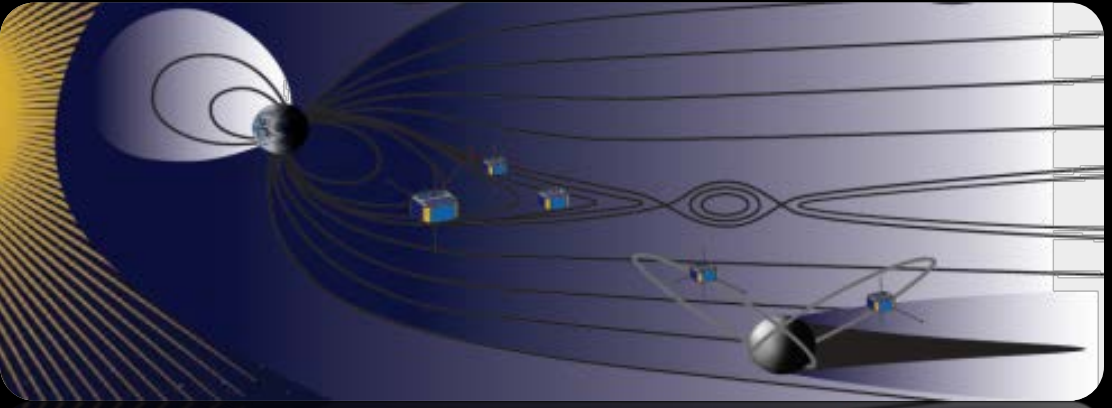
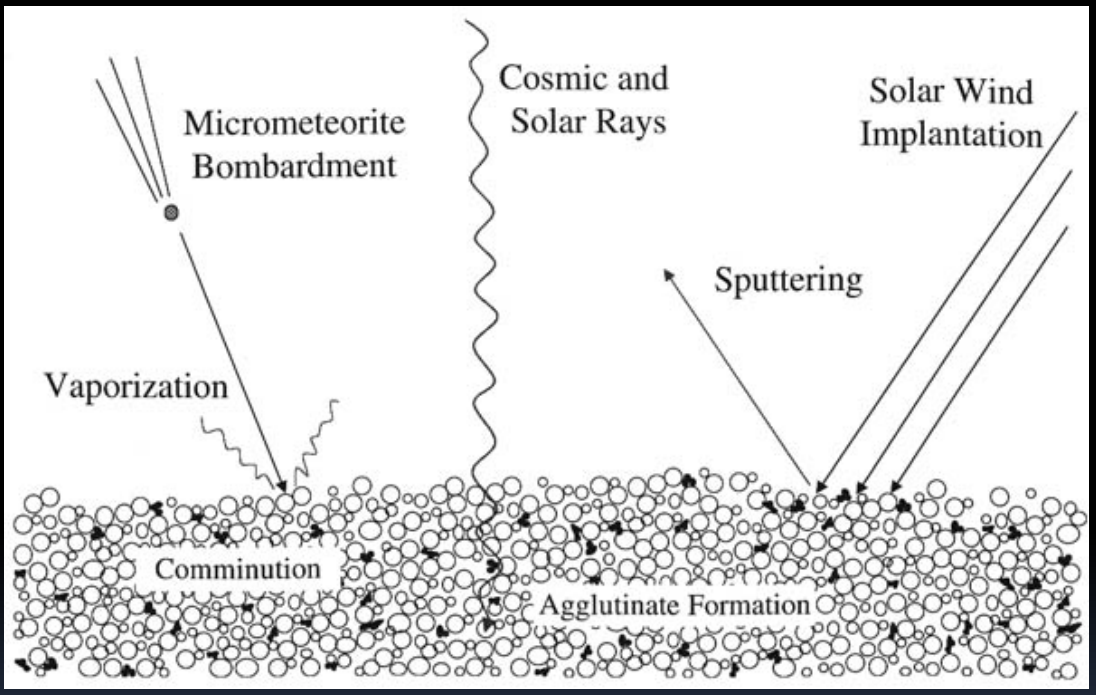


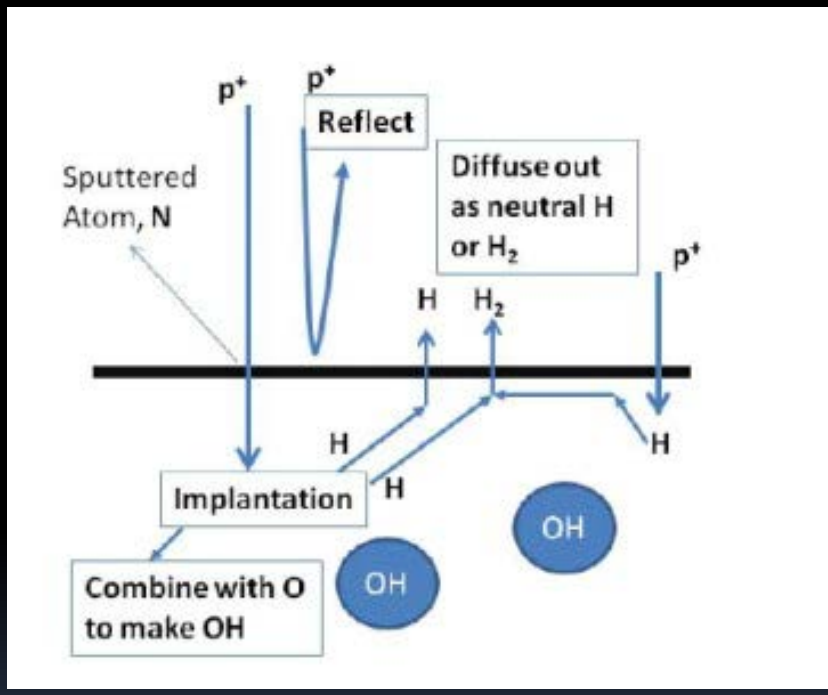
# ARTEMIS OBSERVATIONS OF THE SPACE ENVIRONMENT AROUND THE MOON AND ITS INTERACTION WITH THE ATMOSPHERE AND SURFACE

