



INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
I.C.T.P., P.O. BOX 586, 34100 TRIESTE, ITALY, CABLE: CENTRATOM TRIESTE



H4-SMR 393/9

SPRING COLLEGE ON PLASMA PHYSICS

15 May - 9 June 1989

AURORAL ELECTRON ACCELERATION (I)

D. Bryant

Rutherford and Appleton Laboratories
Chilton, Didcot
Oxfordshire, OX11 0Qx
U. K.

Auroral Electron Acceleration

D.A. Bryant

Part 1 Generally accepted theory

Ordered acceleration by quasi-static
electric fields

Part 2 New theory

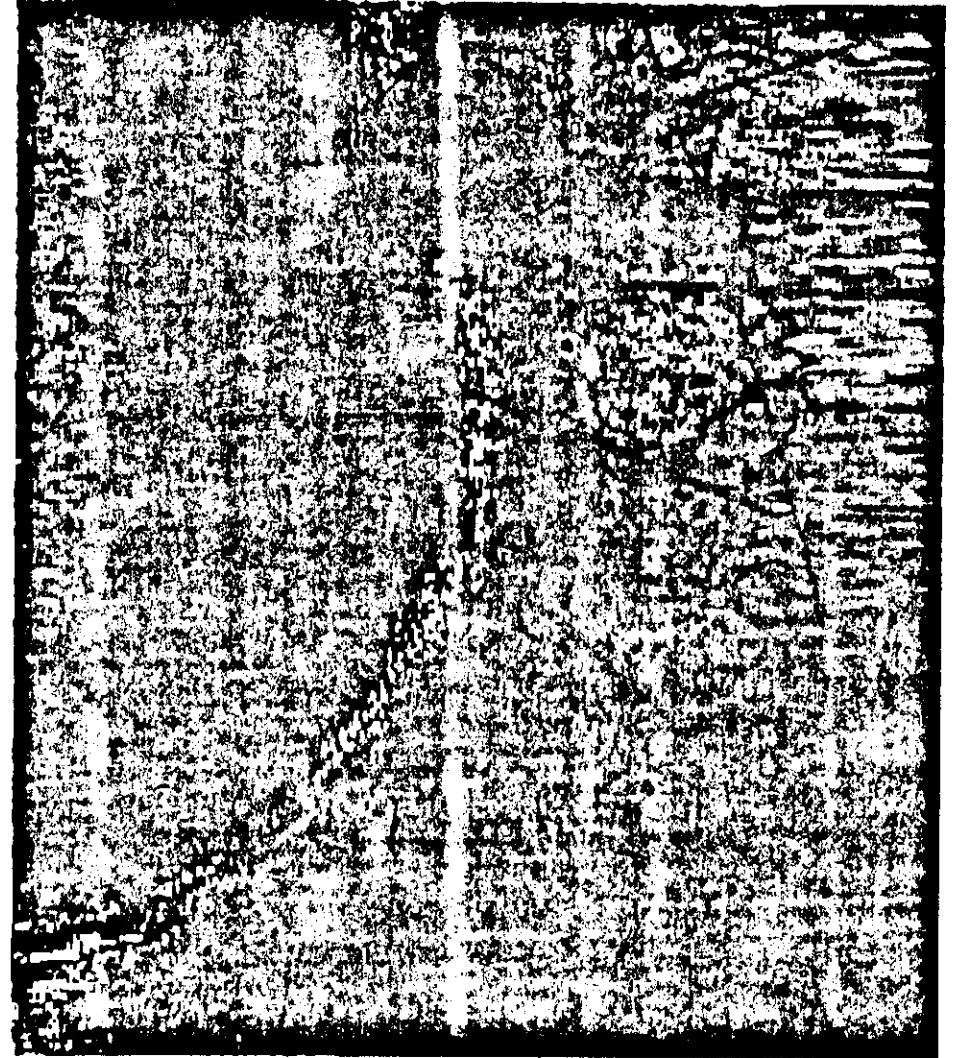
Stochastic acceleration by turbulent
electric fields

