Solar wind ram pressure increases and decreases are shown to be a triggering of dayside auroral intensifications and dimming, respectively. The auroral intensifications last for ~10-15 min propagate towards nightside along both the dawn and dusk flanks. In this study, we analyze interplanetary pressure pulse events and dayside auroral events in 1997-1999 using WIND interplanetary magnetic field and solar wind plasma data and POLAR UVI data. The relationship between the intensity of interplanetary pressure pulses and the intensity and symmetry of dayside auroras will be shown statistically. The micro-mechanism(s) of the particle acceleration and the auroral propagation will be discussed.
FIG. 14.8. Variation in the size of the auroral oval with activity. The shaded area represents the distribution of maximum auroral activity in the northern hemisphere. Coordinate system is corrected geomagnetic (CG) latitude and CG local time, and noon is at the top. (Adapted from Feldstein and Starkov, 1967.)
Table 1. "Auroral speed" in the ionosphere (& mapped into the solar wind/magnetosheath).

<table>
<thead>
<tr>
<th>Event</th>
<th>Ionospheric V (km/s)</th>
<th>Calculated V* (km/s)</th>
<th>Observed V_{sh/w} (km/s)</th>
<th>Spacecraft Position (Re)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 10, 97</td>
<td>6 (dusk)</td>
<td>280</td>
<td>300</td>
<td>I-T (Sheath) (-19, 19, 10)</td>
</tr>
<tr>
<td>Oct 1, 97</td>
<td>10 (dusk)</td>
<td>370</td>
<td>460</td>
<td>IMP-8 (SW) (10, 32, -3)</td>
</tr>
<tr>
<td>Dec 10, 97</td>
<td>11 (dawn)</td>
<td>365</td>
<td>360</td>
<td>GT (SW) (-4, -25, -0.5)</td>
</tr>
</tbody>
</table>

* Assuming a dipole field of L=10.
Fig. 2. Orientations of 38 shock normals. The angle $\theta$ is the solar ecliptic latitude and $\phi$ is the solar ecliptic longitude. The dashed arrows represent events with uncertainties larger than those represented by solid arrows (see text).
Shock normal = (-0.74, -0.3, -0.6) in GSM

IP Shock Plane

00:58:48 UT

POLAR UVI LBHL

October 1, 1997
POLAR Mission
Polar Cap Boundary Layer Waves from 3/13/96 through 3/12/97

Geomagnetic Latitude (degrees)

Geomagnetic Local Time (hour)

Occurrence Rate (raw counts)
The Last Closed Magnetic Field Line (Prior to and after IP shock compression)

- - - Z (Re 64deg/15nPa)
- - - - Z (Re 70.5deg/3nPa)
Sun

Fast Shock

Sun

Alfvén Waves

Sun

Discrete Aurora

Field-aligned Currents

Parallel Electric Fields
Table 1. The 14 BL crossings identified by Phillips et al. [1993]

<table>
<thead>
<tr>
<th>Event</th>
<th>Transition</th>
<th>Boundary</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Msh-BL-Msh</td>
<td>MP1</td>
<td>Date</td>
<td>Day of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MP2</td>
<td></td>
<td>Year</td>
</tr>
<tr>
<td>6</td>
<td>Msp-BL-Msp</td>
<td>MP</td>
<td>Feb. 4, 1992</td>
<td>035</td>
</tr>
<tr>
<td>7</td>
<td>Msp-BL-Msp</td>
<td>MP</td>
<td>Feb. 4, 1992</td>
<td>035</td>
</tr>
<tr>
<td>8</td>
<td>Msp-BL-Msh</td>
<td>MP</td>
<td>Feb. 12, 1992</td>
<td>043</td>
</tr>
</tbody>
</table>

Magnetosheath (Msh), boundary layer (BL), and magnetosphere (Msp), with identification of the boundary crossed, bow shock (BS) or magnetopause (MP). MP! - based on magnetic field observations. MP2 - based on plasma observations. There are five crossings on the Ulysses inbound pass, days 33-35, 1992, and nine crossings on the outbound pass, days 43-45, 1992. The events have been numbered in chronological order for ease of description.
E Power Spectra

\[ I = (4.1 \times 10^{-9}) f^{-2.4} \]

B Power Spectra

\[ I = (3.5 \times 10^{-4}) f^{-2.5} \]

