

Epsilons: we need more theories

Chris Steyaert
steyaert@vvs.be

One year ago

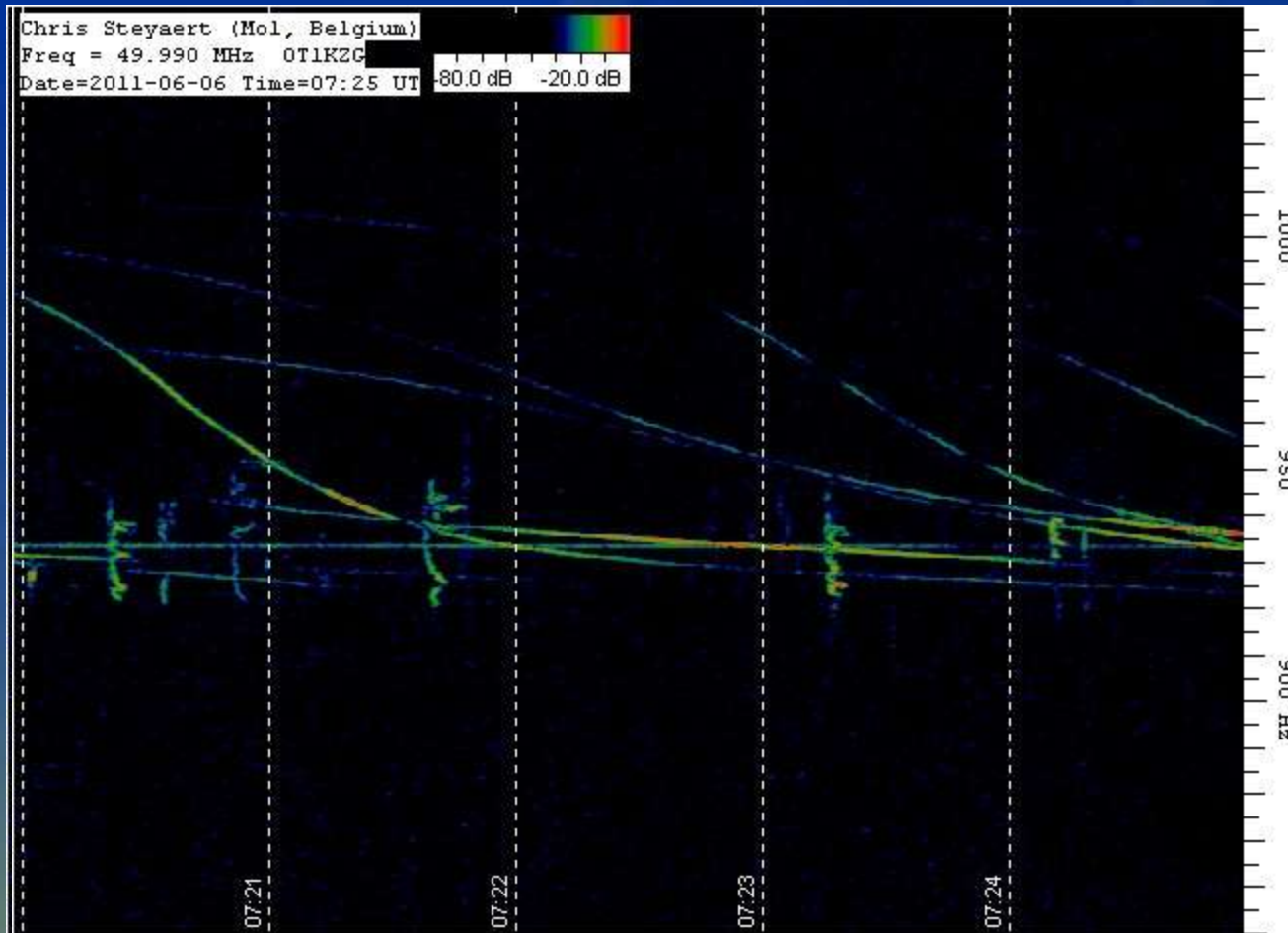
The conclusion is ...

Ve need morr' theorries !!