R. Bingham

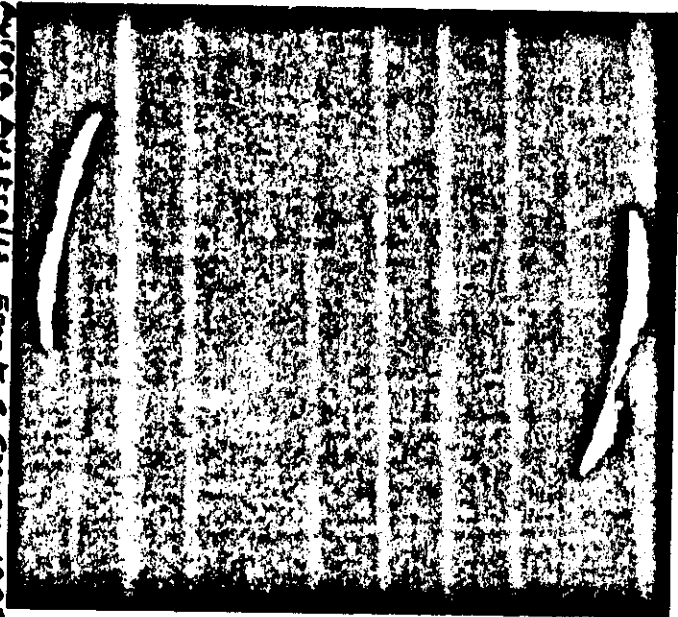
D.A. Bryant

D.S. Hall

Part 1

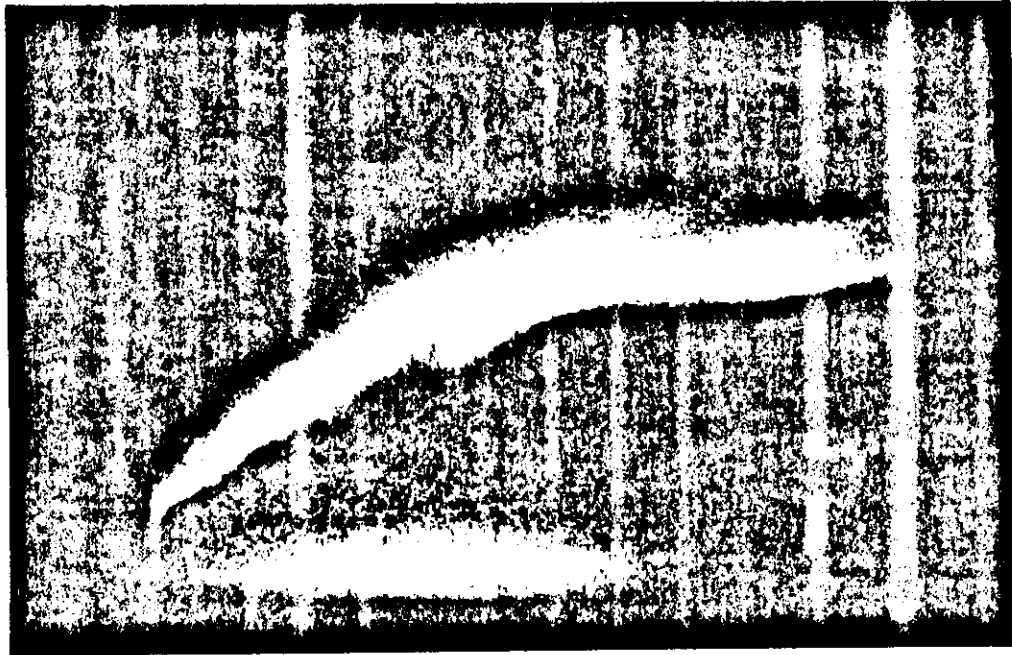


Auroral arc across N. Atlantic



Aurora Borealis

Aurora Australis Frank & Craven 1928

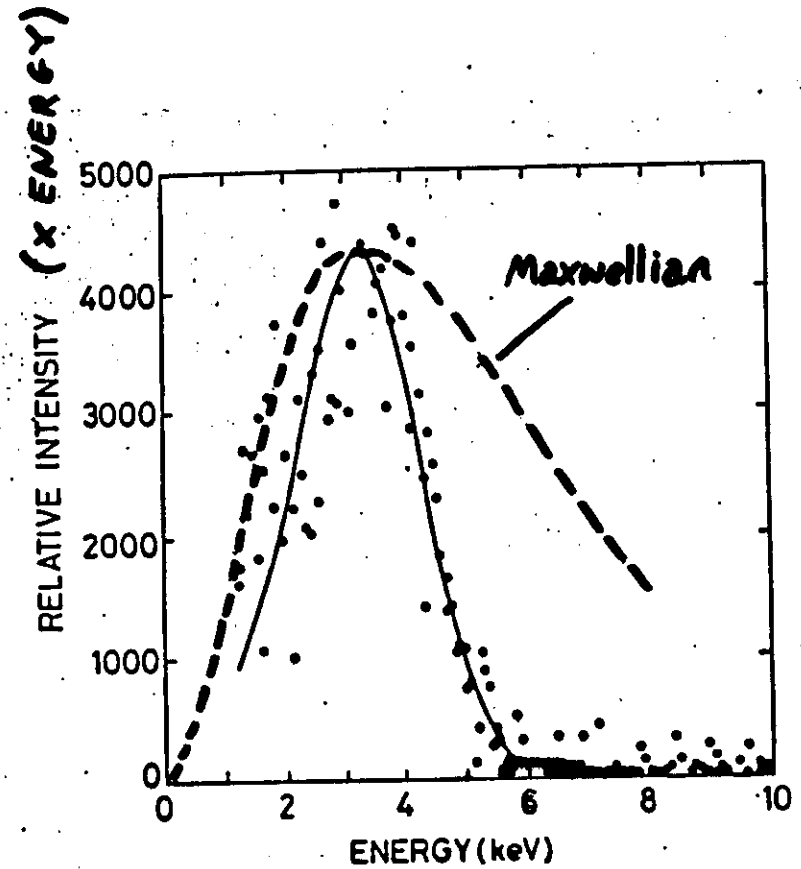


Auroral arc seen from Norway

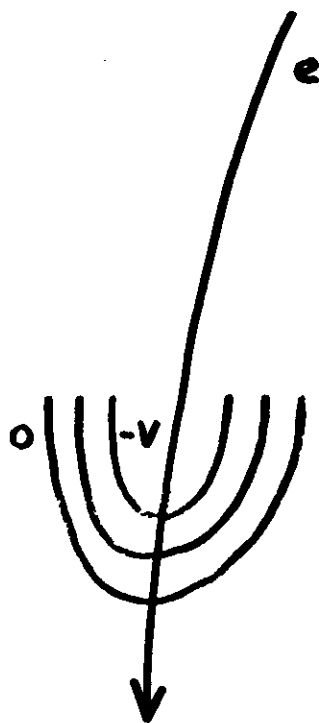
Electrons exhibit peaked spectrum and are
collimated $\parallel \underline{B}$

↓

Electrons accelerated $\parallel \underline{B} \Rightarrow \underline{E} \cdot \underline{B} \neq 0$
at altitudes ~ 1 Re.



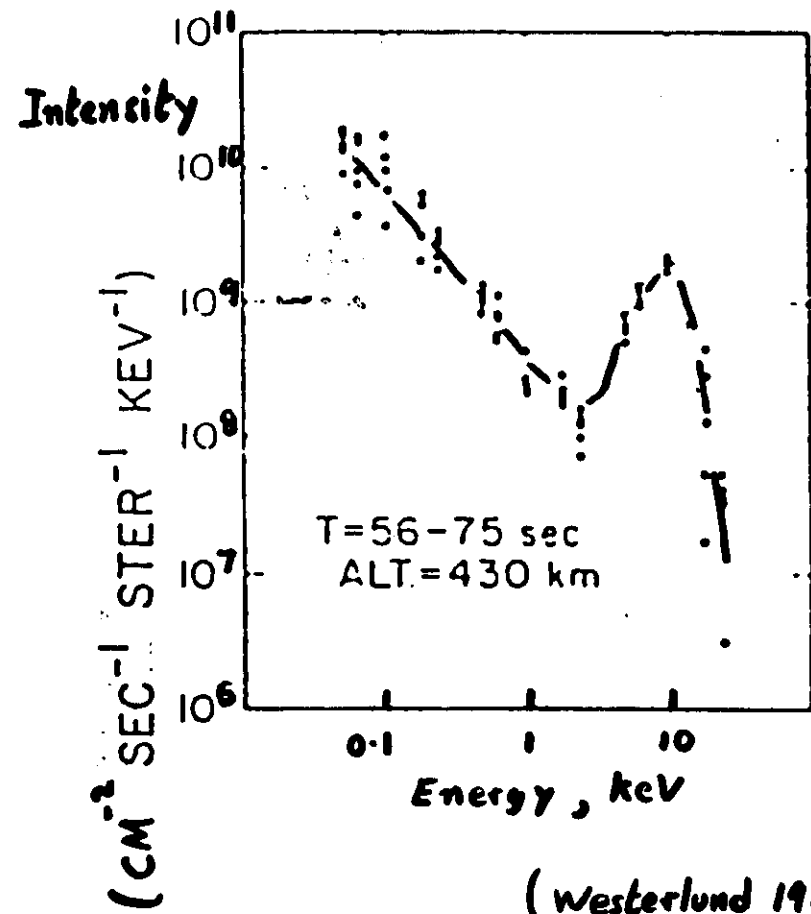
*First measurement of auroral electron
energy distribution from Evans 1968*



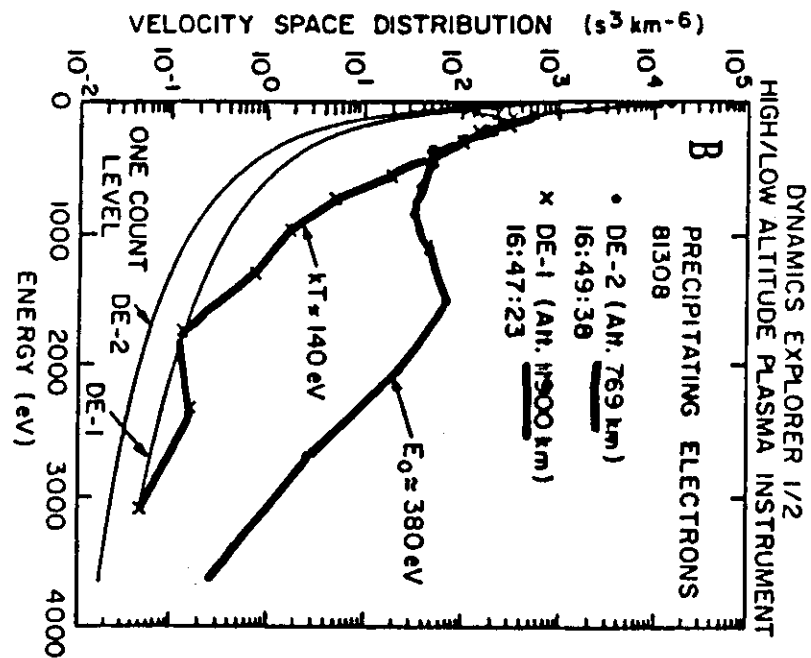
Schematic of acceleration by
quasi-static electric field



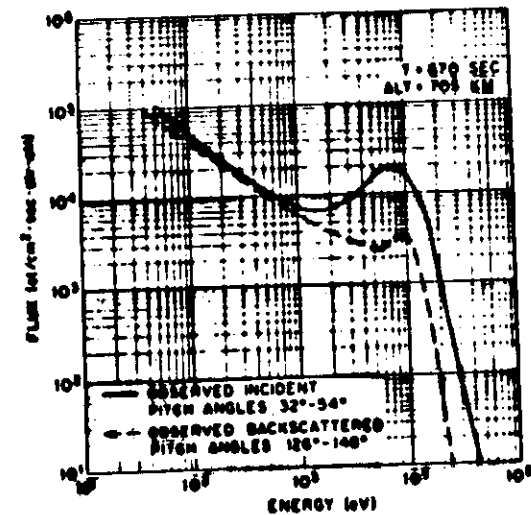
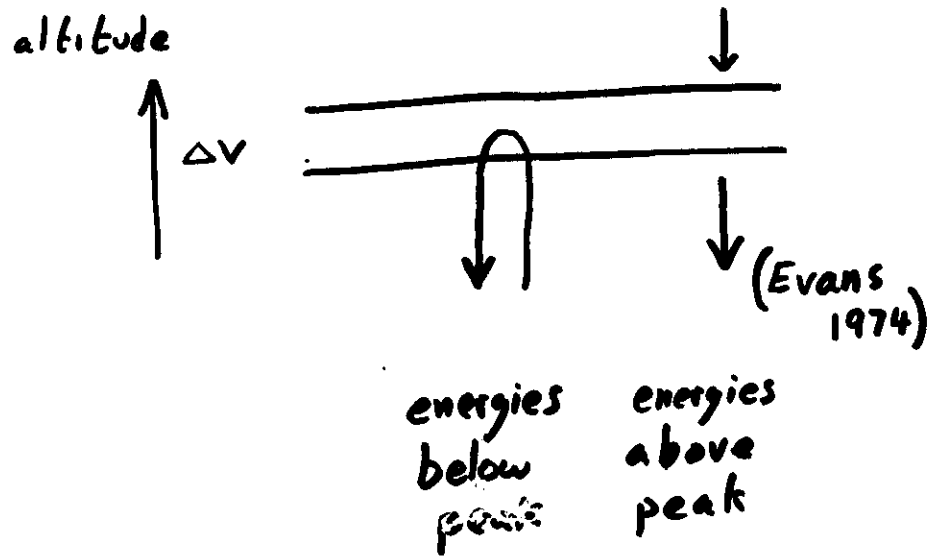
High-and low-altitude DE spacecraft



