APPENDIX

## APPENDIX

## METHODS OF COMPUTING THE ERRORS

1. Standard Error of a sum or difference.

If $D = J_W - J_E$ ,

Where $J_W$ = the intensity in the west direction,

$\sigma_W$ = probable error of $J_W$ ,

$J_E$ = the intensity in the east direction,

$\sigma_E$ = probable error of $J_E$ .

We get $\sigma = \sqrt{\sigma_W^2 + \sigma_E^2}$ .

2. Standard Error of any function.

If a mumber of mean measured quantities are $m_1 + m_2 + \ldots,$ $m_n$ , with standard errors $\alpha_1$ , $\alpha_2$ , .........., $\alpha_n$ repectively, then the standard error of the function $f(m_1, m_2, \ldots\ldots m_n)$, is $\alpha$ , where

$$\alpha^2 = \left(\frac{\partial f}{\partial m_1}\right)^2 \alpha_1^2 + \left(\frac{\partial f}{\partial m_2}\right)^2 \alpha_2^2 + \ldots + \left(\frac{\partial f}{\partial m_n}\right)^2 \alpha_n^2 .$$

In this case

$$f = \frac{2(J_W - J_E)}{(J_W + J_E)} ,$$

$$\alpha_1 = \alpha_2 = \sqrt{\sigma_W^2 + \sigma_E^2} .$$

For simplicity, let $f = 2\frac{N_1}{N_2}$ ,

where $N_1 = J_W - J_E$ , $N_2 = J_W + J_E$ .

Thus
$$\frac{\partial f}{\partial N_1} = \frac{2}{N_2},$$

$$\frac{\partial f}{\partial N_2} = -2\frac{N_1}{N_2^2}.$$

Then

$$\alpha^2 = \left(\frac{2}{N_2}\right)^2 (\sigma_W^2 + \sigma_E^2) + \left(\frac{-2N_1}{N_2^2}\right)^2 (\sigma_W^2 + \sigma_E^2)$$

$$= 4(\sigma_W^2 + \sigma_E^2)\left[\left(\frac{1}{N_2}\right)^2 + \left(\frac{N_1}{N_2^2}\right)^2\right]$$

$$= 4(\sigma_W^2 + \sigma_E^2)\left[\frac{1}{(J_W + J_E)^2} + \frac{(J_W - J_E)^2}{(J_W + J_E)^4}\right]$$

$$= 4(\sigma_W^2 + \sigma_E^2)\left[\frac{(J_W + J_E)^2 + (J_W - J_E)^2}{(J_W + J_E)^4}\right]$$

$$= 4(\sigma_W^2 + \sigma_E^2)\frac{2(J_W^2 + J_E^2)}{(J_W + J_E)^4}.$$

$$\therefore \alpha = 2\sqrt{2}\,\frac{\sqrt{\sigma_W^2 + \sigma_E^2}\,\sqrt{J_W^2 + J_E^2}}{(J_W + J_E)^2}$$

# BIBLIOGRAPHY

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(1) T.H. Johnson, Phys. Rev. 44 $2^{nd}$ series, 126 (1933)

ibid. 43, 381 (1933)

(2) C. Störmer, Z. Astr. Phys., 1, 237 (1930)

(3) G. Lemaitre and M.S. Vallarta, Phys. Rev., 43, 87 (1933)

(4) Charoen Dharmaphanija and Thaworn Suttipongse "East-West Asymmetry of Cosmic Ray Stars at latitude 13° 46' N Journal of the National Research Council of Thailand. (in preparation)

(5) B. Rossi, High Energy Particles, Prentice-Hall , Incorporated, New York, 1952

(6) H.A. Bethe and W. Heitler, Proc. Roy. Soc. A 146, 83 (1934)

(7) O.Klein, and Y. Nishina, Zeits. f. Physik, 52, 853 (1929)

(8) A.W. Wolfendale, Cosmic Rays, Charles Birchall & Sons, Ltd., Liverpool and London, 1963.

(9) C.Störmer, Rev. Mod. Phys., 10, 214 (1938)

(10) G. Lemaitre and M.S. Vallarta, Handbuch der Physik , Springer Verlag, Berlin. Göttingen. Heidelberg., 1961.

(11) E.Fermi, Nuclear Physics, The University of Chicago Press, 1951.

(12) J. Clay, Physica, August, 1934.

(13) R.A. Millikan, The Electron, The University of Chicago Press, Chicago, Illinois, 1947.

(14) P.M.S. Blackett, Phys. Rev., 54, 973 (1938)

(15) S.W. Amos, *The Principles of Transistor Circuits*, London. Iliffe & Sons Ltd., New York. John F. Rider Publisher, Inc. 1959.

(16) D. Bhomik, and G.S. Bajwa, Indian Journal of Physics, 25, 561 (1951).

(17) J. Topping, *Errors of Observation and Their Treatment*, The Institute of Physics, 47 Begrave Square, London. S.W.1 (1957). See also Thaworn Suttipongse, Thesis, Graduate School, Chulalongkorn University. (1962).

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