万物は因縁より生ずる

釈尊

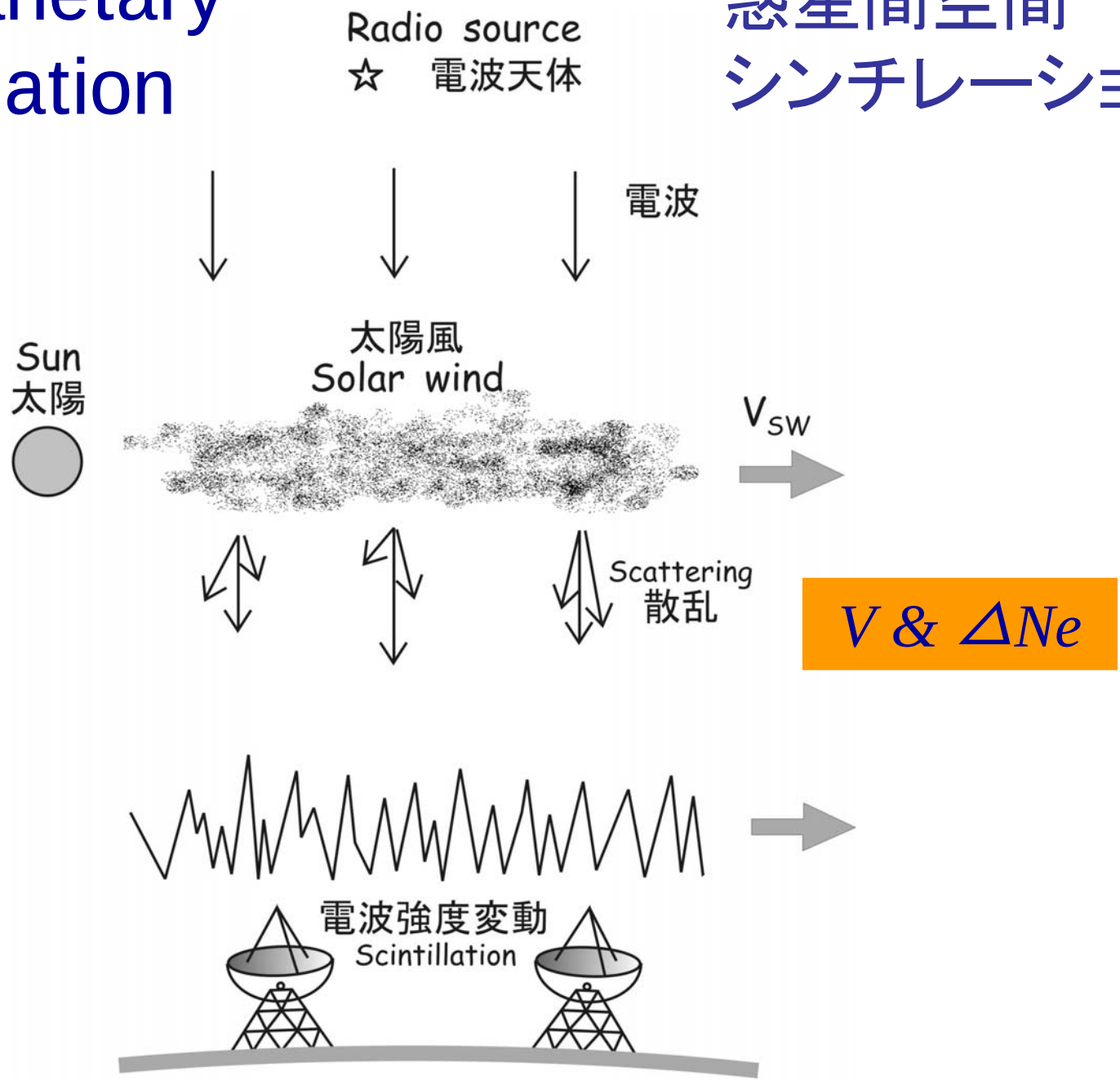
ロードマップは、科学の進展に役立つか

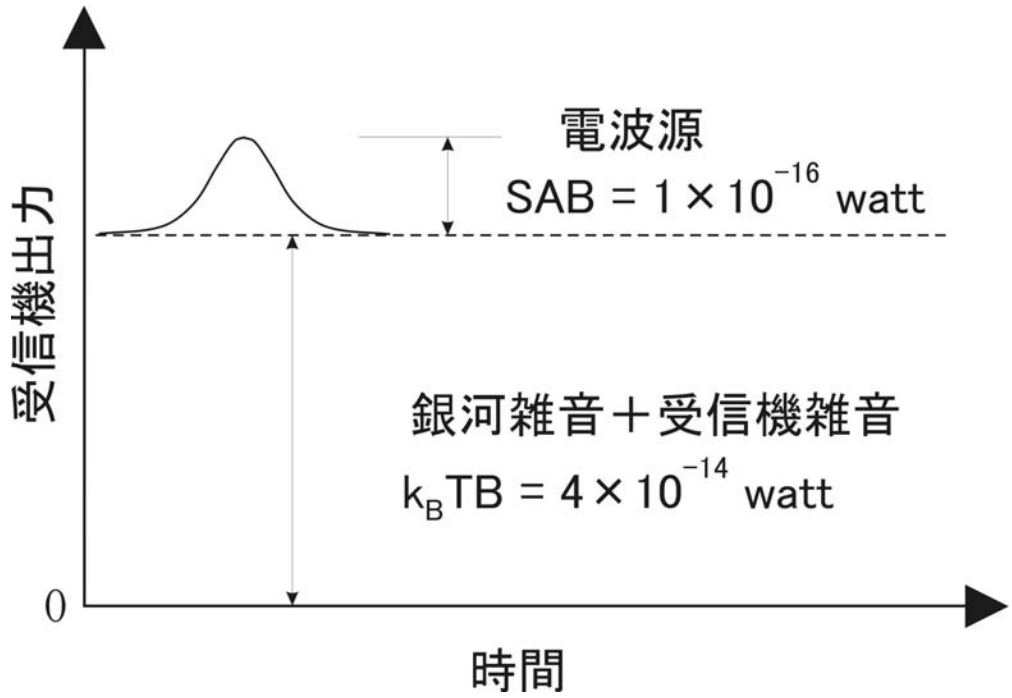
名古屋大学太陽地球環境研究所
小島正宜

2008年3月19日

Interplanetary Scintillation

惑星間空間シンチレーション





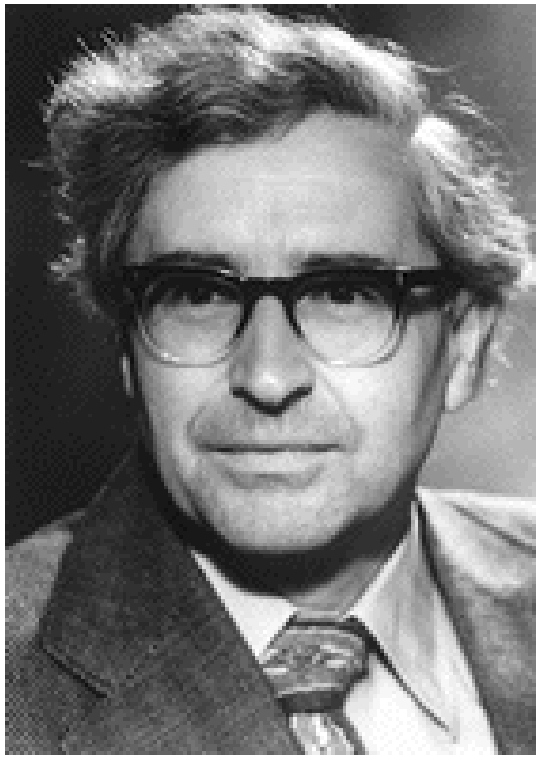
●Compact radio source → 微弱電波 → その揺らぎ

　＝ 惑星間空間シンチレーション → 大口径電波望遠鏡

●惑星間空間シンチレーション → 早い変動 τ<1sec を観測できる受信機

1964

interplanetary scintillation discovery

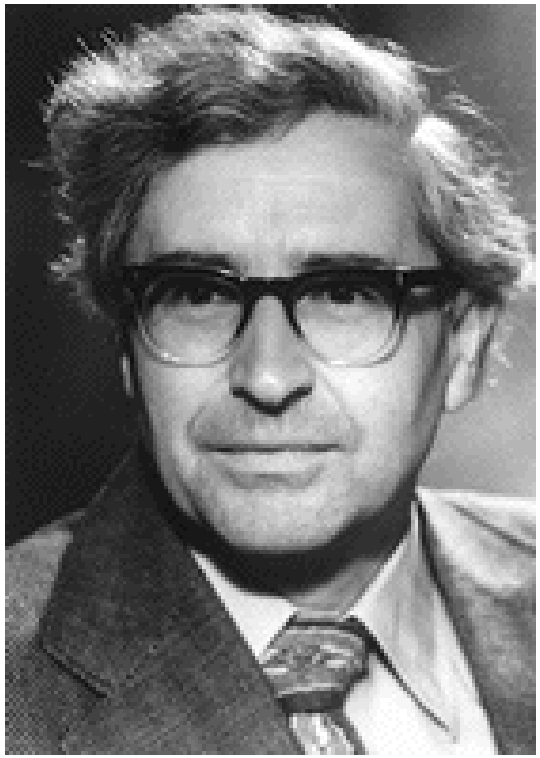


Antony Hewish


36,000m2 81.5 MHz

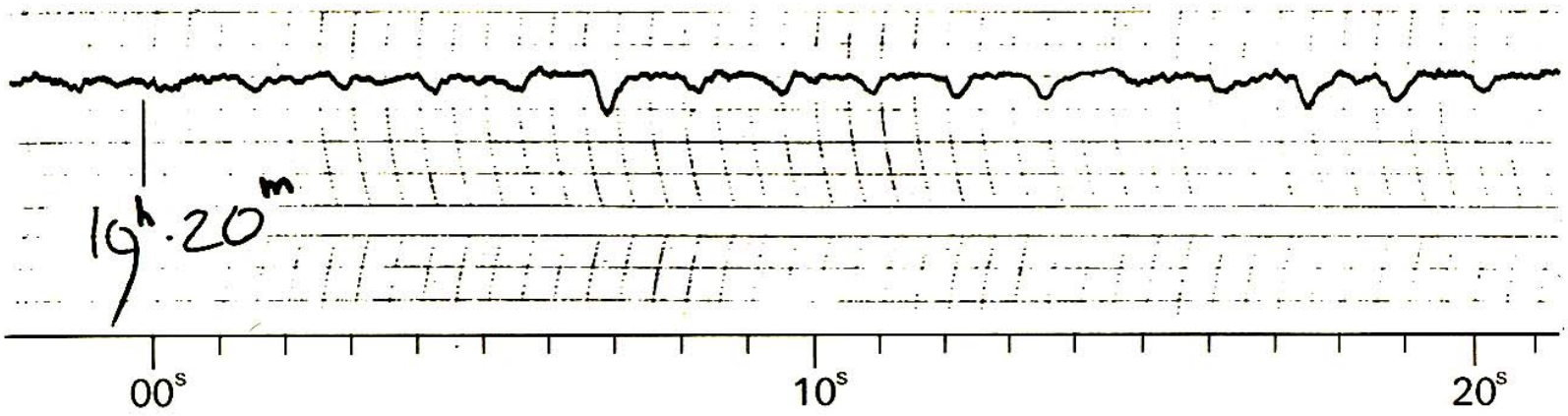
1964

