 1955 to May 1959. The main conclusions of the investigation are presented below.

1. The amplitude of the mean daily variation as well as the daily variation on individual days during the period 1957 and 1958, observed with telescopes of narrow and wide angles of opening in the E-W plane, are not significantly different. During 1954 - 1955, when solar activity was minimum, the situation was different. At low latitudes, telescopes with a narrow angle opening in the E-W plane recorded a daily variation with an amplitude (0.5 to 1.0 %) which was significantly larger than what was observed with wide angle telescopes. Thus the comparative response of narrow and wide angle telescopes, related to the profile of the anisotropy, is different at different periods of time.

2. Telescopes having different semiangles in the N-S plane do not reveal any difference in the amplitudes of the diurnal and the semidiurnal components of the daily variation during the period 1957 and 1959. However,

the time of maximum of the diurnal variation is found to be later by about 2 hours in wide angle telescopes as compared to narrow angle telescopes. The difference in the time of maximum of the diurnal variation is found to be independent of the level of geomagnetic disturbance. It is shown that this difference cannot arise from a difference in the applicable barometric co-efficient. Nor has it been possible to explain the difference on the basis of the differential geomagnetic bending of the particles coming along different zenith angles in the N-S plane. The result may be due to the effect, on the anisotropy of cosmic rays, of beams emitted from the sun in directions inclined to the plane of ecliptic.

3. The long term changes of the daily variation as seen in terms of the form of the daily variation as well as the time of maximum and the amplitude of the diurnal and the semidiurnal component of the daily variation of cosmic ray intensity, measured with both narrow and wide angle telescopes, during the years 1954 to 1958, are presented. The results relating to individual days as well as to the average daily variation are separately examined.

The form of the 12 month mean daily variation measured by a wide angle telescope which exhibits two peaks in 1954-1955, one in the early morning and the other near noon, changes into a curve having a single peak near noon by 1957 - 1958.

The amplitude of the 12 month mean daily variation as well as the daily variation on individual days recorded by a narrow angle telescope shows a large decrease from 1954 to 1958 whereas the corresponding amplitudes measured by a wide angle telescope do not reveal any significant difference during the same period. From the changes observed in a narrow angle telescope the author is led to believe that the power of the source has decreased with increase in solar activity. This result would be consistent with the weakening of the polarisation of beam of solar plasma with trapped magnetic fields, as the conductivity of the interplanetary space increases with increased solar activity. More experimental confirmation concerning the eleven year change of power of the source of an anisotropy, observed at low latitudes, is required for a confirmation of the interpretation. This is particularly so in the light of conflicting views held by other workers.

4. An examination of the form of the average daily variation on days of low, medium and high geomagnetic disturbance during the years 1954 - 1963 reveals that the early morning maximum, observed during 1954 - 1955, is a feature exclusively associated with days of low and medium geomagnetic disturbance. The days of high geomagnetic disturbance at all times are associated with a noon maximum.

The long term changes of the diurnal time of maximum on groups of days of low, medium and high C_p shows that the year to year change is most prominent on low C_p days.

5. A comparison of the changes of the daily mean intensity recorded by a wide angle and narrow angle telescope during cosmic ray storms shows that they are similar during the period 1957 and 1958.

The conclusions are discussed in chapter V of the thesis and a list of references consulted by the author is included at the end of the thesis.

H. Razdan

ACKNOWLEDGEMENT

The work presented in this thesis was carried out under the guidance of Prof. V.A.Sarabhai. I am grateful to him for the encouragement he has given throughout the period of my work and the valuable help he has rendered in interpreting the results.

It is a pleasure to acknowledge the useful discussions I have had with Prof. K.R.Ramanathan, Dr.R.P. Kapp, Dr.H.S.Ahluwalia and Dr.U.R. Rao. Mr. D.V.N. Sharma was kind enough to give valuable suggestions in interpreting the statistical aspects of data which is gratefully acknowledged. The help rendered by Mr.U.T.Bhand in the design and construction of the experimental set up is also gratefully acknowledged.

Thanks are also due to Mr.S.R. Thakore and the computational section for the assistance rendered by them.

The project under which the present investigation was carried out has been supported by the Department of Atomic Energy, Government of India. In the initial stages, the author was the recipient of a Fellowship from the Karmakshetra Education Foundation and later on was a Senior Research Scholar of the Government of India. These awards are gratefully acknowledged.

H.L. Mandan.

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