J.S. HALEKAS AND THE ARTEMIS TEAM

# The Solar Wind Meets the Surface

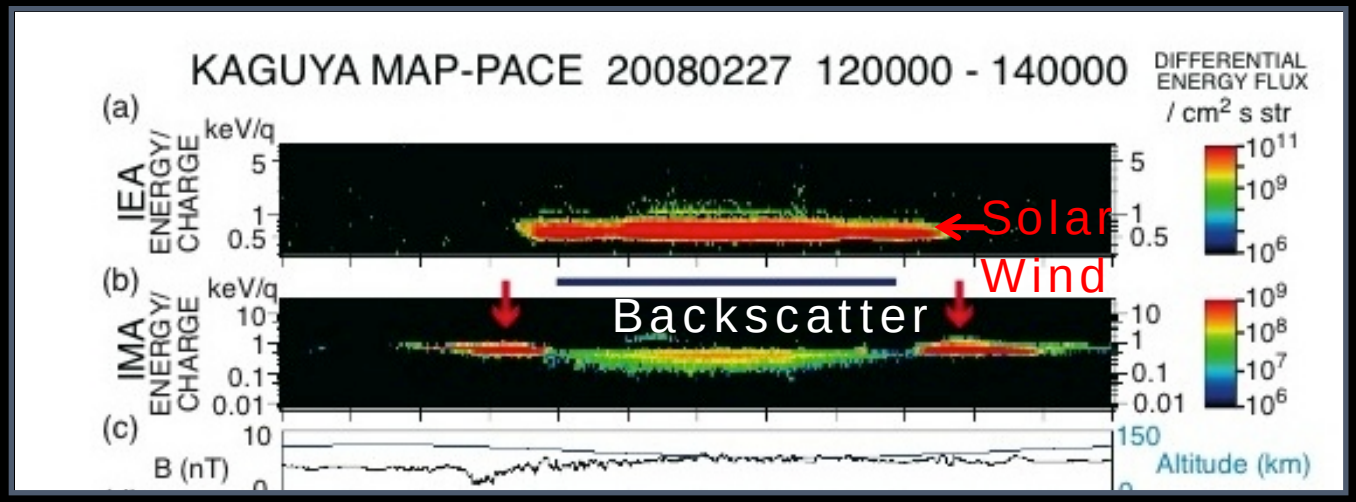



*Sarah Noble*




*Bill Farrell*

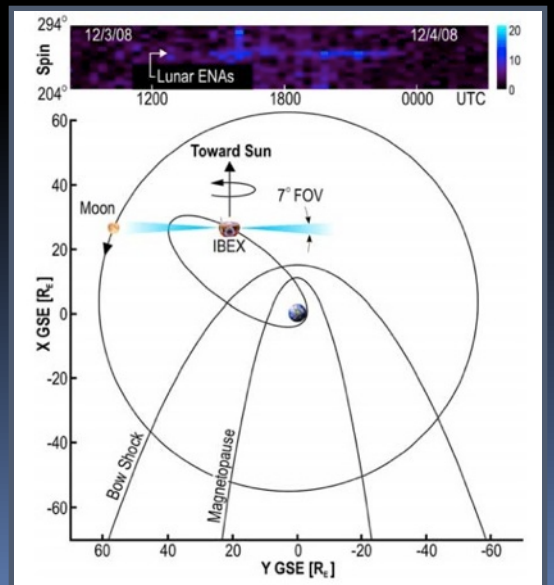
# Dayside Interaction



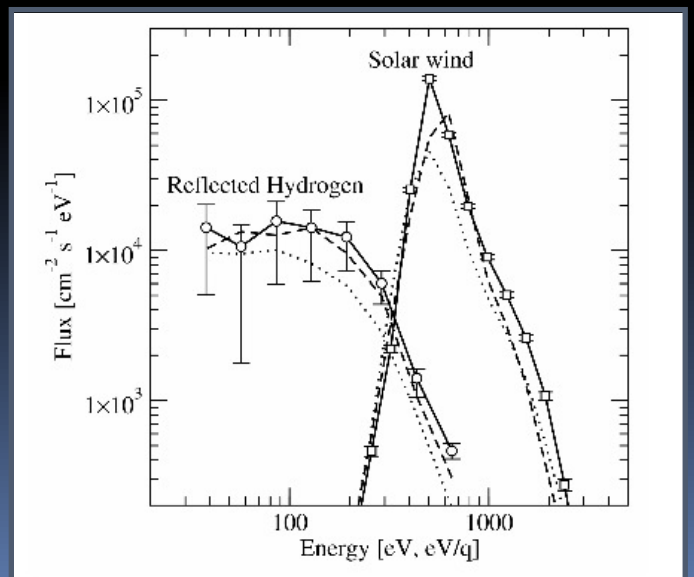

Saito et al., 2008, 2010

Solar Wind Protons

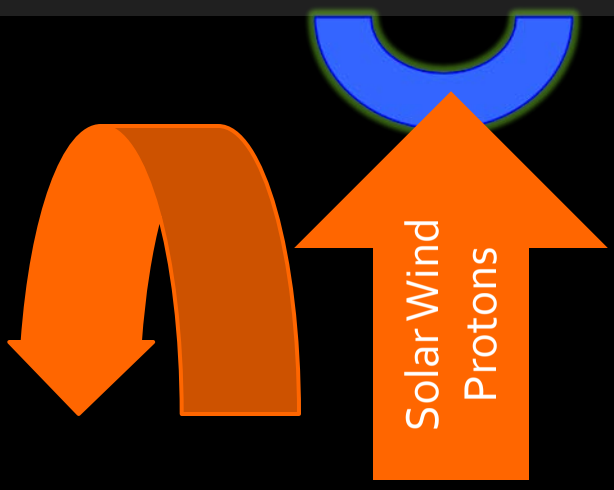
McComas et al., 2009