Нам надо больше теории



Typical radio spectrogram



- Carrier
- underdense meteors
- Planes
- ϵ

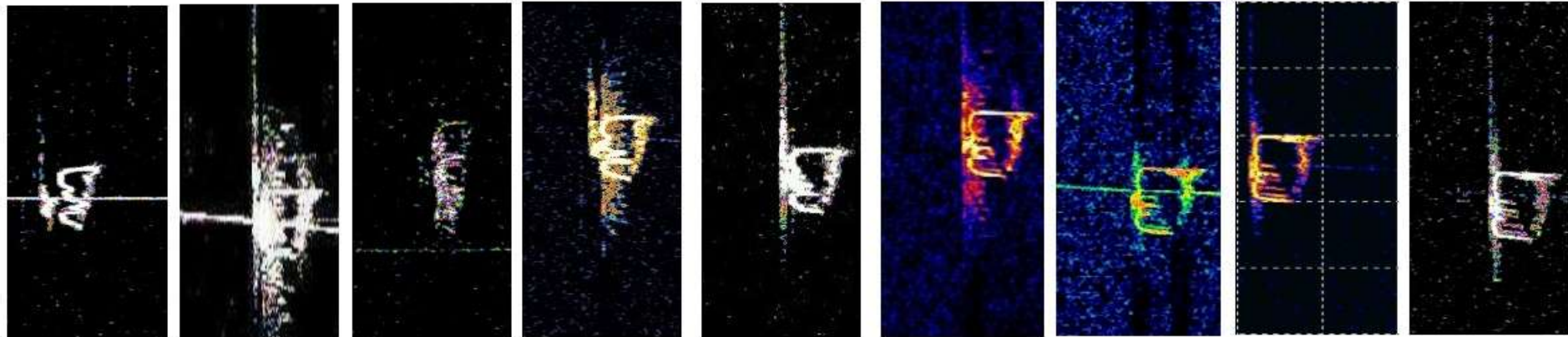
Simultaneous observations

- VWS beacon observers



Simultaneous epsilons

49.99 MHz - 200912050427



Johan
Harelbeke

Roger
Puurs

Roland
Halle

Janos
Zaventem

Felix