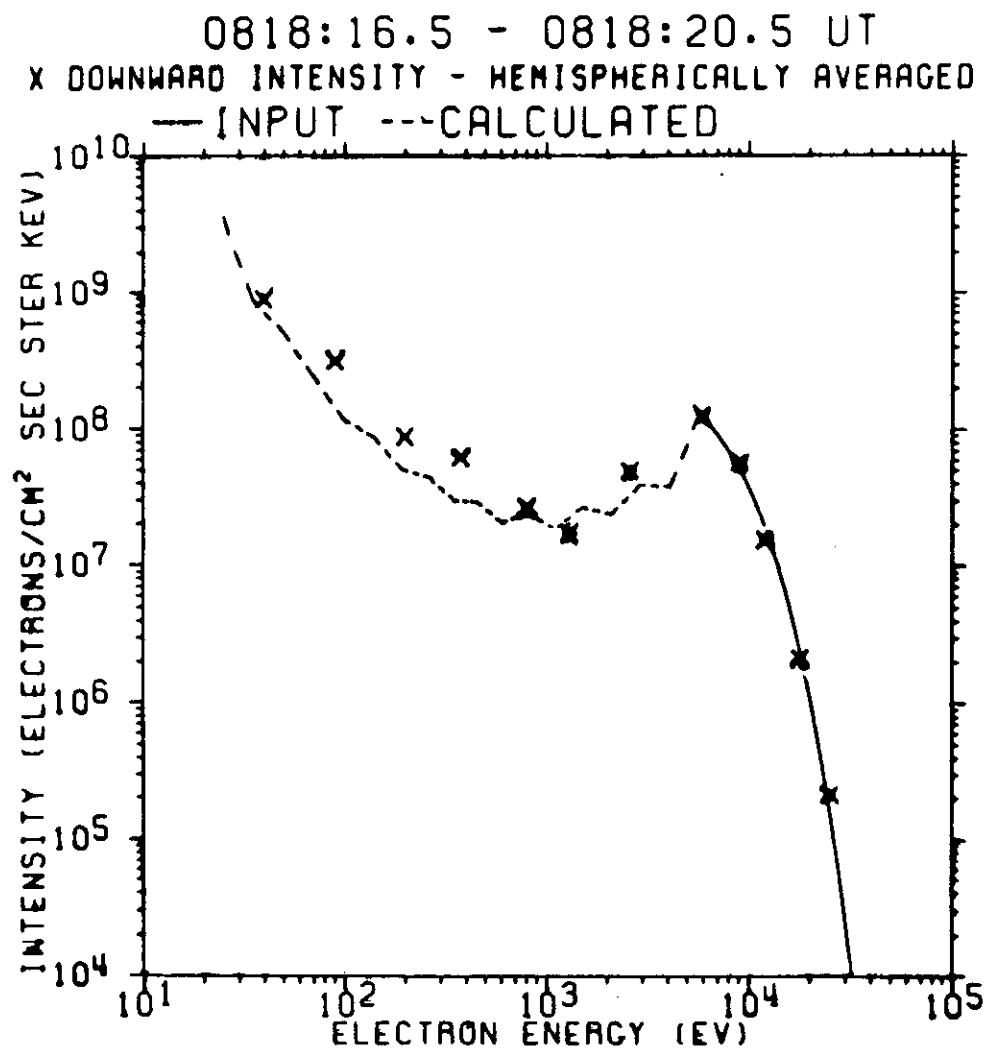
Electron spectrum extended to low energies



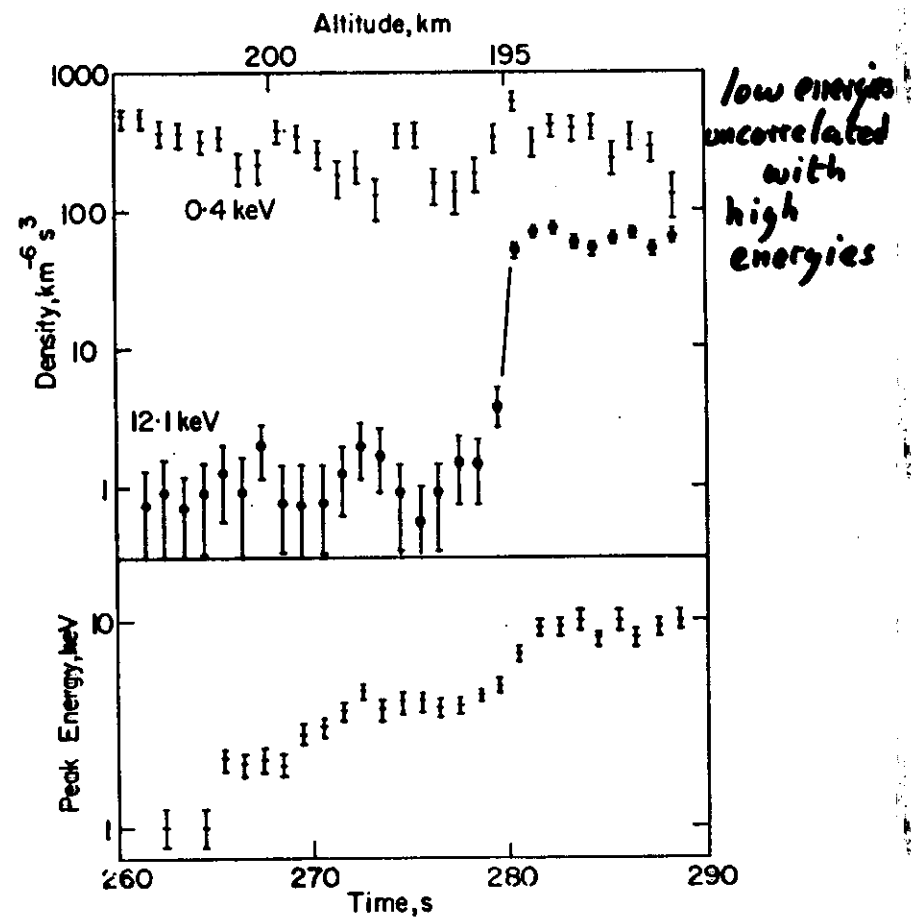
(Reiff et al 1986)



Comparison of electron fluxes at complementary pitch-angles, demonstrating that downgoing electrons outnumber the upgoing ones, even at energies below the peak in the spectrum. Reasoner and Chappell (1973).