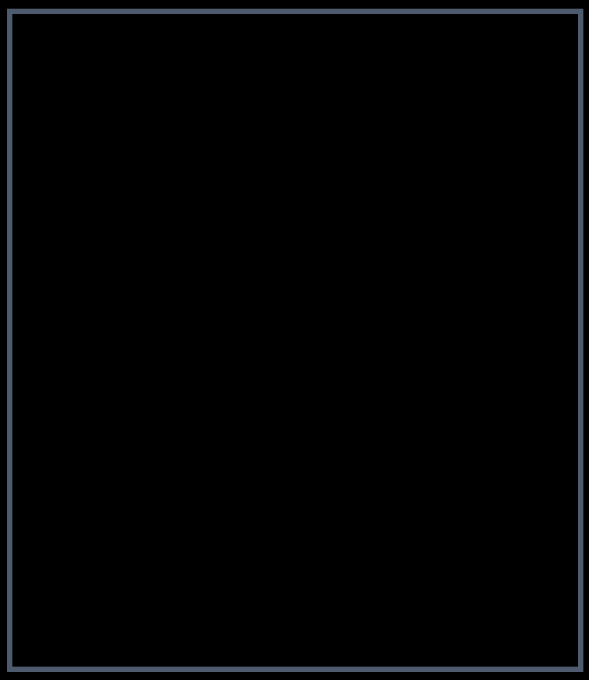

Bhardwaj et al., 2009



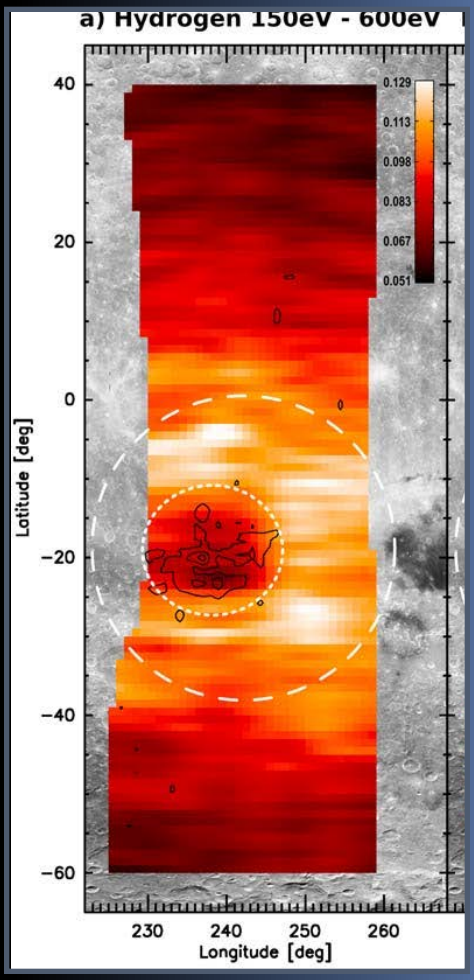
# Solar Wind Interaction w/ Crustal Fields



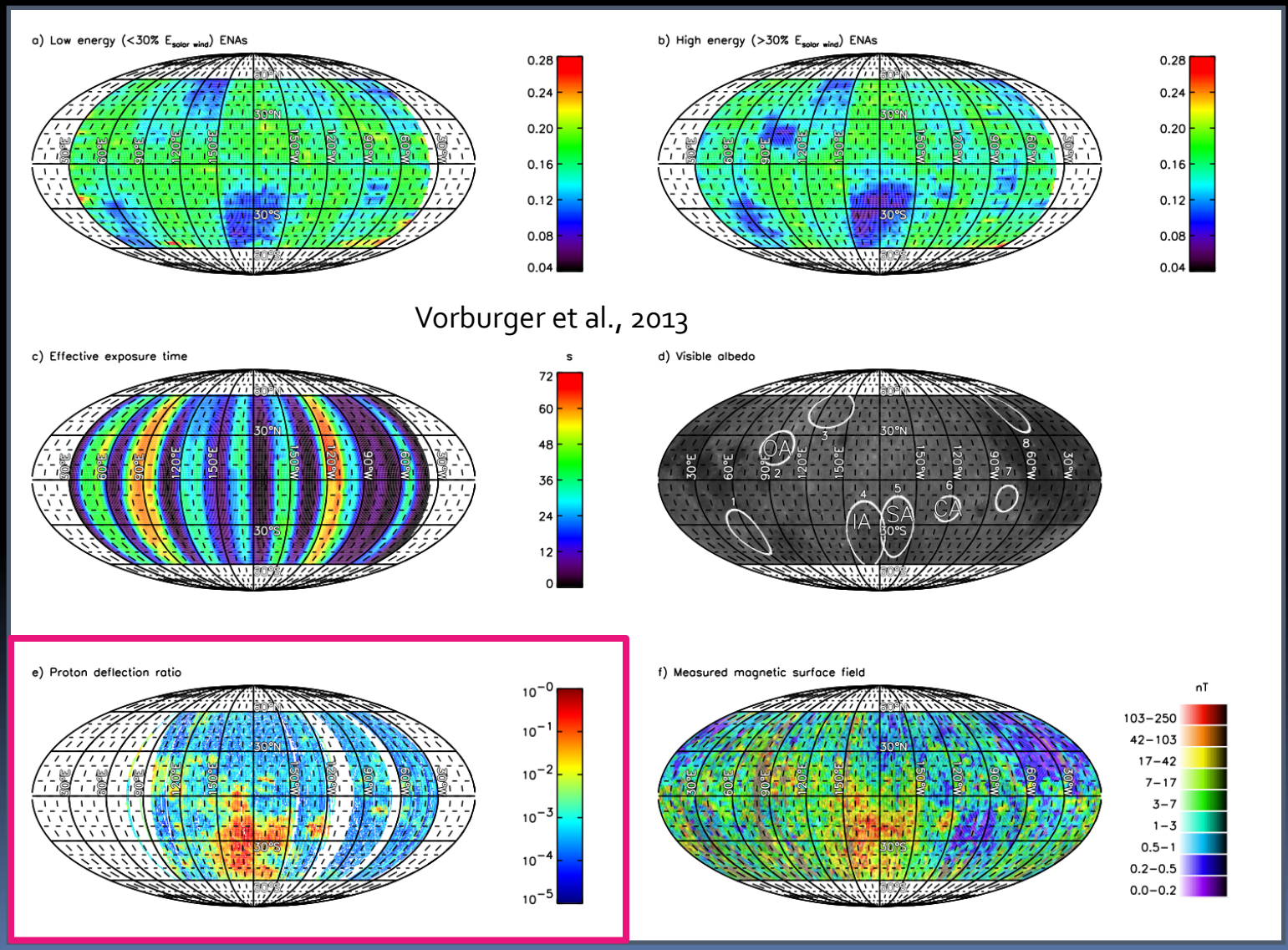

Lue et al., 2011



Wieser et al., 2010

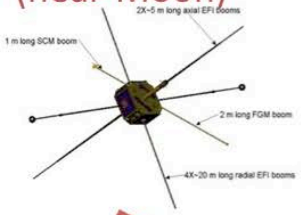


# Magnetic Anomalies in Ref. Protons & ENAS



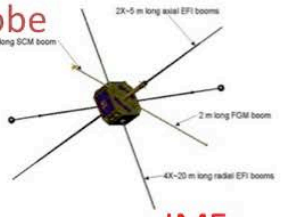
# What Can ARTEMIS Do?