Kampenhout

Willy
Tessengerlo

Chris
Mol

Gaspard
Dessel

Lucas
Overpelt

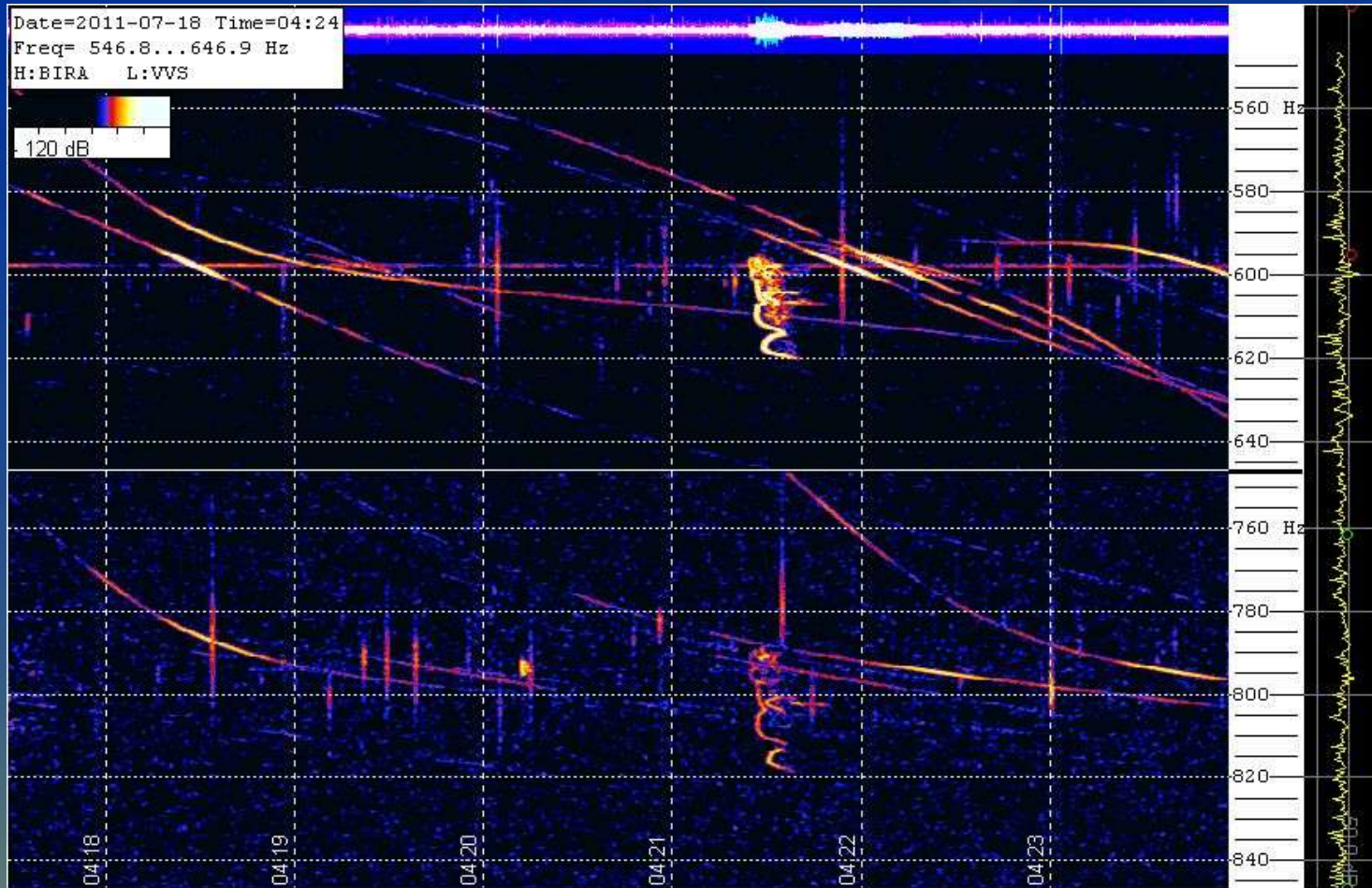
One transmitter, several receivers

Simultaneous observations



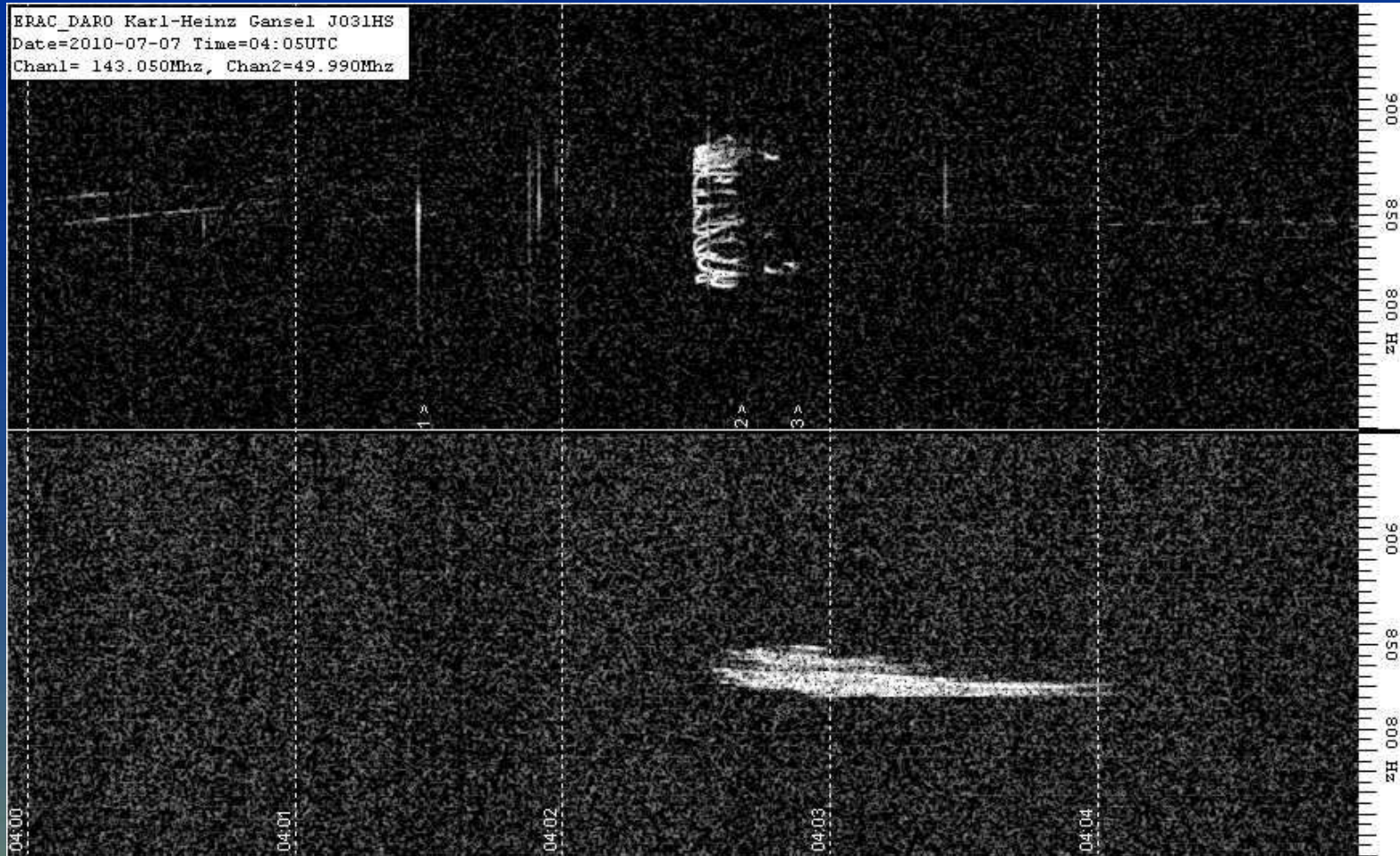
Two beacons

Simultaneous epsilons



Two transmitters, one receiver (synchronised)