Figure 5
<table>
<thead>
<tr>
<th>Spacecraft</th>
<th>Location</th>
<th>Date</th>
<th>$B'$</th>
<th>$E'$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISEE 1$^a$</td>
<td>Earth magnetopause</td>
<td>day 314, 1977</td>
<td>$f^{-3.3}$</td>
<td>$f^{-2.1}$</td>
</tr>
<tr>
<td>ISEE 1 and 2$^b$</td>
<td>Earth magnetopause</td>
<td>1977</td>
<td>$(1 \times 10^1), f^{-3.9}$</td>
<td>$(3 \times 10^{-5}), f^{-1.8}$</td>
</tr>
<tr>
<td>ISEE 1 and 2$^c$</td>
<td>Earth magnetopause</td>
<td>1977</td>
<td>$(7.9 \times 10^{-2}), f^{-2.9}$</td>
<td>$(6.3 \times 10^{-6}), f^{-2.2}$</td>
</tr>
<tr>
<td>GEOS 2$^d$</td>
<td>Earth magnetopause</td>
<td>day 240, 1978</td>
<td>$X: (3.6 \times 10^1), f^{-2.6}$</td>
<td>$Y: (1.8 \times 10^1), f^{-2.4}$</td>
</tr>
<tr>
<td>ISEE 1$^e$</td>
<td>Earth magnetopause</td>
<td>1977-79</td>
<td>$(3 \times 10^{-1}), f^{-3.3}$</td>
<td>$(6 \times 10^{-7}), f^{-2.1}$</td>
</tr>
<tr>
<td>Ulysses</td>
<td>Jupiter magnetopause</td>
<td>day 043, 1992</td>
<td>$(2 \times 10^{-4}), f^{-2.4}$</td>
<td>$(4 \times 10^{-9}), f^{-2.4}$</td>
</tr>
</tbody>
</table>
JOVIAN LLBL REGION AND AURORAL LATITUDINAL WIDTHS

- Mapping the Jovian BL to ionospheric heights give latitudinal widths of ~150-200 km.

- The “main” Jovian ovals can be as narrow as 230 ± 100 km in width.
Do Pitch Angle Scattering of Electrons and Ions Have Insufficient Energies to Create Aurora?

- 1-5 keV electrons and 1 keV – 1 MeV protons on strong pitch angle diffusion. But $E_{\text{TOTAL}} = 0.1$ erg cm$^{-2}$s$^{-1}$. 
FIELD-ALIGNED POTENTIAL DROPS*

\[ j_{\parallel} = k \cdot \phi_{\parallel} \]

where \( k^{-1} \) is the mirror impedance \( \frac{m_e C_{\text{BL}}}{e^2 n_{\text{BL}}} \)

\[ \phi_{\parallel} = j_{\parallel} k^{-1} = j_{\parallel_{\text{BL}}} \frac{B_c}{B_{\text{BL}}} k^{-1} \]

let:

\[ B_{\perp} \approx B_{\text{BL}} \approx 5 \text{nT}, \quad B_o \approx 10 \text{G}, \]

\[ w = 7,000 \text{ km} \quad (\text{Sonnerup et al., 1981}), \quad n_{\text{BL}} = 0.1 \text{ cm}^{-3}, \]

\[ C_{\text{BL}} = 10^4 \text{ km s}^{-1} \]

\[ \phi_{\parallel} = 50 \text{ kilo Volts} \]

CONCLUSIONS

• "Magnetopause boundary layers" are on **auroral zone field lines**.

• The dynamics of boundary layers is perhaps controlled by near-ionospheric physics, rather than the other way around.

• The ionospheric parallel electric fields can easily be 10 - 100 k Volts.

• Shock compression of the Jovian magnetosphere with simultaneous auroral observations can establish the magnetic field mapping from the equatorial plane to the ionosphere.
MAGNETOSHEATH  BOUNDARY LAYER  MAGNETOSPHERE

AMPTÉ/CCE CHEM ION DATA Dec. 13, 1984 (Day 348)

ION FLUX (1/\text{cm}^2 \cdot \text{s} \cdot \text{sr} \cdot \text{keV/e})

- Hg^{++}
- O^{+}
- CNO (\geq 3^+)
Magnetopause

Closed boundary layer?

Polar orbit

PCBL events

Earth
1996/7/8
05:05:14.470

1996/114/
06:33:10.682

Ratio of B/E

Frequency (Hz)

10000
1000
100
10

ψ = 60
ψ = 0