ARTEMIS probe (near-Moon)




Reflected Protons

ARTEMIS probe (upstream)




IMF

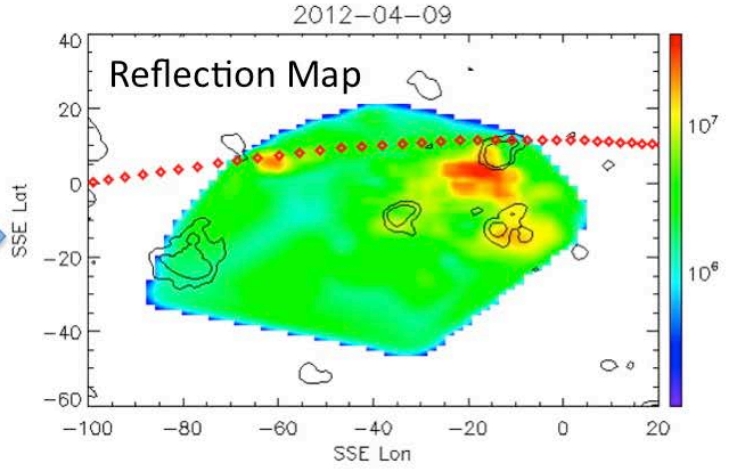
Solar Wind

E

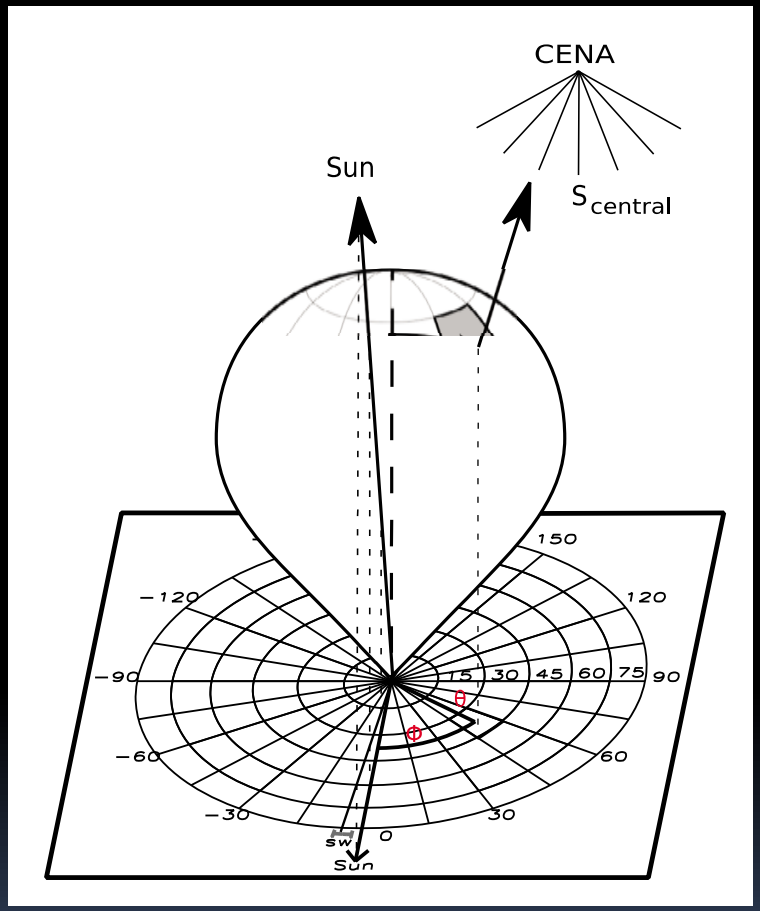
ARTEMIS measures reflected protons near moon