Simultaneous epsilons



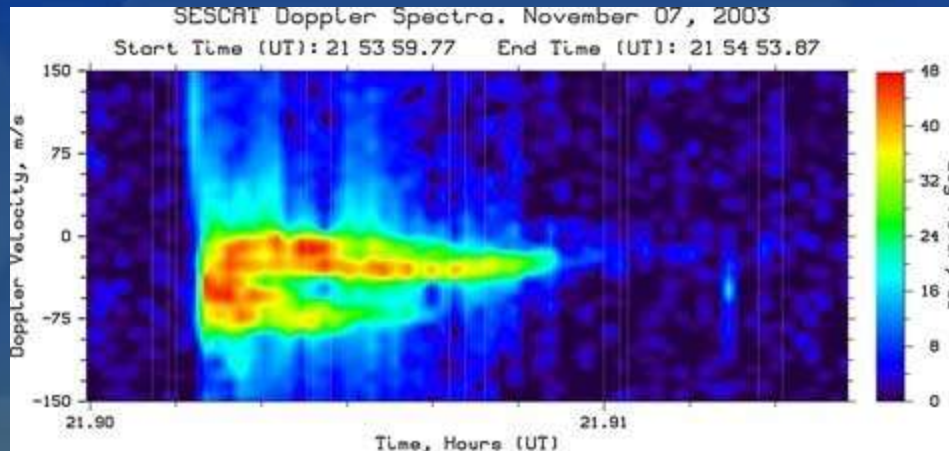
Two transmitters, one receiver (synchronised)

Small epsilons



Professional reference

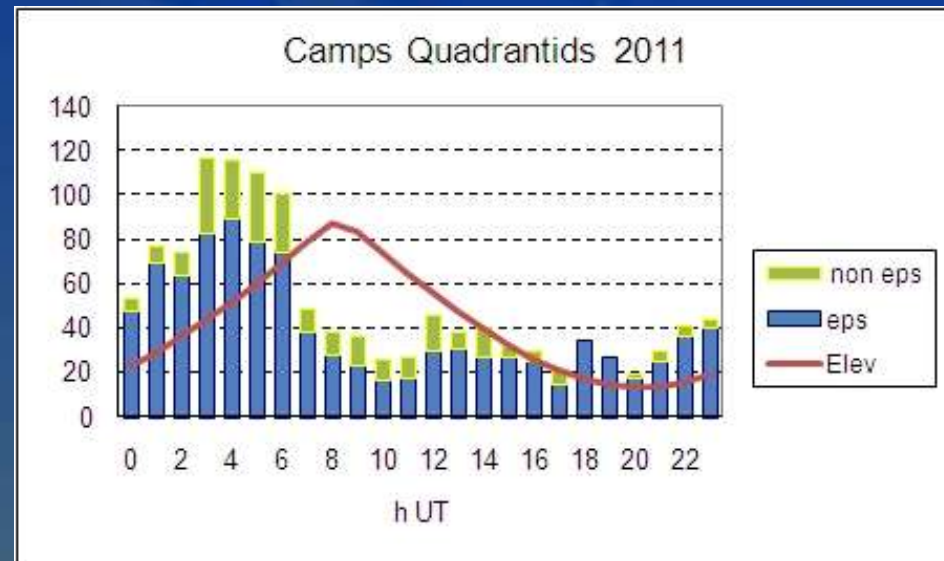
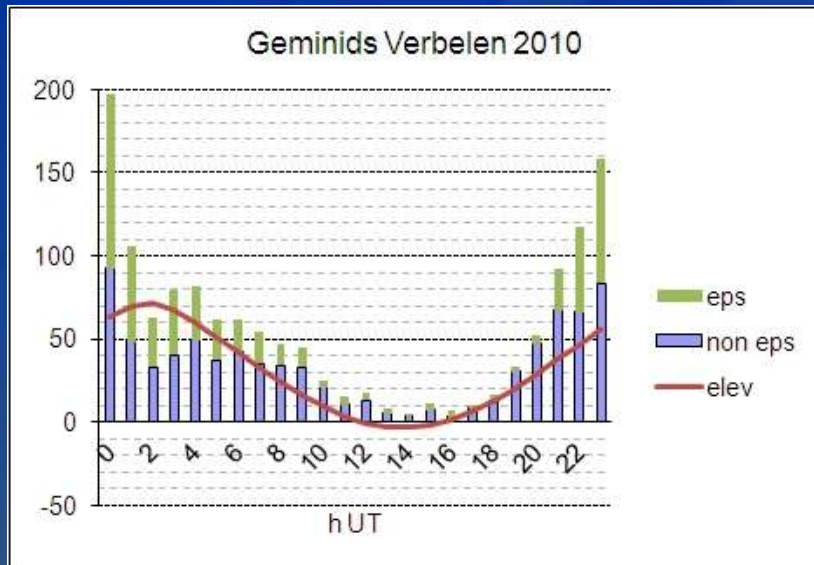
Long duration meteor echoes characterized by Doppler spectrum
Bifurcation A. Bourdillon, C. Haldoupis, C. Hanuise, Y. Le Roux,
and J. Menard March 2005