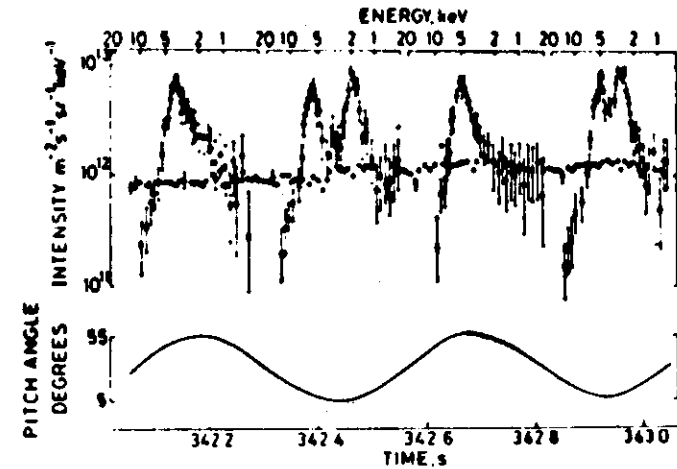
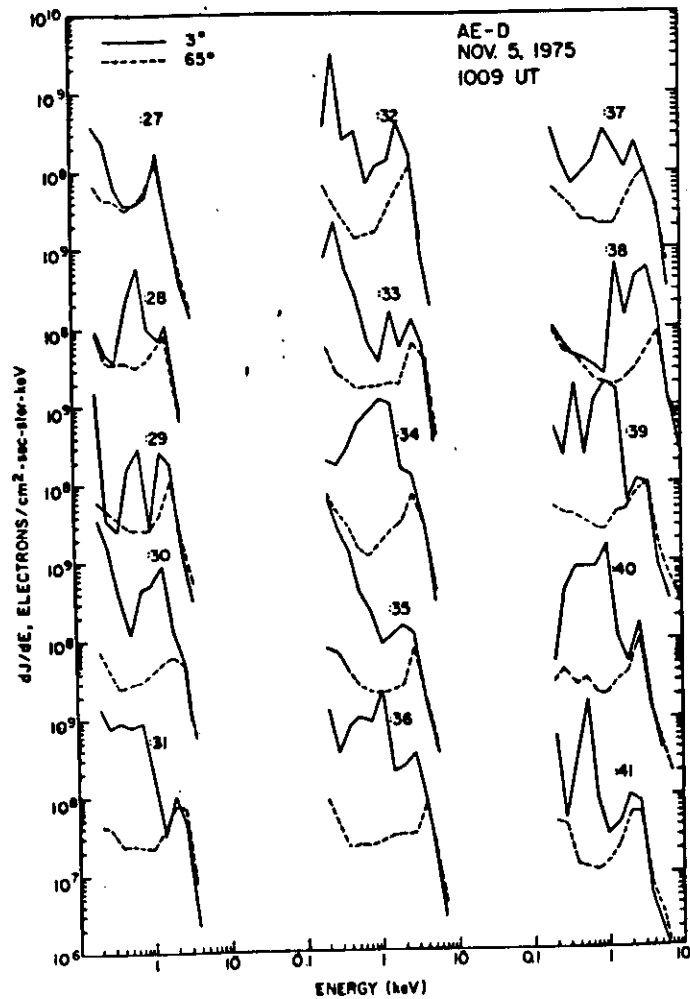
211:11:1981



Velocity Space Densities and Peak Energy
 Measured on F39 at Pitch Angles 20-40°

Hall 1980
 also Whalen and Doly 1979 REG 50412 REF 2759/2

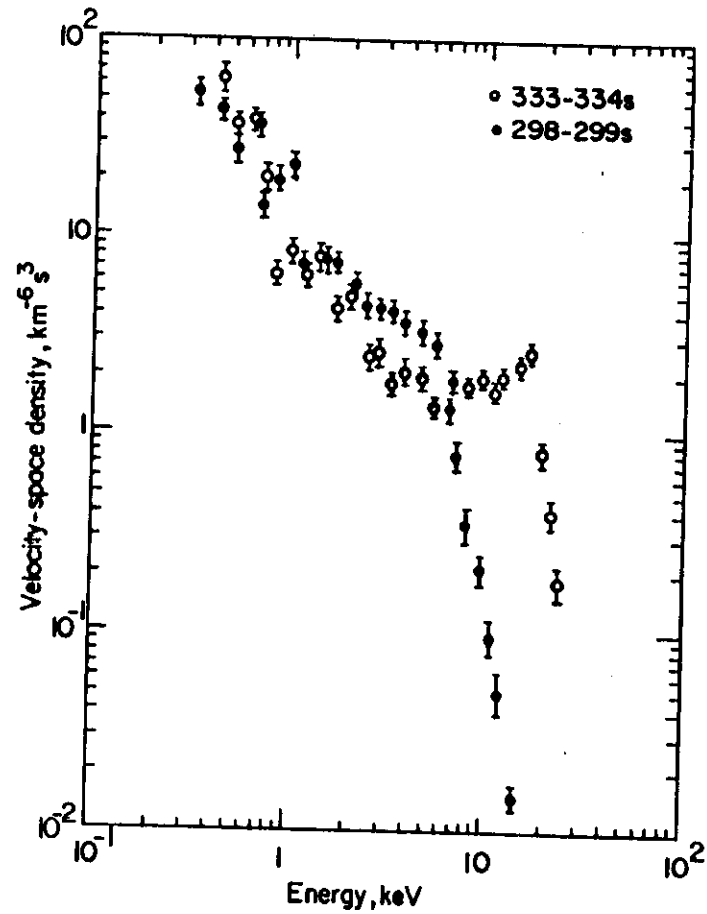
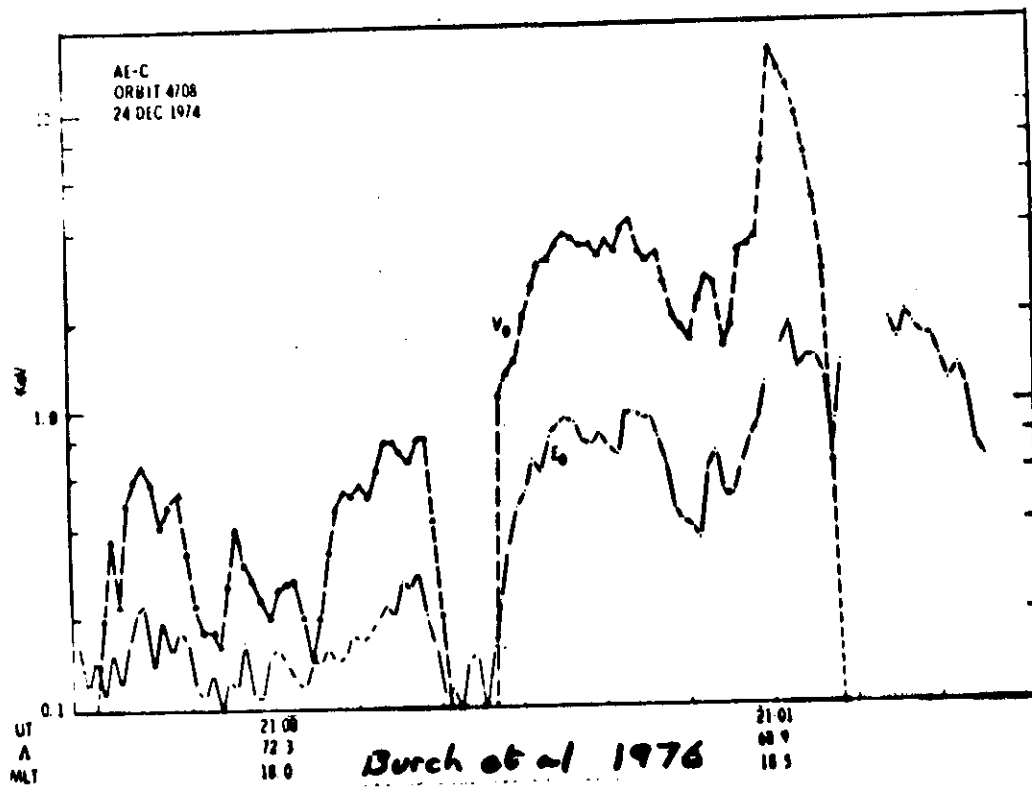
1981