ARTEMIS measures V and B upstream

Particle Tracing

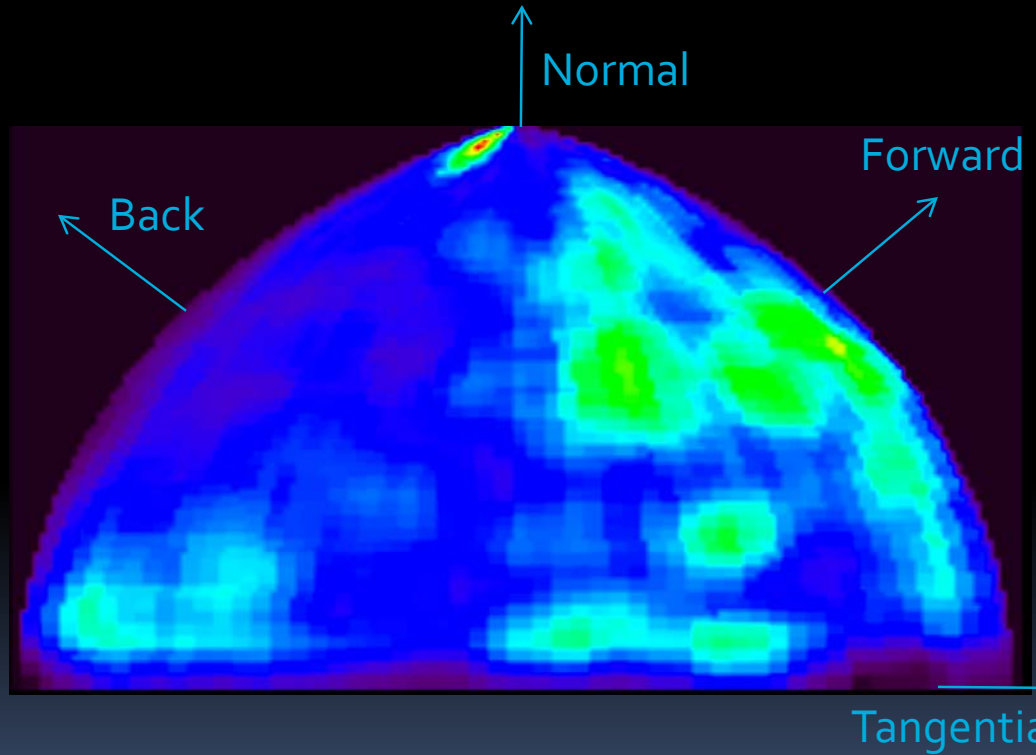


# Reflection Function



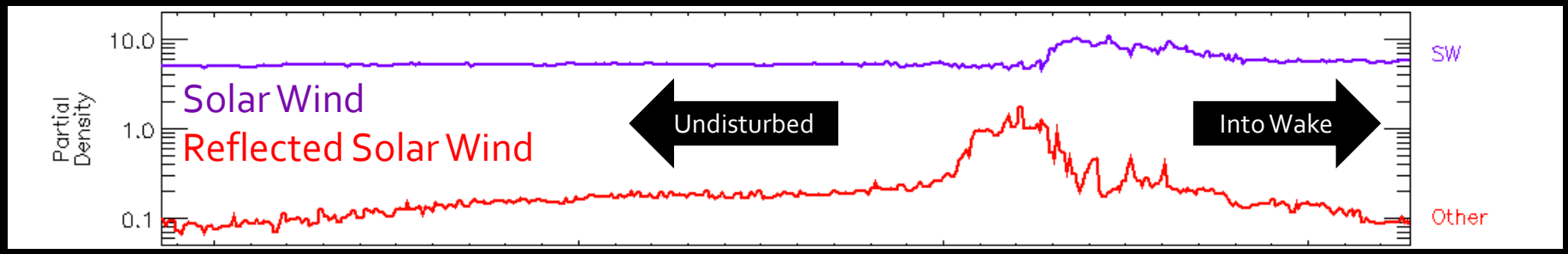

ENA Reflection Function
Schaufelberger et al., 2011

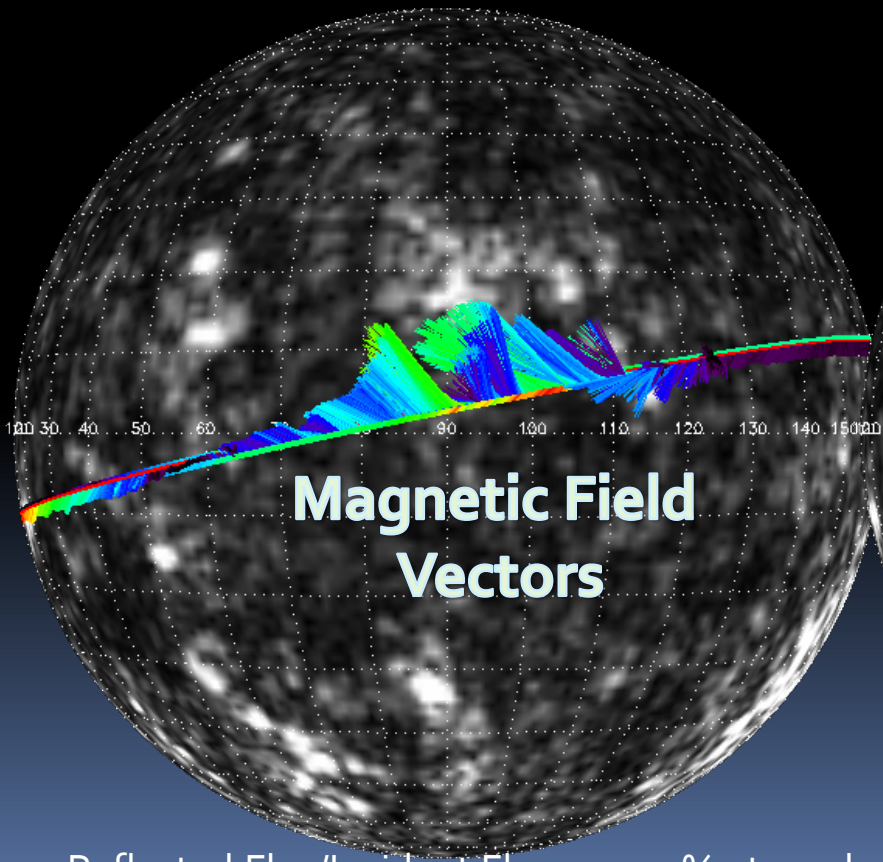
Proton Reflection Function from Two ARTEMIS Orbits

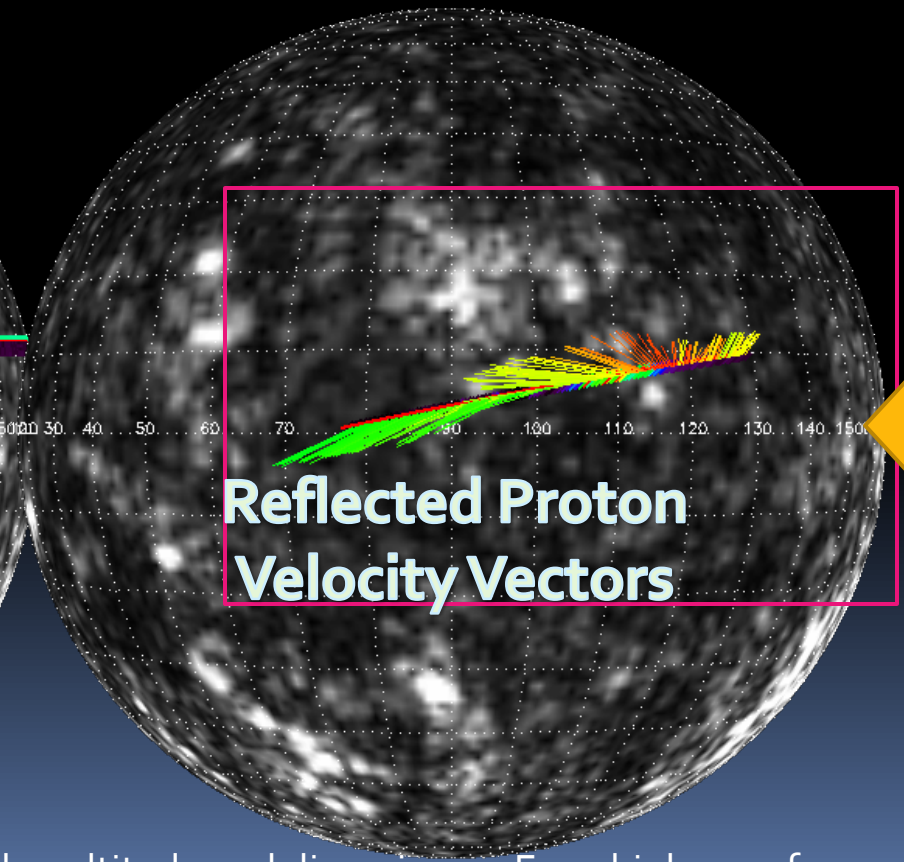



Also varies as function of SZA, solar wind, etc.!

