Table II. Characteristics of the Telescope

Detecting Area (Sum of two tubes)		$\sim$20 m^2	
Total Field of View		A circle of 15° dia	
Resolution Angle	(for a Y-combination)	A circle of 7° dia.	
〃	(for a V-combination)	5°×7°	
Minium Energy of the Particle	(μ-meson)	5 GeV	
observed by the Telescope	(electron)	200 MeV	
		Z=0°	Z=75°
Mean Energy of the Particles	(μ-meson)	18 GeV	40 GeV
observed by the Telescope	(electron)	500 MeV	600 MeV
Mean Energy of the Particles at the Top of the Atmosphere	(μ-meson)	20 GeV	50 GeV
Mean Energy of the Primary Protons which produce μ-mesons observed.		90 GeV	300 GeV
Counting Rate of a Y-combination		90/min.	15/min.
Total Counting Rate of the Telescope (Sum of two tubes)		2000/min.	300/min.

of energies lower than 200 MeV are assumed to be absorbed by 1 cm Pb fixed on the front face of the telescope tube. As seen from Fig. 11, the observed dependence is in good agreement with the theoretical curve.

Summarizing the results stated above, the characteristics of the Telescope No. 3 are listed in Table II.

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INTERNATIONAL CONFERENCE ON COSMIC RAYS AND THE EARTH STORM Part III

III-2-19. Sidereal Time Variation of Low Energy Cosmic Rays

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As no individual contributions were given in this Conference on sidereal time variations of low energy cosmic rays, this will be a short review of the latest papers that have appeard in the literature up to now, regarding this subject.

It should be first of all stressed that the expression "sidereal" has to be taken with much caution. In fact, most of the primary energies here dealt with are below 10^{11} eV. And it is obvious that the lower the energy of the cosmic ray particles, the stronger is the mixing action of intergalactic magnetic fields: so that the least one would expect these particles to provide information about possible anisotropies, either real or apparent, existing outside the solar system. Just in one of these very sessions, it was *f.i.* recalled by Dr. Korff as particles of rigidity as high as 10^{14} V would have a gyration radius of less than 1 light year—*i.e.*, 10^{-4} times the thickness and up to 10^{-6} times the diameter of our Galaxy—in a magnetic field of 10^{-6} gauss, which from the optical observations seems to be quite a conservative value for galactic fields.

However, it cannot be excluded that the study of the diurnal variations may contribute to indications of certain properties of the cosmic rays in the space. It is well known that the solar daily variation of the cosmic ray intensity exhibits changes of amplitude and phase, which are in some cases of a cyclic character and cannot be explained only in terms of terrestrial effects.

The last period of sunspot minimum (especially in 1954) was exceptional in this sense as compared to other periods, in particular to the previous year of minimum, 1944. Data of ion chambers, counter arrays and neutron monitors, operated at different stations, were studied by several authors: the diurnal vector, obtained from harmonic analysis or other methods, exhibits in most cases a gradual progression toward earlier hours (counter-clockwise) during the course of the year, in such a manner that if replotted on a sidereal dial it seems to approximately maintain there

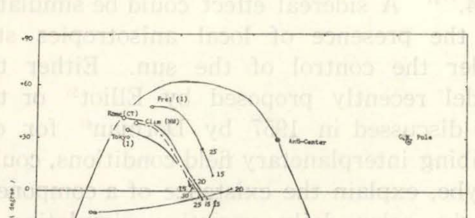

Fig. 1. Celestial map of the asymptotic directions of sidereal variation during 1954 (see Table I). Right ascension and declination of each white circle indicate T_{max} and geographic latitude of corresponding station, respectively. Lines extending from white circles are asymptotic directions of particles, the rigidities of which are indicated by dots and figures in units of GV (After Y. Mishima).

a constant direction.

Some of the so obtained figures for the sidereal times of maximum, (T_{sid}), are reported in the Table.[1) 2)] The amplitude ratios of sidereal and solar variation are also included, to make possible an inter-comparison of results obtained by different methods.

The influence of seasonal atmospheric variations, which could simulate a spurious sidereal effect, are considered to be strongly reduced in these results for different reasons, which for brevity shall not be explained here in detail. However, some residual contributions from these or other spurious effects are likely to still be present, especially in the ionizing component data.

There seems to be a good agreement among the various results, although not a complete one: it is seen *f.i.* that while at Huancayo this "sidereal" effect seems to be very strong in the neutron monitor and also present in the ionizing component data, it is practically absent at Colombo, also near the Equator as well.

Anyway, it is tempting to see whether the results obtained might really indicate the existence of a unique direction for an outside anisotropy of some kind: when plotted on a celestial sphere the $T_{max}^{(sid)}$ points seem to lie nicely along the galactic equator (See the figure). Dr. Mishima of Osaka City

Table I. Sidereal Time Variation

Station	Component	T max (LST)	Amplitude (%)	Sidereal /Solar
London (BT)	CT (60 MWE)	21,00	0,21	
Cheltenham (B)	IC	22,00	0,03	
Huancayo (B)	IC	03,00	0,04	
Canberra (BT)	IC	09,36	0,05	
Canberra (B)	IC	08,00	0,04	
Christchurch (B)	IC	08,06	0,04	
Climax (B)	NM	21,30		
Huancayo (B)	NM	19,20		
Freiburg (BT)	IC	22,20		
Tokyo (B)	IC	21,00	0,06	0,6
Rome (B)	CT	20,50		
Horbert (B)	CT	23,20	0,06	0,3
Huancayo (B)	IC	19,00	0,06	0,6
Colombo (B)	IC	no significance		
Cheltenham Christchurch	IC	23,30	0,05	0,8