ELECTRON INTENSITIES MEASURED ON SL1422-1 AT ENERGIES BETWEEN 0.5 AND 20 keV
Dyrc 1982
-- CONTINUOUSLY AT 7.3 keV

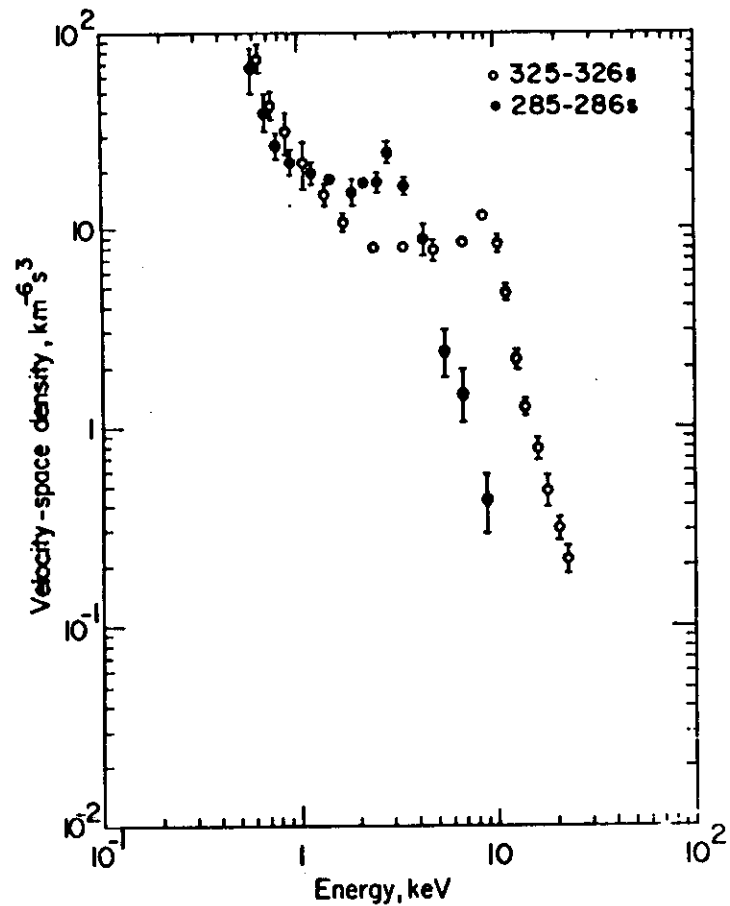
Multiple peaks and fluctuations at

~~186~~
186



Electron Distribution Functions from Flight
SL1122 Launched 2044 UT 1 Nov 1973

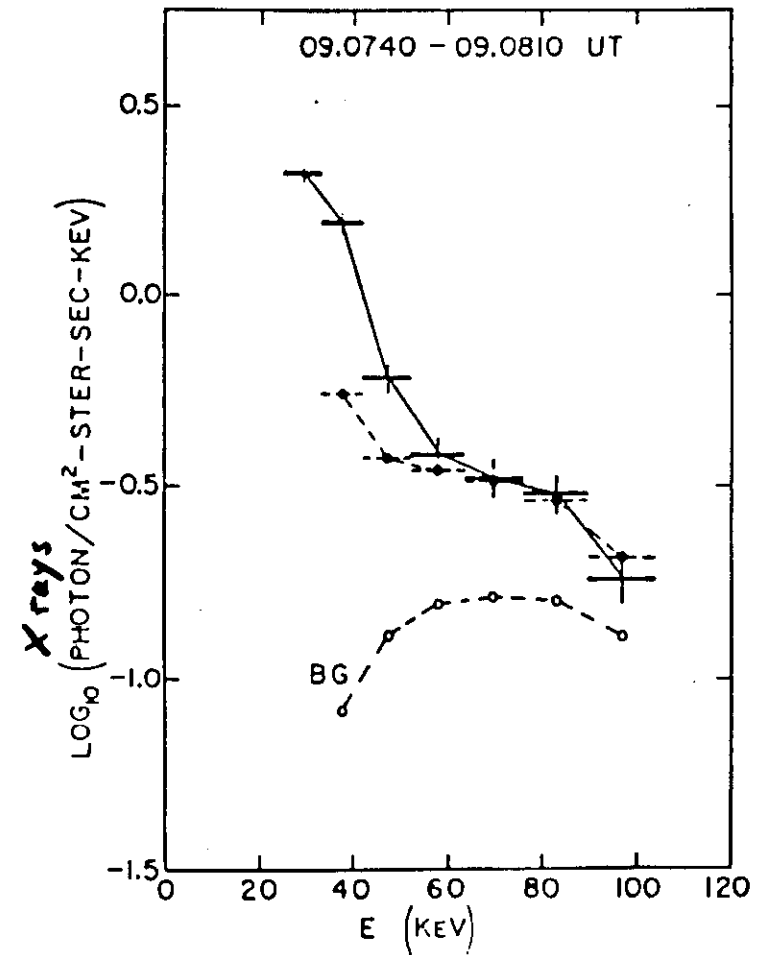
Bryant 1981
NEG 505214 REF 2757/4
V.G. 19