# Anomalies at Low Altitude

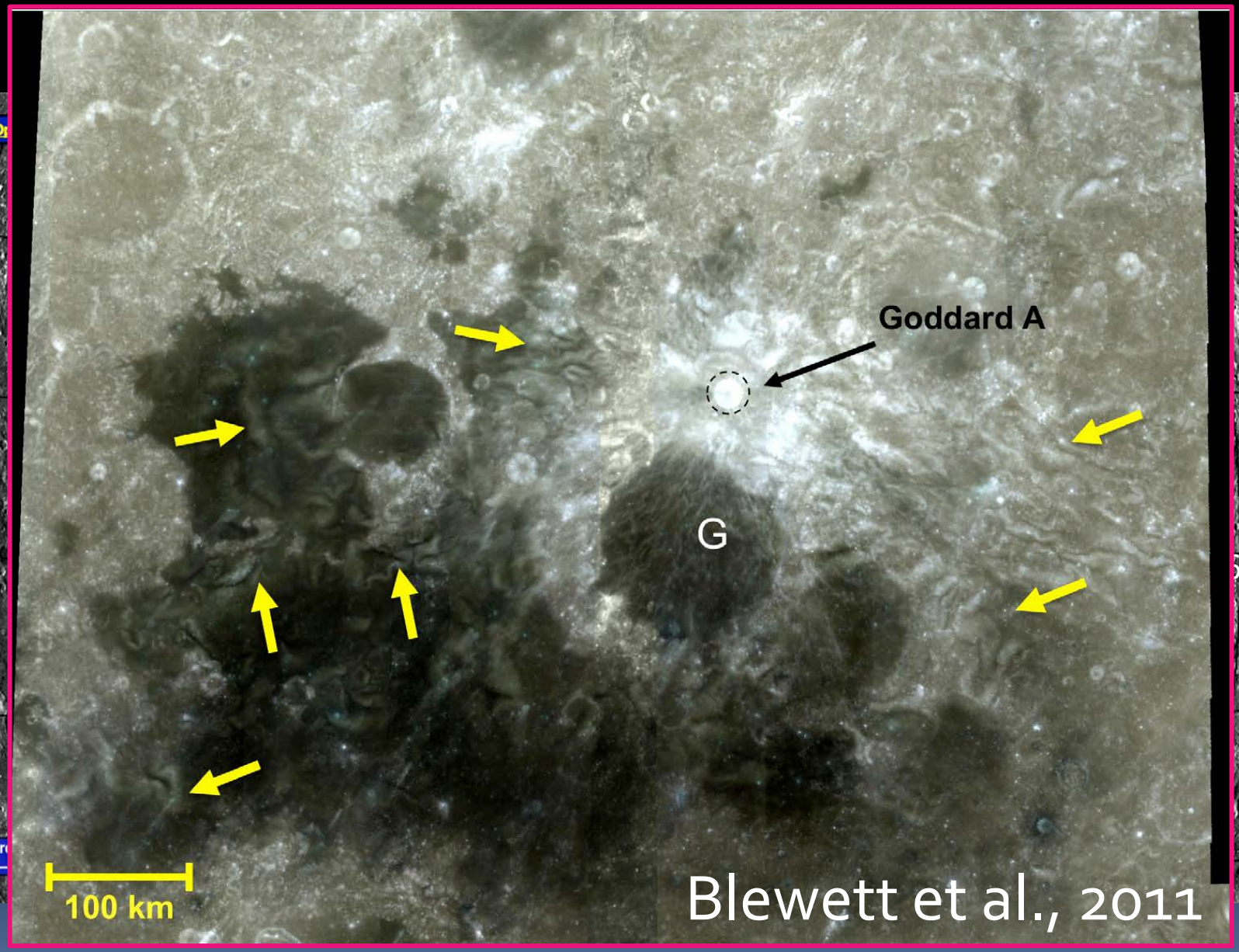



Reflected Flux/Incident Flux ~20-30% at ~20 km altitude and diverging => Even higher surface reflection