4. Discussion and Speculation

But why these fragmented meteor trails last so long? There is no easy answer to this question, as long duration meteors have remained a mystery for many years.

Statistical data



Epsilons at the time of high radiant elevation

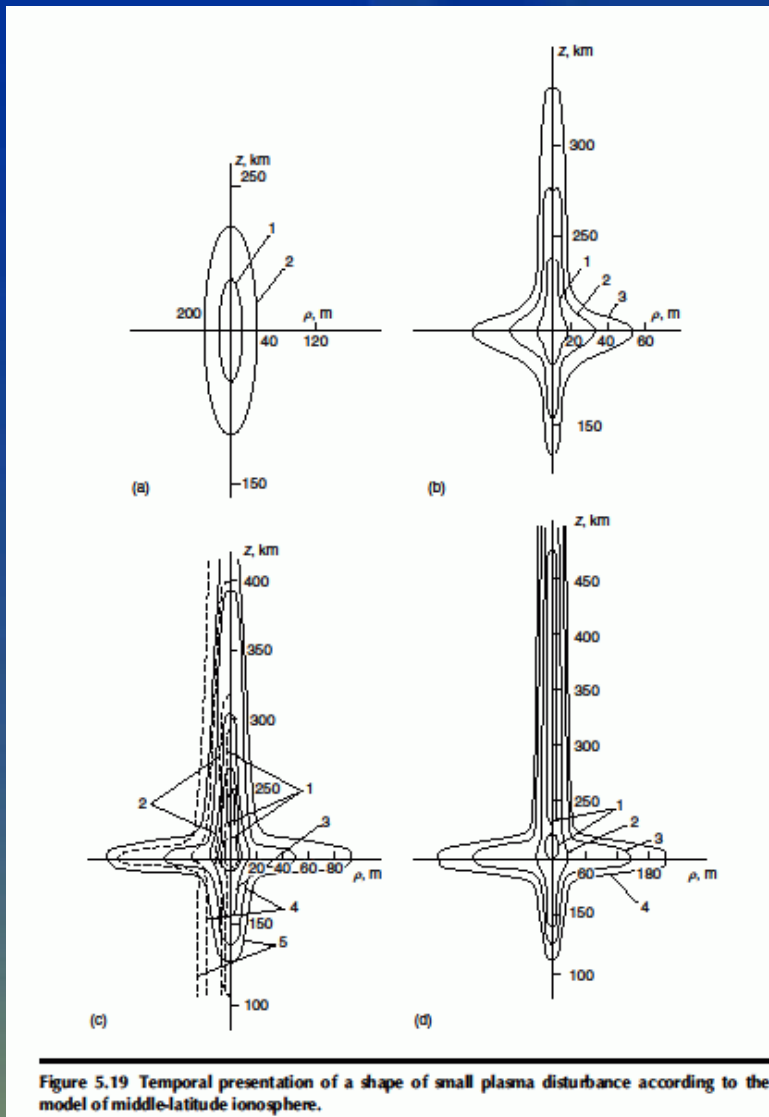
Ray tracing

POV-RAY [Persistence of Vision Raytracer](#)