Electron Distribution Functions from Flight SL1422
Launched 2115 UT 21 Nov 1976

Bryant 1981
NEG NO 5052/2 REF 2757/2

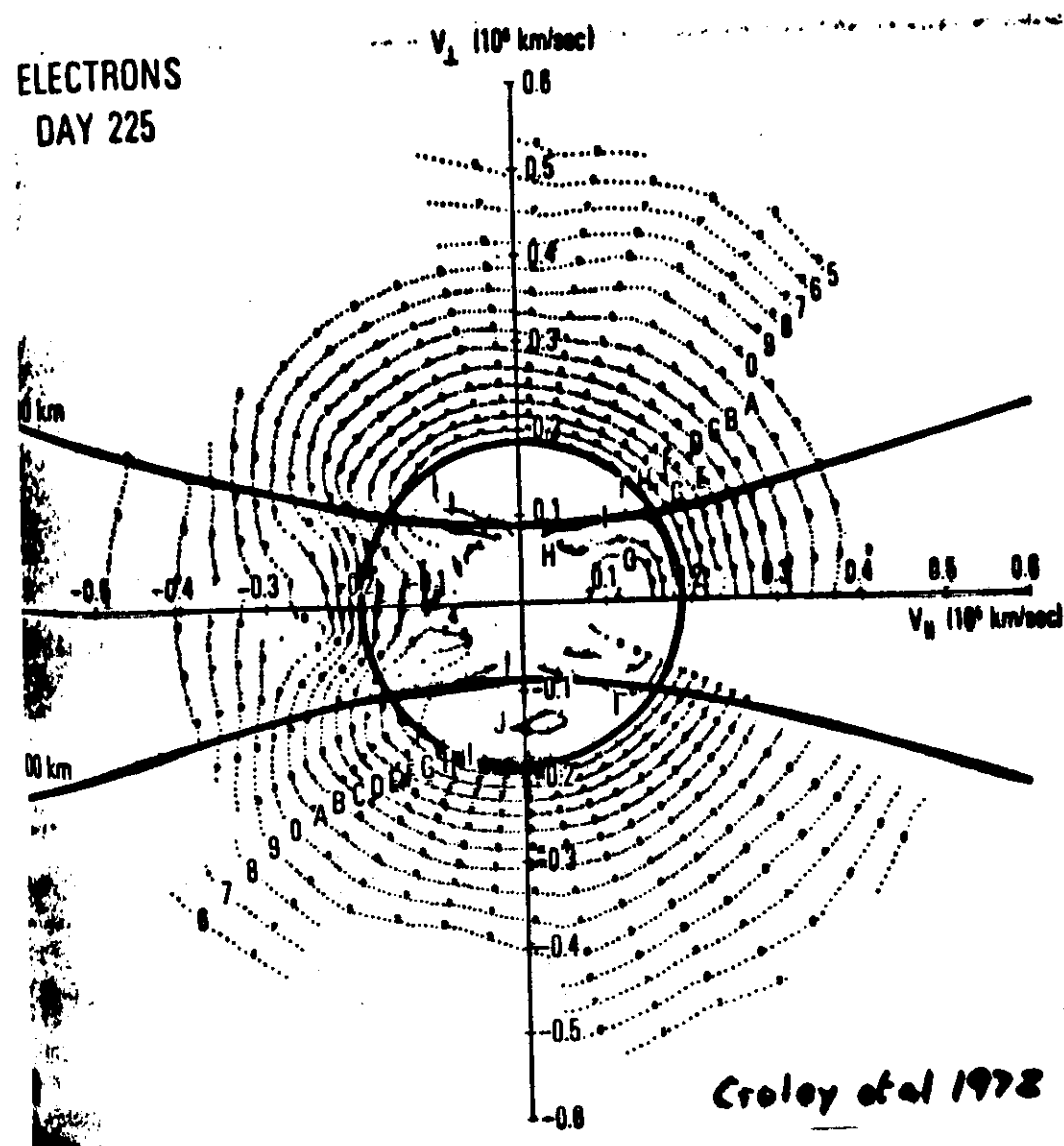
V-G-21



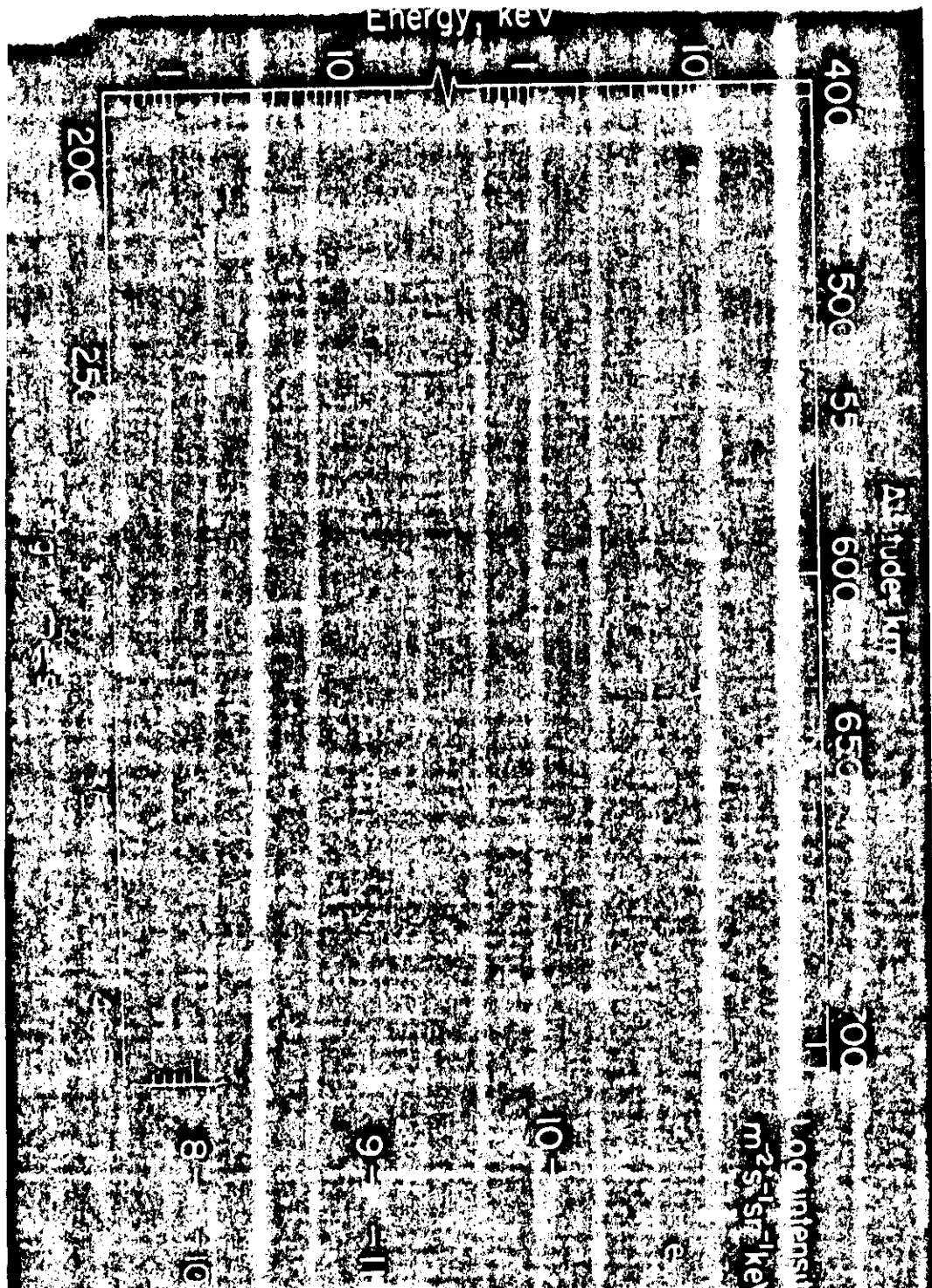
Mauk & Parks 1981