Table II. Sidereal Time Variation in 1954

Station	Geogr. lat.	Altit.	Apparatus	T_{sid}	A_{sid}/A_{sol}	Reference
Climax	39°N	3400 m.	NM	2130	2.0	(1) from (2)
Huancayo	12°S	3350 m.	NM	1920	9.0	(1) from (2)
			IC	1900	0.6	(1)
				Only partial cycle		(4)
Colombo	7°N	s. l.	CT	Not significant (0.1)		(1)
Tokyo	36°N	s. l.	IC	2100	0.6	(1)
				Only partial cycle		(4)
Rome	42°N	s. l.	CT	2050	1.6	(1) from (2)
Christchurch	43°S	s. l	IC	(a) { Only partial cycle		(4)
Cheltenham	39°N	s. l.	IC	(a) { 2230	0.8	(1)
				(a) { Only partial cycle		(1)
Horbert	43°S	s. l.	CT	2320	0.3	(1)
				Only partial cycle		(4)
Freiburg	48°N	1220 m.	IC	2220	1.0	(1) from (2)
London (b)	51°N	s. l.	NM	No phase displacement		
			CT	Phase displacement dubious		(3)

(a)—These figures for T_{sid} and A_{sid}/A_{sol} are not directly comparable to the others, as referred to the vector computed for the average of Cheltenham/Christchurch.

(b)—The data here referred to were actually taken in Manchester until March 1954 and in London after June 1954.

NM=Neutron Monitor; IC=Ion Chamber; CT=Counter Telescopes

T_{sid}=local sidereal time of Maximum of the diurnal variation

A_{sid}/A_{sol}=amplitude ratio of "sidereal" and "solar" vectors.

(1) from (2) means that the figures are given in Ref. (1) and are worked out from data obtained from Ref. (2).

University, in cooperation with Dr. Wada, Institute of Physical and Chemical Research, is here working now to the computations of the deflecting action of the geomagnetic field. The preliminary results are shown in the figure, where the lines starting from the experimental points are such as to represent the asymptotic direction values for different energies. Some first approximation corrections of this type were also reported by Venkatesan[4]. It is obvious that in order to arrive at conclusive results it would be necessary to take into account the directional sensitivity and the energy response of the various instruments.

In any case one should be careful before hazarding any conclusion about the real existence of an outside anisotropy. Some authors[2] have suggested that such an observation was, maybe, made possible in 1954 because of the particularly low level of solar activity, as several cosmic ray phenomena seemed to indicate[2]. However, some other authors[1] were able to show that a strong anti-sidereal component not purely of atmospheric origin was present in some cases; and this, in their opinion, would prove that "the solar daily variations belonging to the primary radiation were not constant throughout 1954."[1] A sidereal effect could be simulated by the presence of local anisotropies still under the control of the sun. Either the model recently proposed by Elliot[5] or the one discussed in 1957 by Dorman[6] for describing interplanetary field conditions, could, maybe, explain the existence of a component of the solar daily variation simulating a source in a direction opposite to the sun and varying somehow in amplitude during the course of the solar cycle. One may recall at this point the other puzzling problem of an apparent secular variation of the phase of the diurnal vector with a period of 22 years—(or maybe 11 years; there is still some controversy on this regard), and this might indicate some more or less direct connection with solar fields and their polarities.

A paper by Dorman was announced in the preprints of this Conference, on "Cosmic Radiation Anisotropy Sources at the Minimum of Solar Activity and the Nature of 22-year Changes of the Cosmic Ray Solar Diurnal Variation", which might be of interest in this regard; but unfortunately it was not presented.

Anyway, it appears that much more still to be done, especially as regards the methods of analysing the experimental data without prejudices, before arriving at a clear understanding of these phenomena.

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Discussion

Korff, S. A.: There is a possible source of error in deriving a sidereal effect, for a solar diurnal wave and a yearly wave may in certain circumstances combine to give an apparent sidereal wave. One should therefore be conservative in accepting simple interpretations.

Sarabhai, V. A.: It was pointed out by Conforto and Simpson that towards the end of 1959, interplanetary conditions were such that solar daily variation was down to the noise level. We find by examination of distributions of amplitudes on individual days that the solar variation was active during 1959 and the average value was reduced due to wide scatter of time of maximum. This condition for observing a sidereal anisotropy does not appear to be better at solar minimum, but it would be good to confirm this at the next minimum.

Greisen, K.: It is interesting that the phase of the maximum frequency of small air showers, which recurs persistently in many experiments, is very close to the consistent phase of sidereal maximum in the low-energy cosmic radiation, as summarized by Miss Conforto. The agreement may be accidental, since both types of experiments are subject to solar influences on the atmosphere, both diurnal and seasonal; but it is possible that the agreement is more than coincidental.

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III-2-20. Point Source of Cosmic Rays

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This article is a summarizing talk of III-2-15, III-2-16 and III-2-17.

Discussion

Burbidge, E. M.: Since the resolution of the cosmic ray telescope is low, with a beam width of a few degrees, I think it would be very dangerous to try and make identification with an optical source. Particularly, it would be dangerous to try and make identification with some relatively bright optical object such as variable star. Experience with attempts to identify radio sources with optical objects has shown that the radio sources were in general faint optically, and good resolution with radio telescopes was required before any progress could be made, and I would expect the same situation to hold for cosmic ray sources.