cylinder

only part of trail
contributes

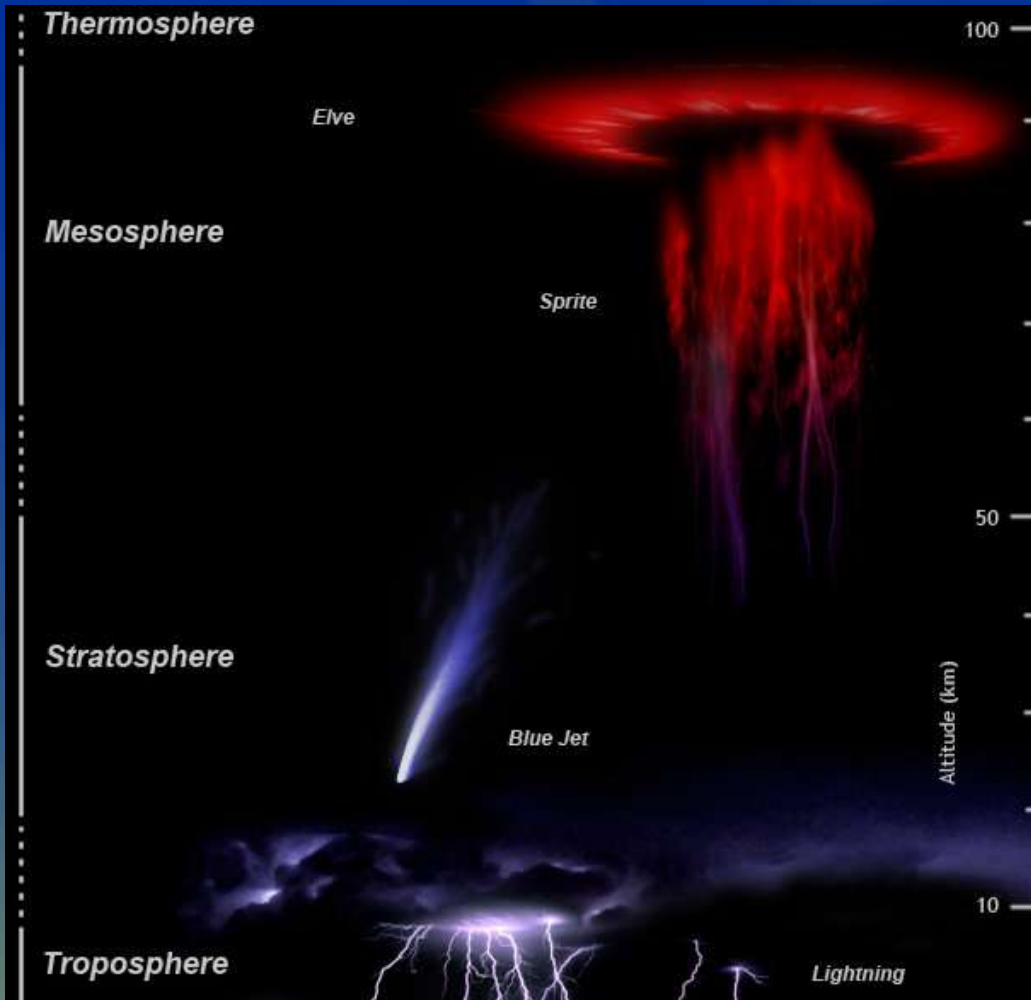
Upper atmosphere phenomena



Ionosphere and Applied
Aspects of Radio
Communication and Radar
- N. Blaunstein, E.
Plohotniuc (CRC, 2008)

$t = 0, 5, 40, 100 \text{ s}$

Upper atmosphere phenomena

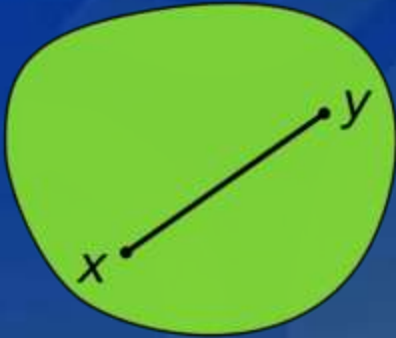


ELVE = **E**mission of **L**ight
and **V**ery low-frequency
perturbations from
Electromagnetic pulse
sources

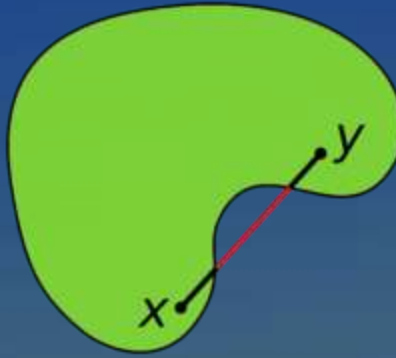
discovered 1989
lasting ms to couple of s