Counterstreaming electrons observed from the S3-3 satellite

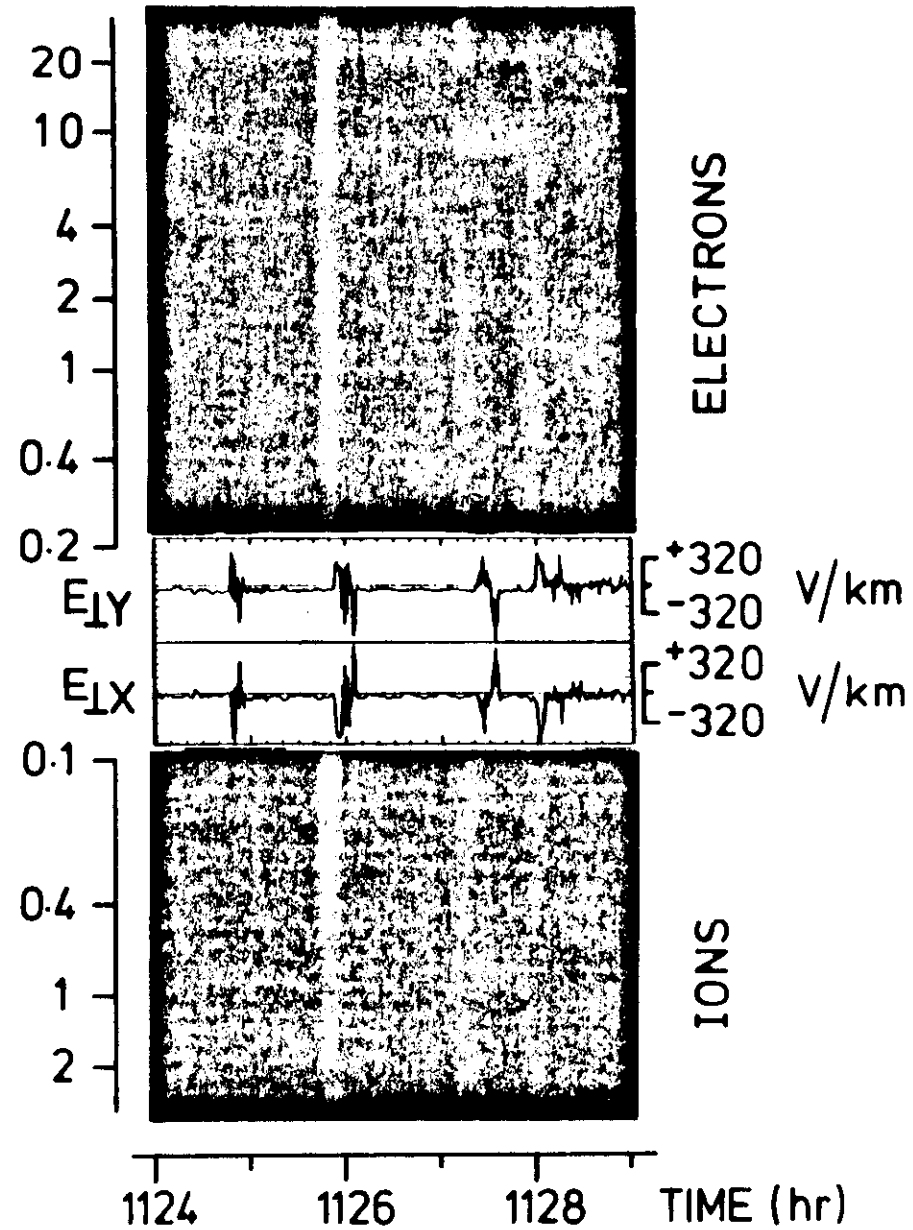


Croley et al 1978



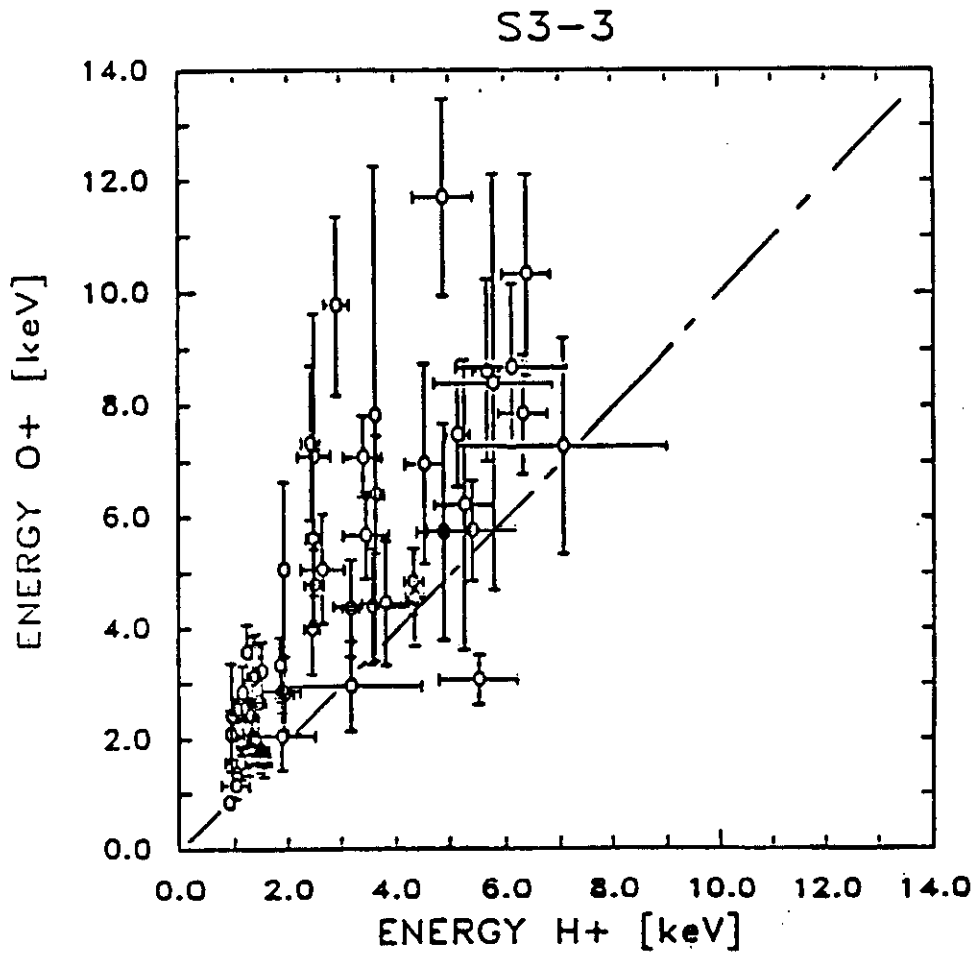
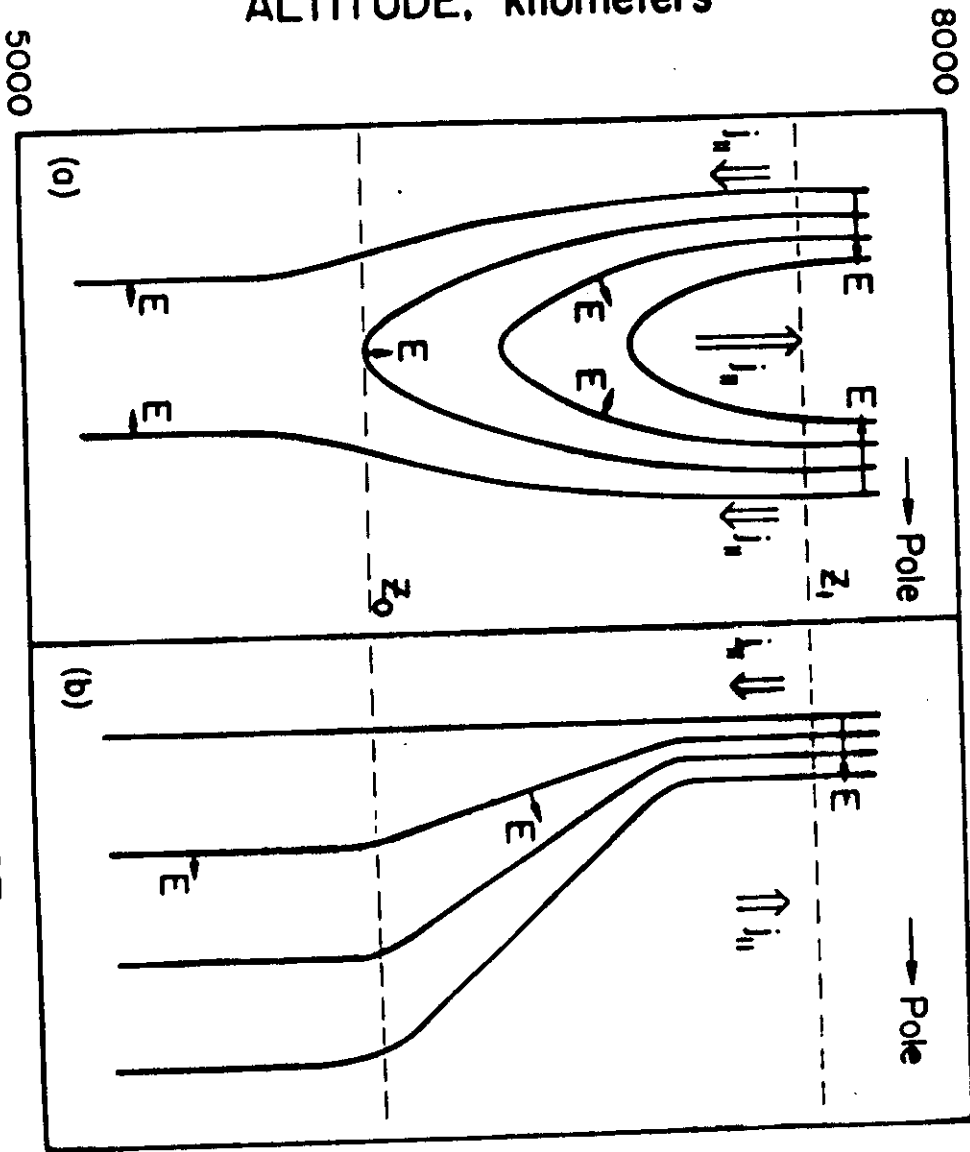
keV