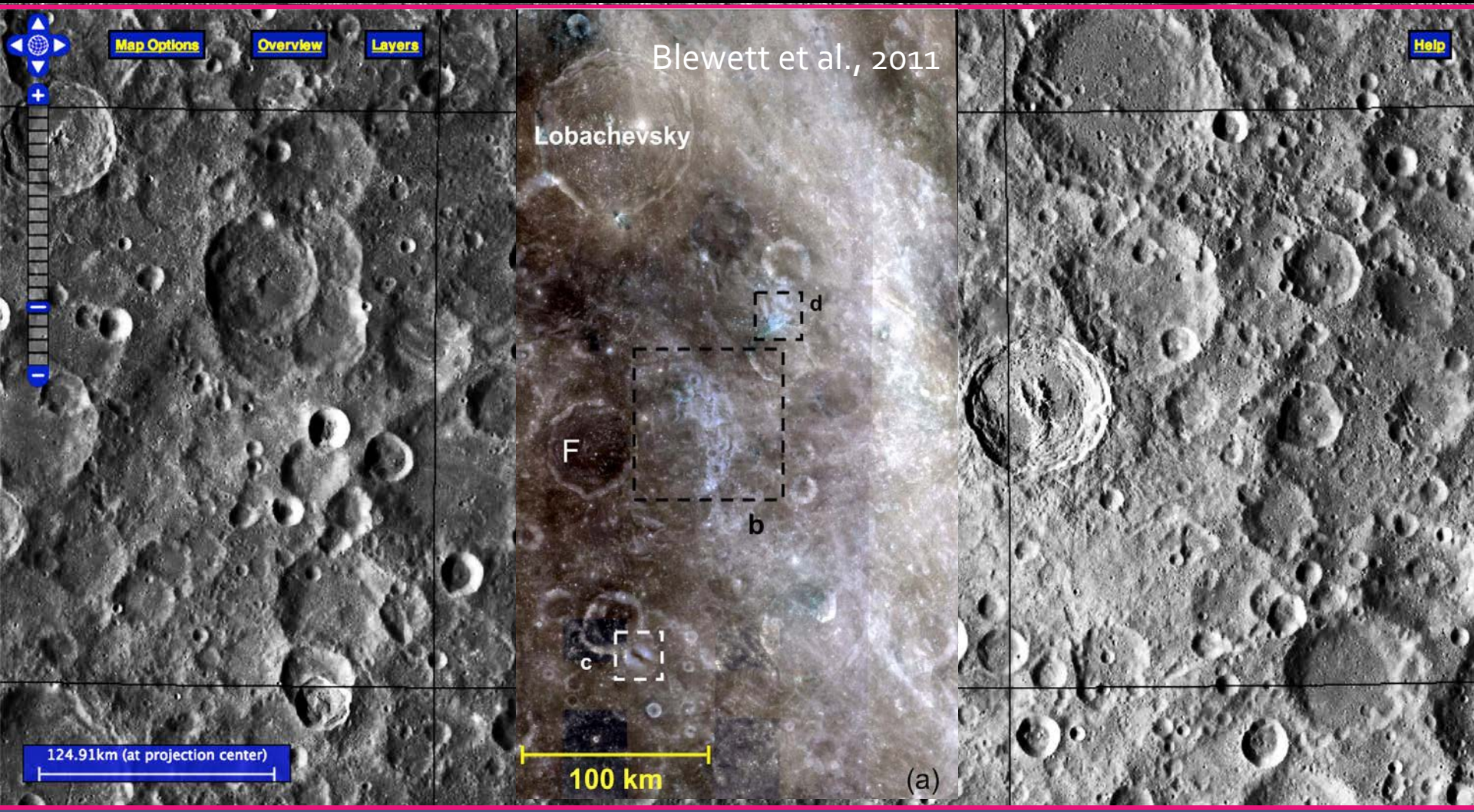
# Regional Overview



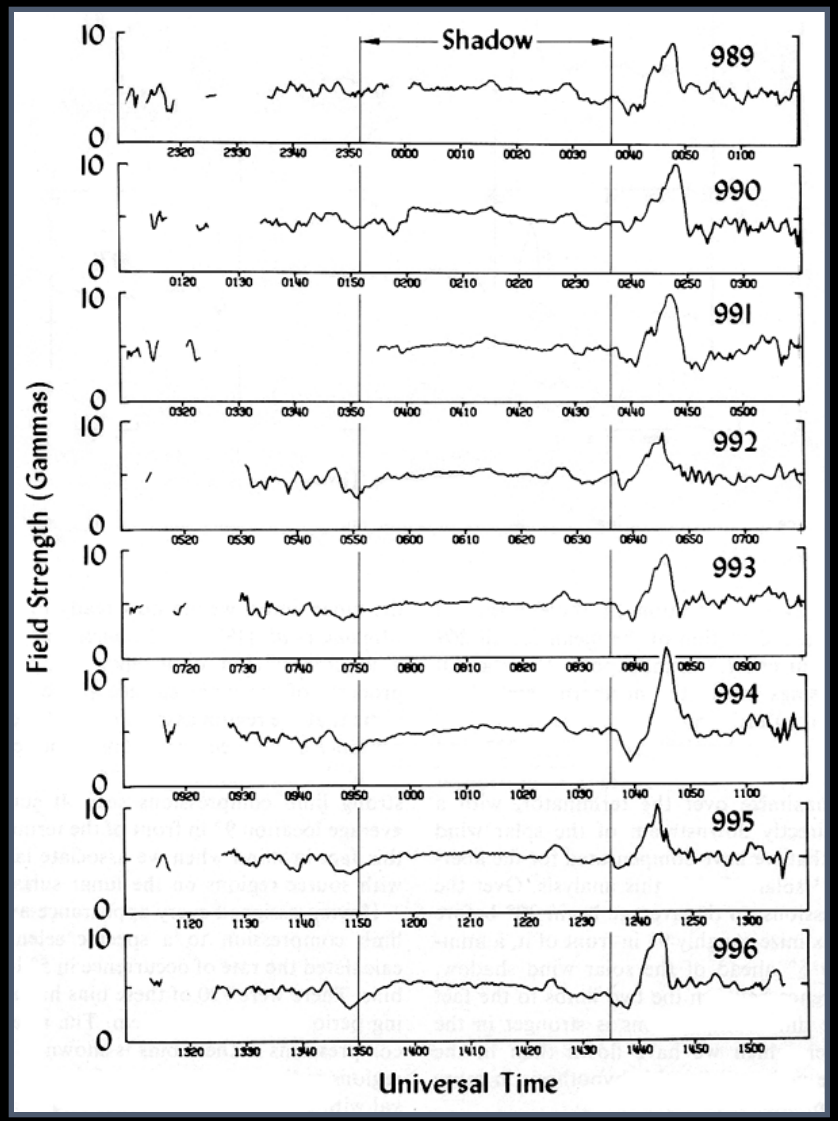

Blewett et al., 2011

Thanks to LROC Team (Images from Lunaserv)

