HIGH ALTITUDE INTENSITY OF PENETRATING COSMIC RAYS AT POONA 9° N. (mag.)

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As part of the programme of the Tata Institute of Fundamental Research initiated by Dr. H. J. Bhabha in 1945 to measure and study the variation of the intensity of the different components of cosmic radiation with altitude at different latitudes throughout India, the authors have conducted a number of balloon flight experiments at Poona, 9° N. (mag.), during the months of April and May 1949. The measurements were made with quadruple-coincidence counter telescopes, without lead absorber and also with 10 cm. of lead between the counters. The geometry of the telescopes was the same as that used in the previous flights[1] with the sole difference that the diameter of the counters was now 4·2 cm. instead of 3·5 cm. The extreme counters of all the (identical) quadruple-coincidence telescopes defined a cone making angles of 7·5° and 25° with the vertical. The temperature inside the gondola which contained the apparatus was maintained above + 10° C., even at the highest altitudes reached, by using the "greenhouse effect". Quadruple-coincidences, together with the atmospheric pressure and temperature inside the gondola, were transmitted continuously over a single ultra-high-frequency radio carrier to the ground receiving apparatus, which recorded the information automatically on a moving paper tape. In the previous experiments[1] two separate channels were used, one for the cosmic-ray counts and another for the meteorological elements.

All the four flights made with 10 cm. of lead absorber were successful in giving reliable intensity data up to altitudes of 60,000 feet, corresponding to a pressure of 100 millibars. A typical curve showing intensity *vs.* pressure in millibars for a telescope with 10 cm. of lead absorber is given in the accompanying figure, with the root-mean-square deviations marked on the points. It will be seen that there is some indication of a maximum in the neighbourhood of 250 mb., followed by a minimum and a subsequent rise beyond 150 mb. Although this feature appears on three of the curves its reality must be considered doubtful, since the scatter of the points is somewhat large owing to the relatively low counting rate. The results are consistent

with a monotonic increase in the intensity of the hard component to the lowest pressures reached by the apparatus.

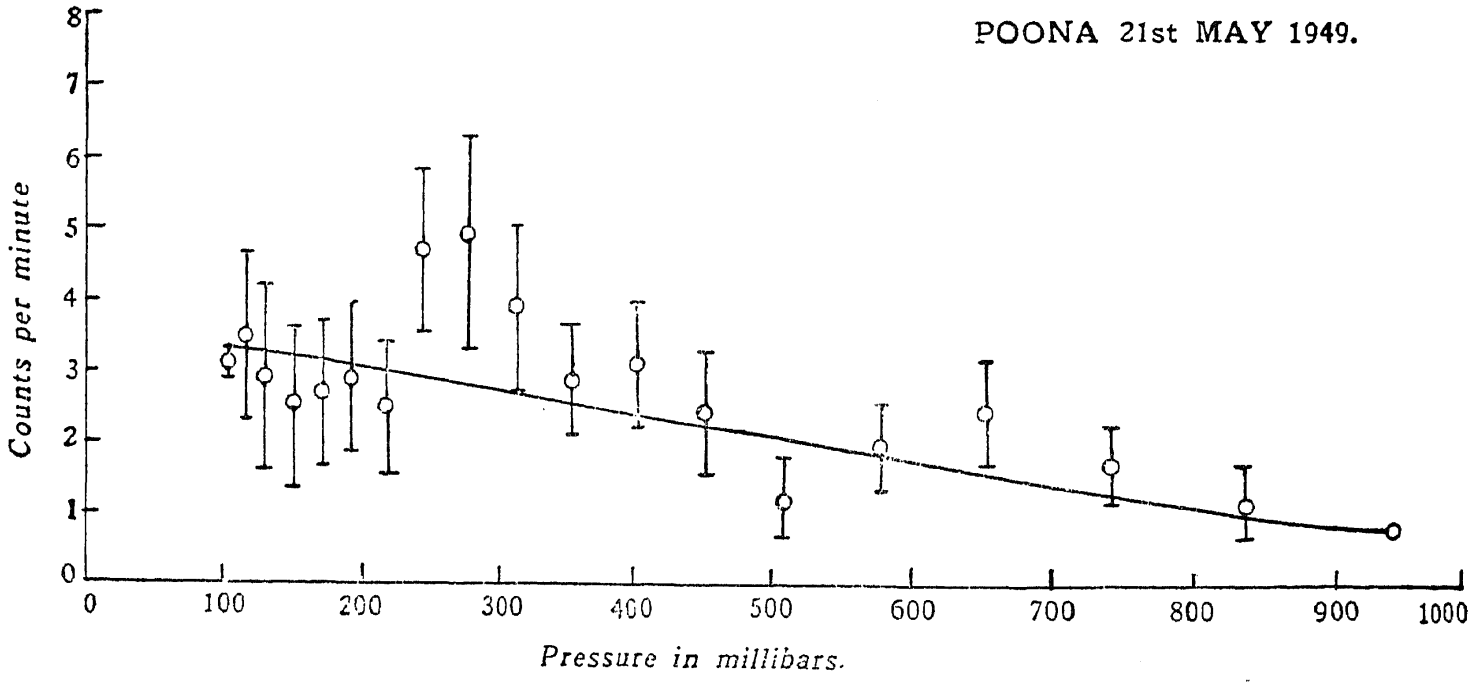

FIG. 1. Vertical Intensity of Cosmic radiation penetrating 10 cm. of Lead.

The vertical intensity of the penetrating component of cosmic-rays has been measured by several groups of workers, as for example Schein, Wollan and Groetzinger,[2] Bhabha, Aiya, Hotcko and Saxena,[3] Schein, Jesse and Wollan,[4] Gill, Schein and Yngve,[5] Pomerantz,[6] and J. R. Winckler, W. G. Stroud and J. Schenck,[7] using lead absorbers varying in thickness from 2 to 30 cm. Most of these workers have found that the hard component intensity continues to increase monotonically to the lowest pressures their apparatus could reach, except Dymond[8] who has reported that the vertical hard component under 10 cm. of lead at 59° N. geomagnetic latitude passes through a maximum at 107 millibars.

Similar flights from Bangalore 3° N. (mag.) have been planned in the near future. A fuller account of these experiments will be published later.

It is a great pleasure to express our gratitude to the India Meteorological Department for the facilities provided for the flights and especially to Mr. S. P. Venkiteswaran and his staff of the Instrument Section of the Poona Meteorological Office for their co-operation and help.

We are greatly indebted to Prof. H. J. Bhabha for his guidance of this work.

SUMMARY

High-altitude balloon flight experiments were conducted at Poona 9° N. (mag.) to measure cosmic-ray intensity with quadruple-coincidence counter telescopes with 10 cm. of lead between the counters, using the radiosonde technique. Heights of 60,000 ft. (100 mb.) were reached. It is concluded that the intensity of cosmic radiation penetrating 10 cm. of lead absorber increases monotonically with decreasing atmospheric pressure.

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