More ray tracing

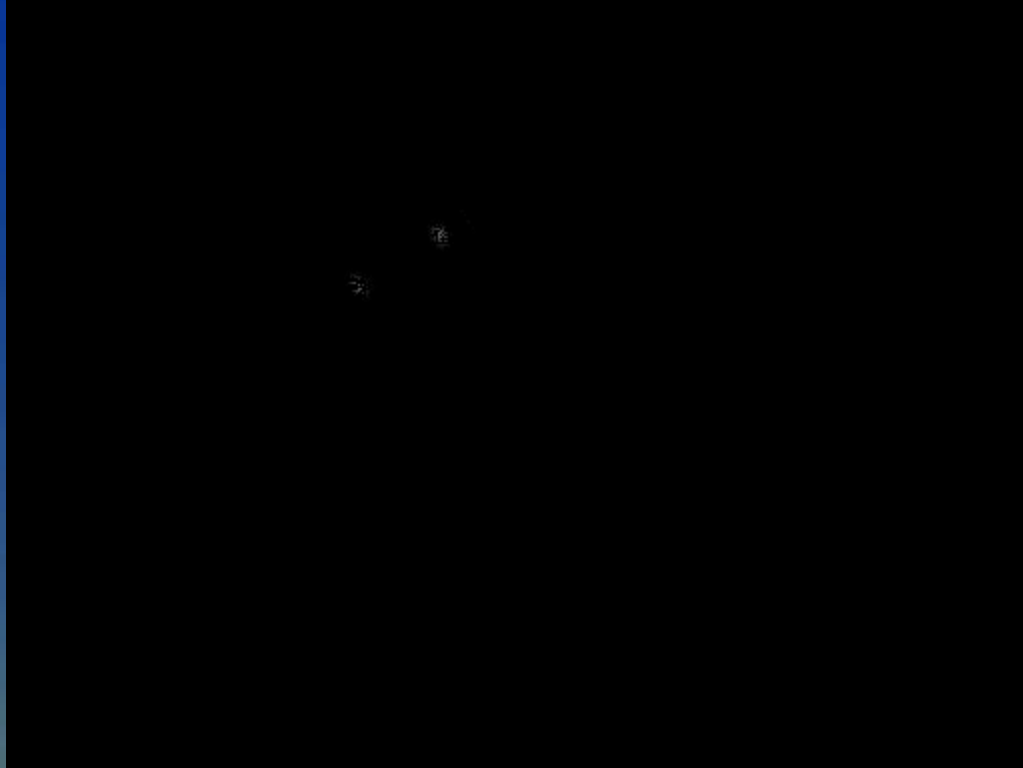
Convex



Concave

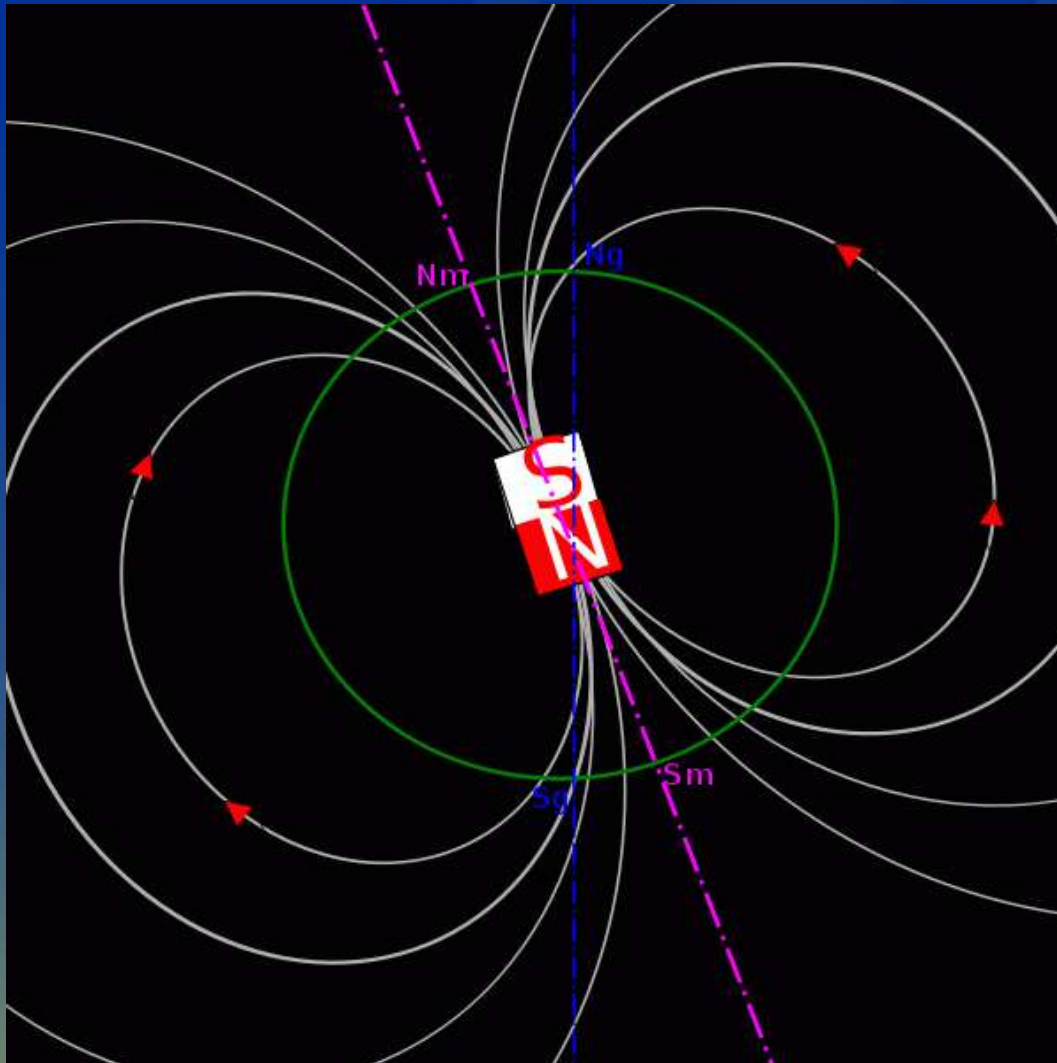


More ray tracing



Torus: 4 reflection points

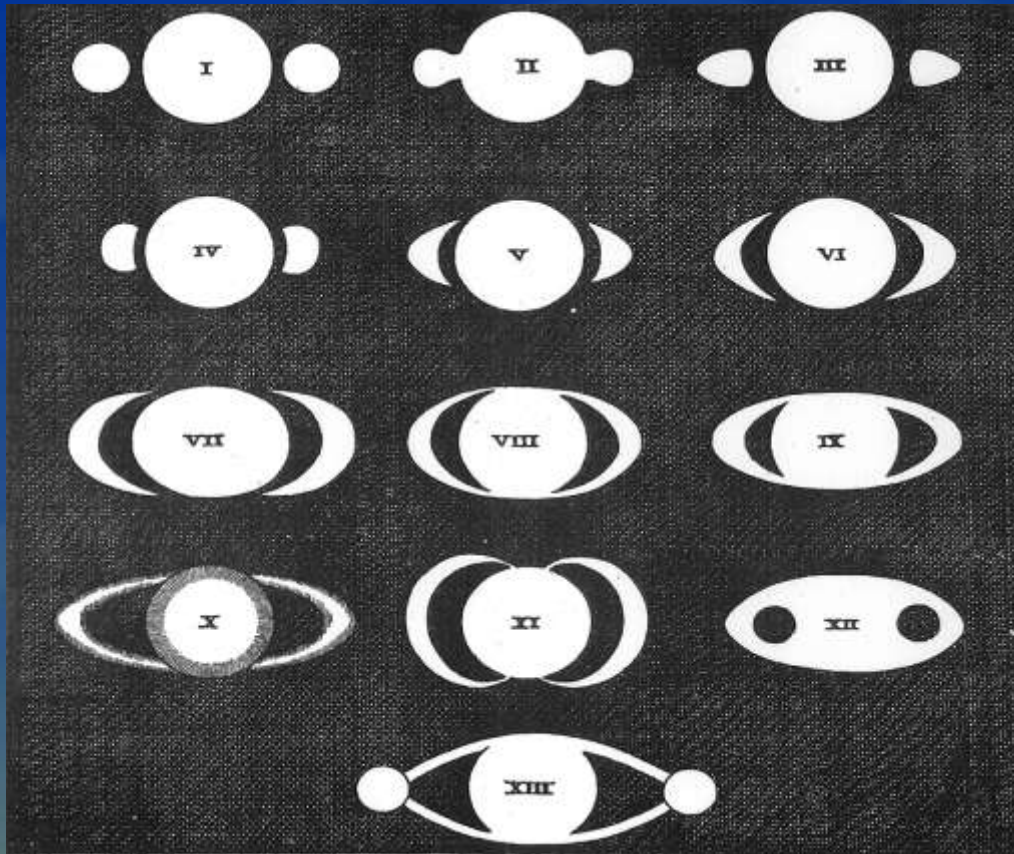
Geomagnetism



Magnetic inclination 66°
(Western Europe)

Reflection duration
enhancement when trail
aligned with \mathbf{B}_0

Present status



Huygens' Saturn observations

Thanks to

- Jean-Louis Rault
- David Entwistle
- Willy Camps
- Felix Verbelen
- Gaspard De Wilde
- Astrolab IRIS, Zillebeke
- VVS
- BIRA IASB Belgium