# Reflection Zone Context

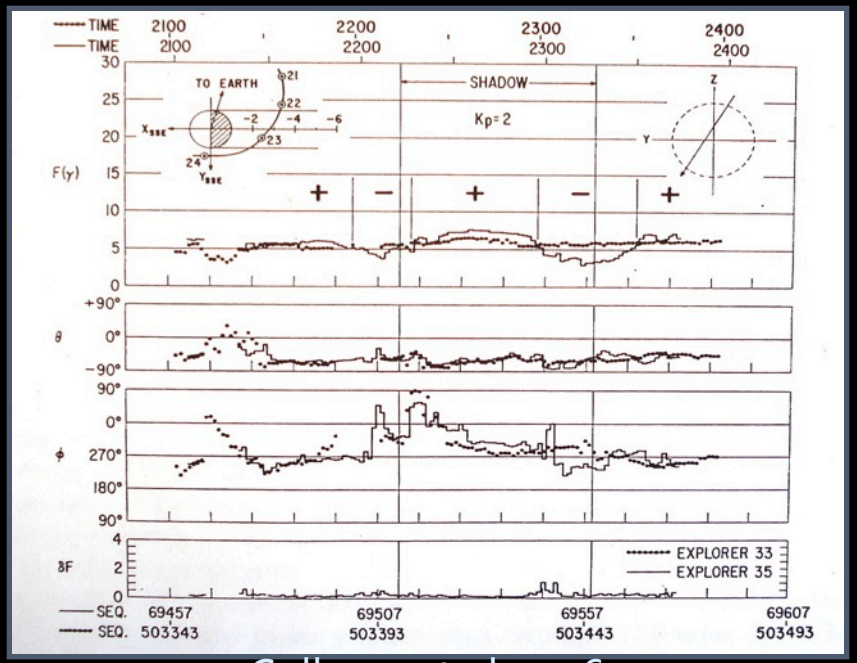


# Small-Scale Shocks at the Moon



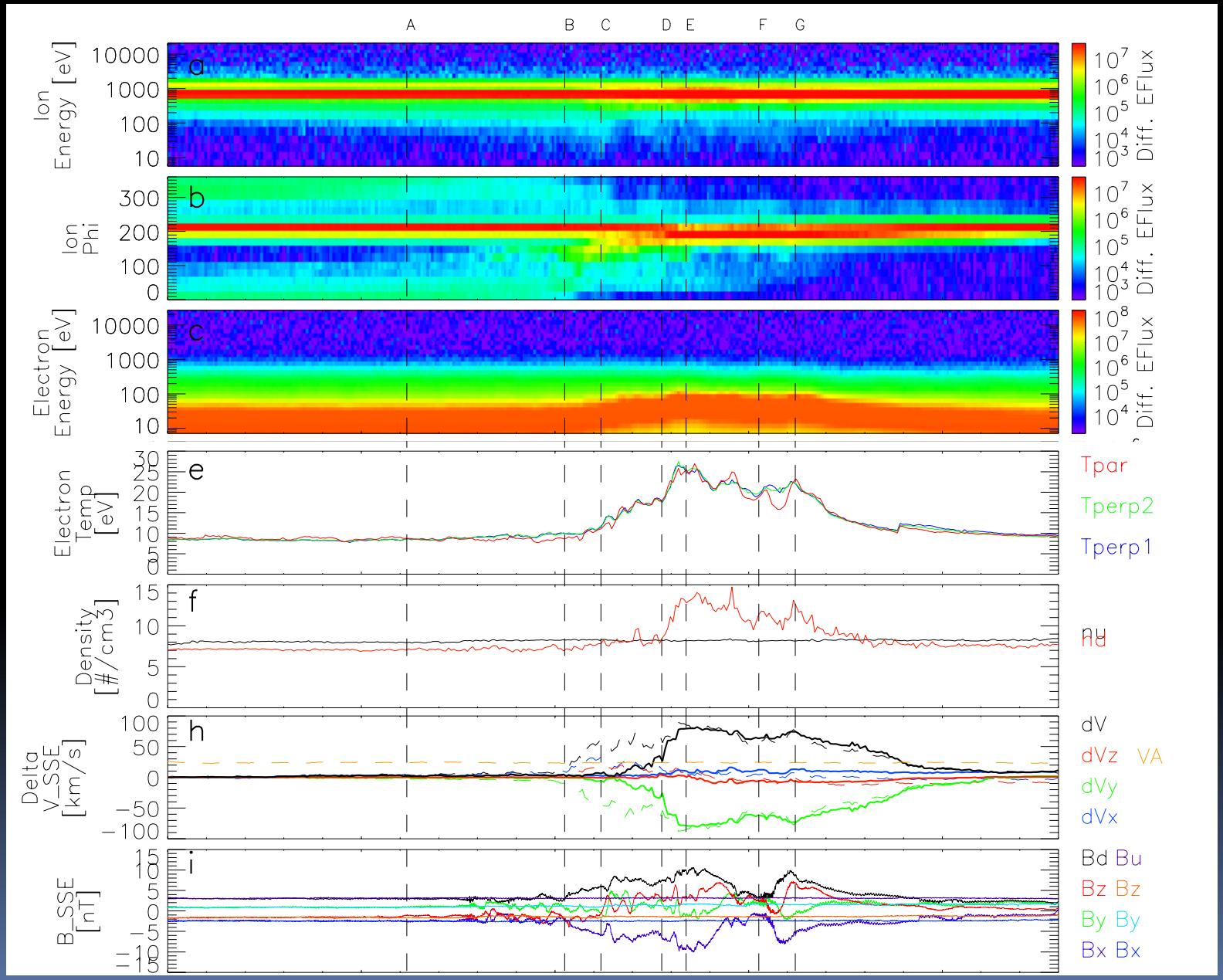

Russell and Lichtenstein, 1975

"there is no evidence that the plasma is shocked on passage through the features"
[Russell and Lichtenstein, 1975]

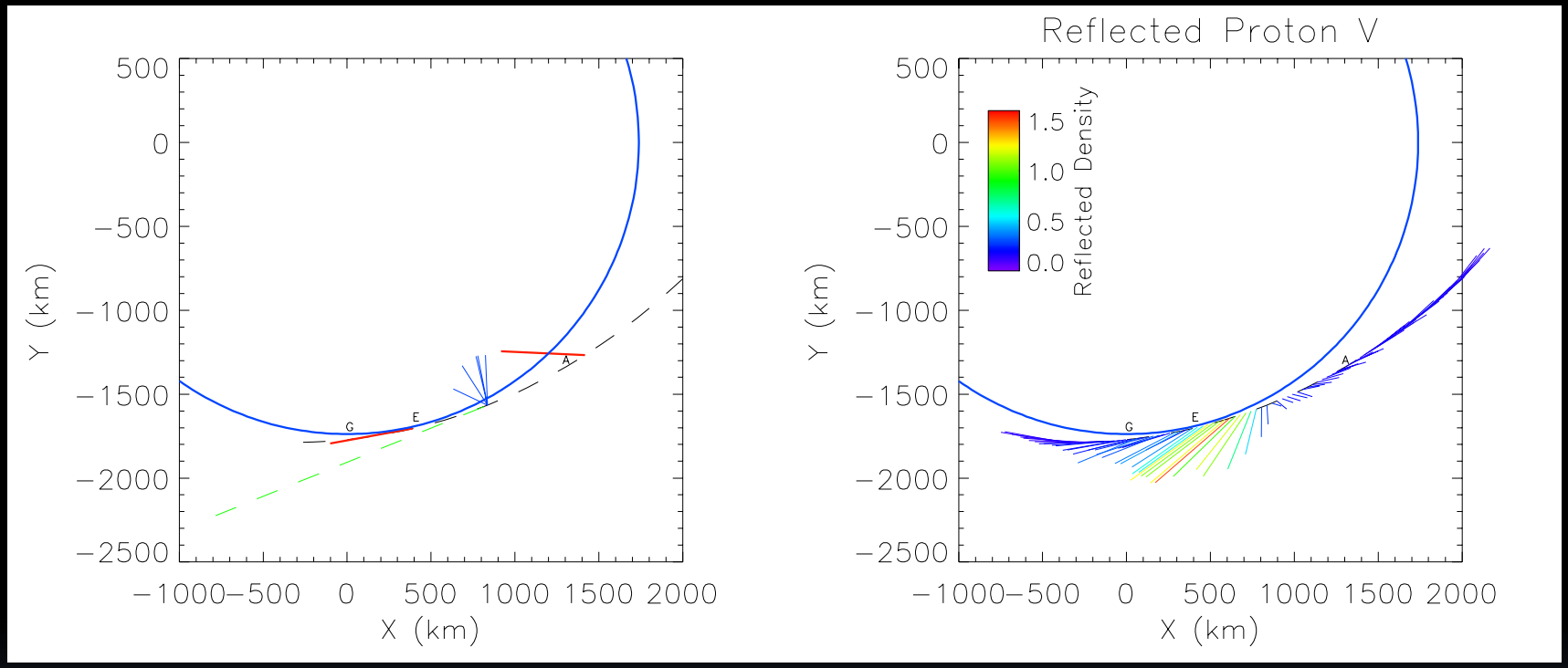



Colburn et al., 1967

# Shock Signatures

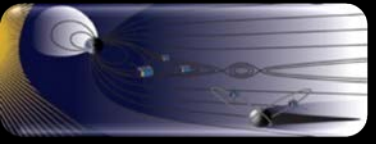


# Shock Geometry




$\Delta V$ = 75 km/s, $V_N$ drops from 135 km/s to 60 km/s

$V_A$ = 25 km/s, $V_{MS}$ = 45 km/s, $V_{SW}$ = 360 km/s



# Conclusions

- ARTEMIS Observations Allow us to Investigate:
  - The interaction of the solar wind with the lunar regolith
  - The impact of reflected protons from the Moon on the plasma environment