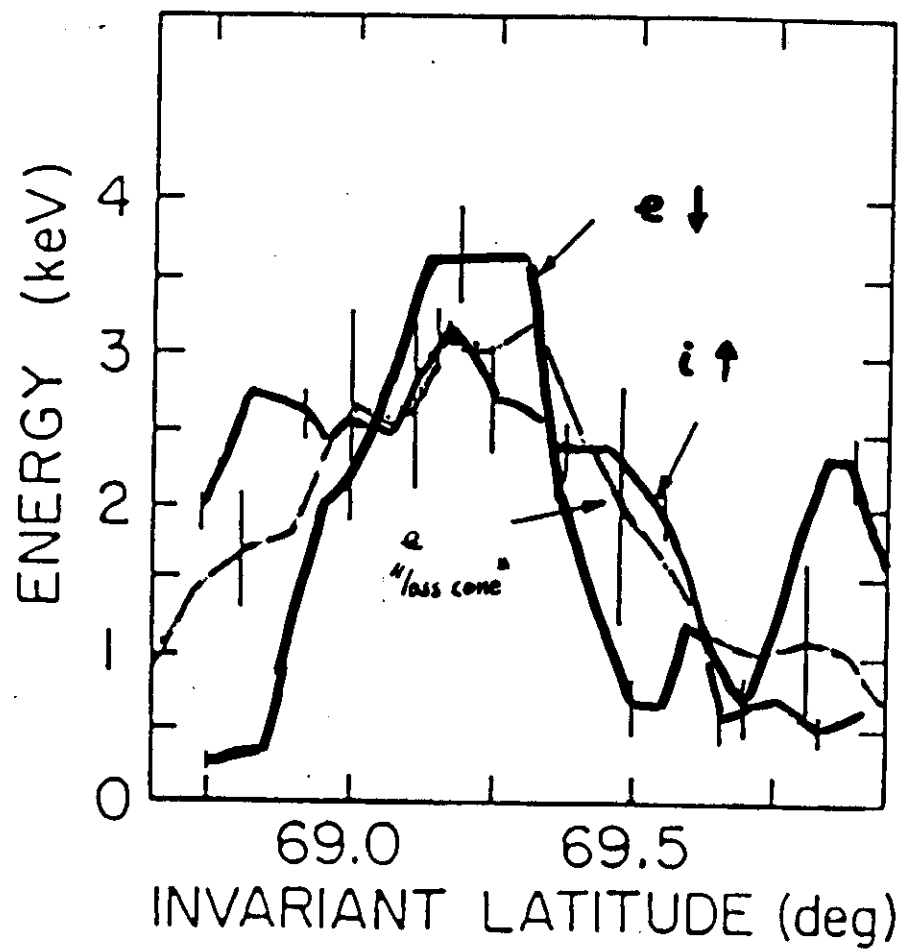
keV



Bryant 1983

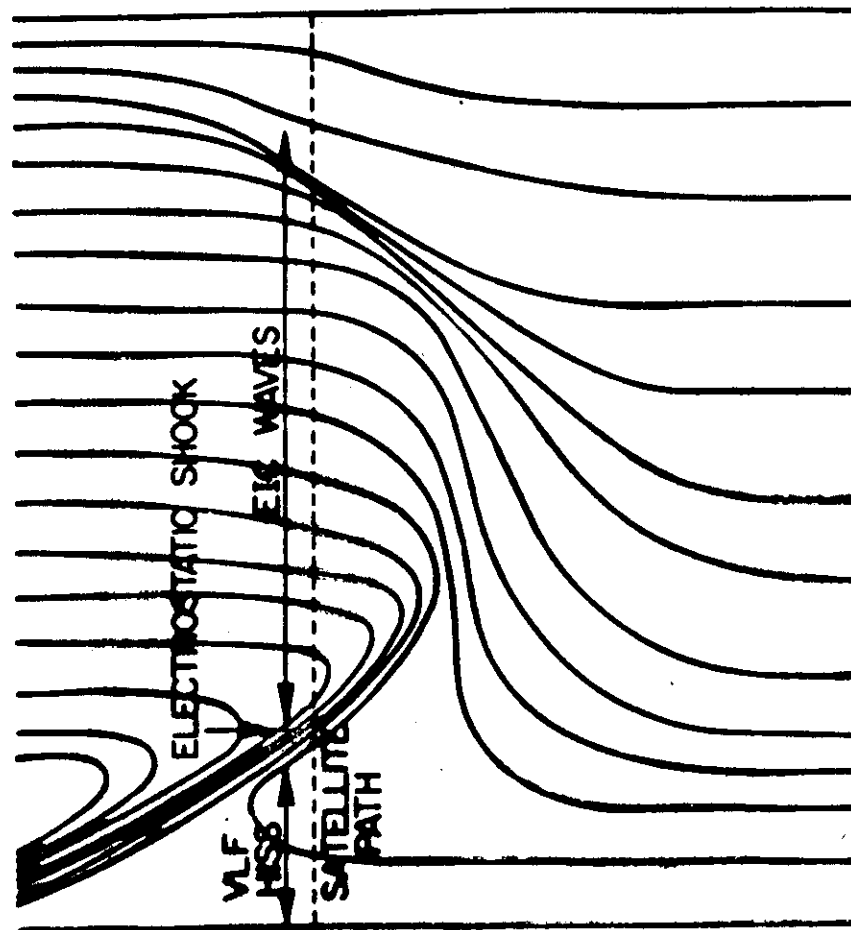
ALTITUDE, kilometers





Reiff et al 1988

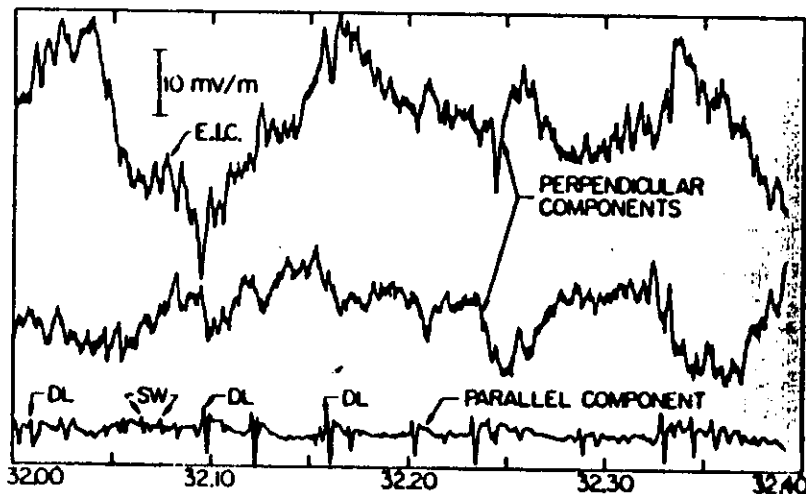
JGR
93 7441 1022



INVERTED 'V' POTENTIAL STRUCTURE

Fig. 9. Possible electric field potential contours for orbit 619.
(TEMERIN, 1981)

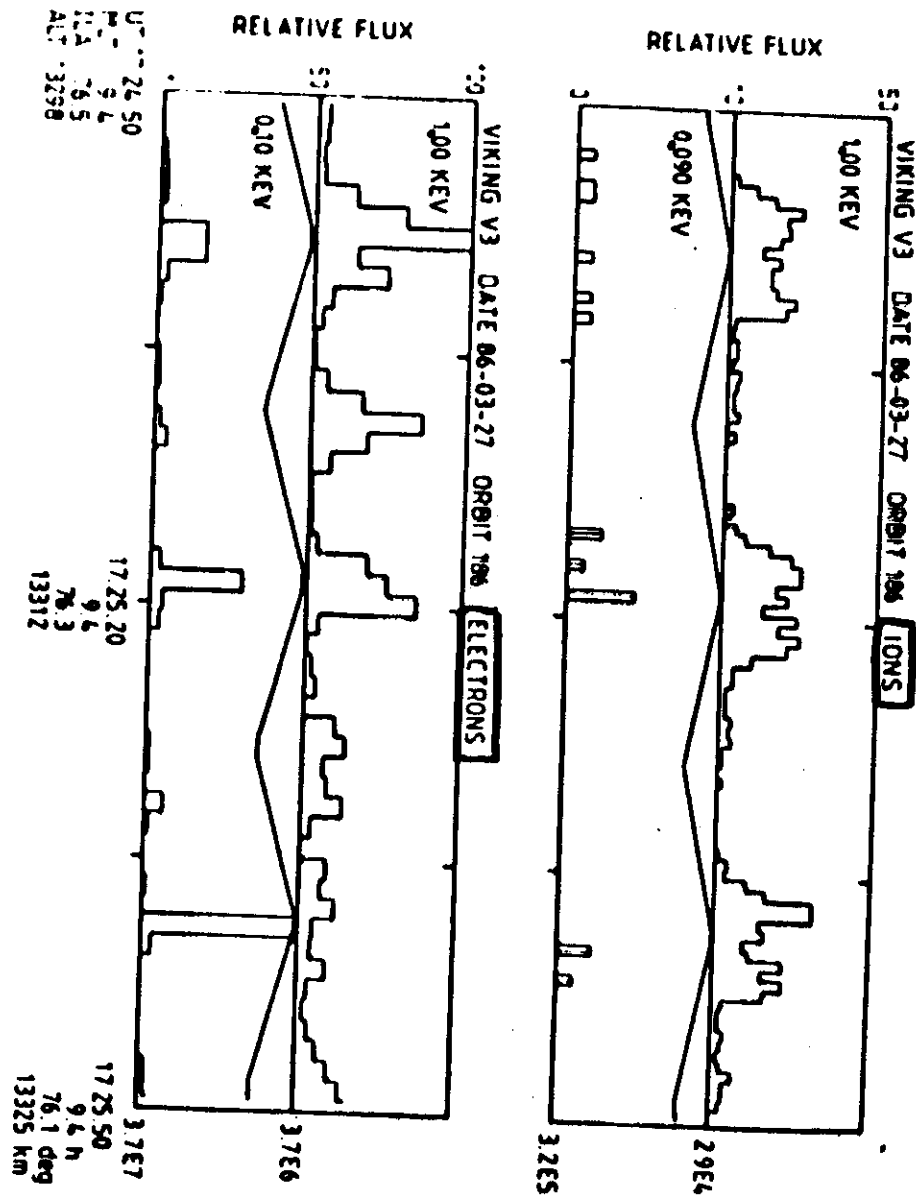
1.6.24.2 82MB 1621

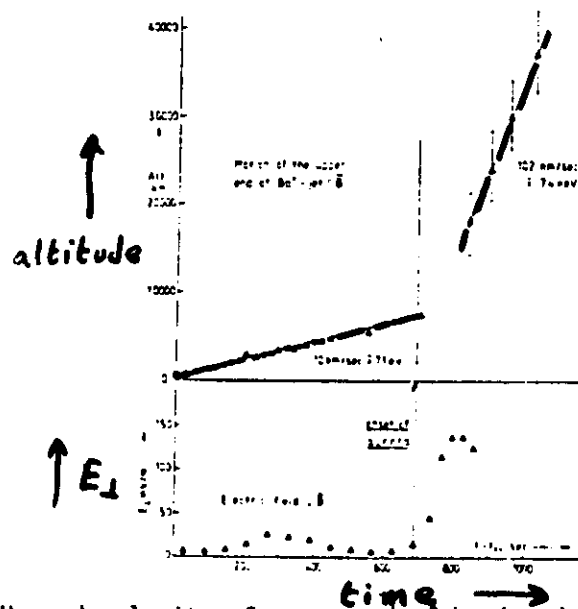


Temerin et al 1982

- 1 mV/m seen 5% of time along horizontal path
- $\therefore$ 1 mV/m exists over 5% of vertical path
- vertical path $\sim 10,000$ km
- $\therefore$ 1 mV/m occupies ~ 500 km
- $\therefore$ total potential drop ~ 500 V.

Phyo Rex Lett





Upward velocity of upper end of barium ion jet (Jan. 11, 1975) (upper panel) and transverse electric field projected to 100 km level as derived from low altitude portion of ion jet (lower panel).

Rieger et al 1976

WILHELM ET AL.: FAST MAGNETOSPHERIC ELECTRON ECHOES 1985