interplanetary scintillation discovery



Antony Hewish

ノーベル賞1974年
電波天文学における先駆的研究
（パルサーの発見に果たした決定的な役割）



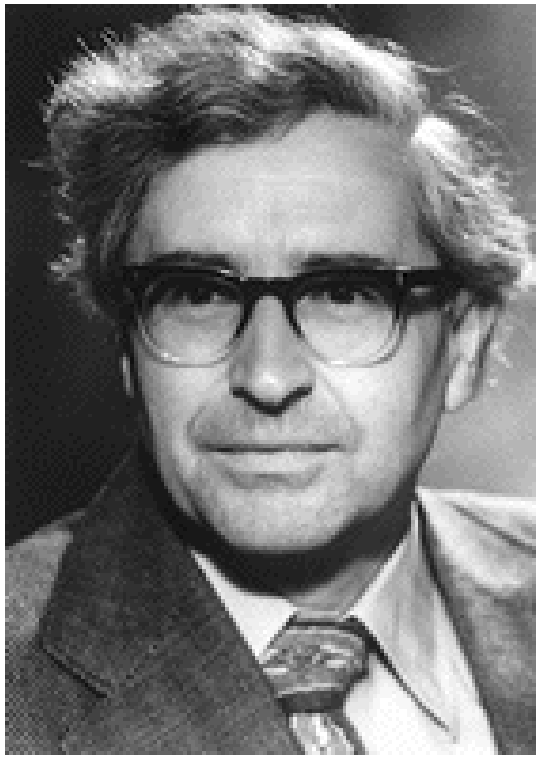
1-2 The first chart record of individual pulses from a pulsar, PSR 1919+21, recorded on November 28, 1967. Increasing intensity is downwards on the chart. [From Hewish, 1975. Copyright American Association for the Advancement of Science.

The Discovery of Pulsars

One of the most remarkable astronomical discoveries in recent memory was the detection in late 1967 of the clocklike radio pulses emitted by objects that have come to be called pulsars. The discovery was made by Jocelyn Bell and Antony Hewish at Cambridge University, and it came about as a direct (but unexpected) result of putting into operation a large radio telescope array designed to study the interplanetary scintillation of compact radio sources. The telescope is a rectangular array containing

43yrs from

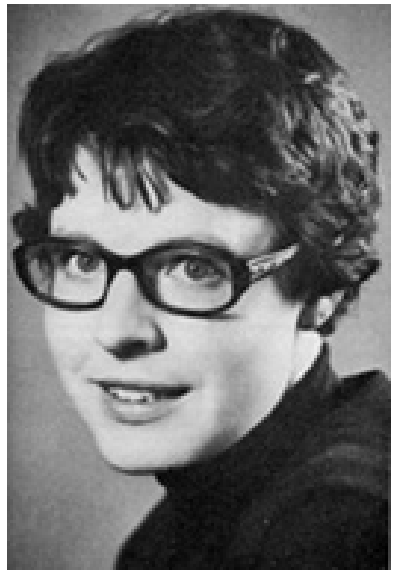
interplanetary scintillation discovery



Antony Hewish

ノーベル賞1974年
電波天文学における先駆的研究
（パルサーの発見に果たした決定的な役割）

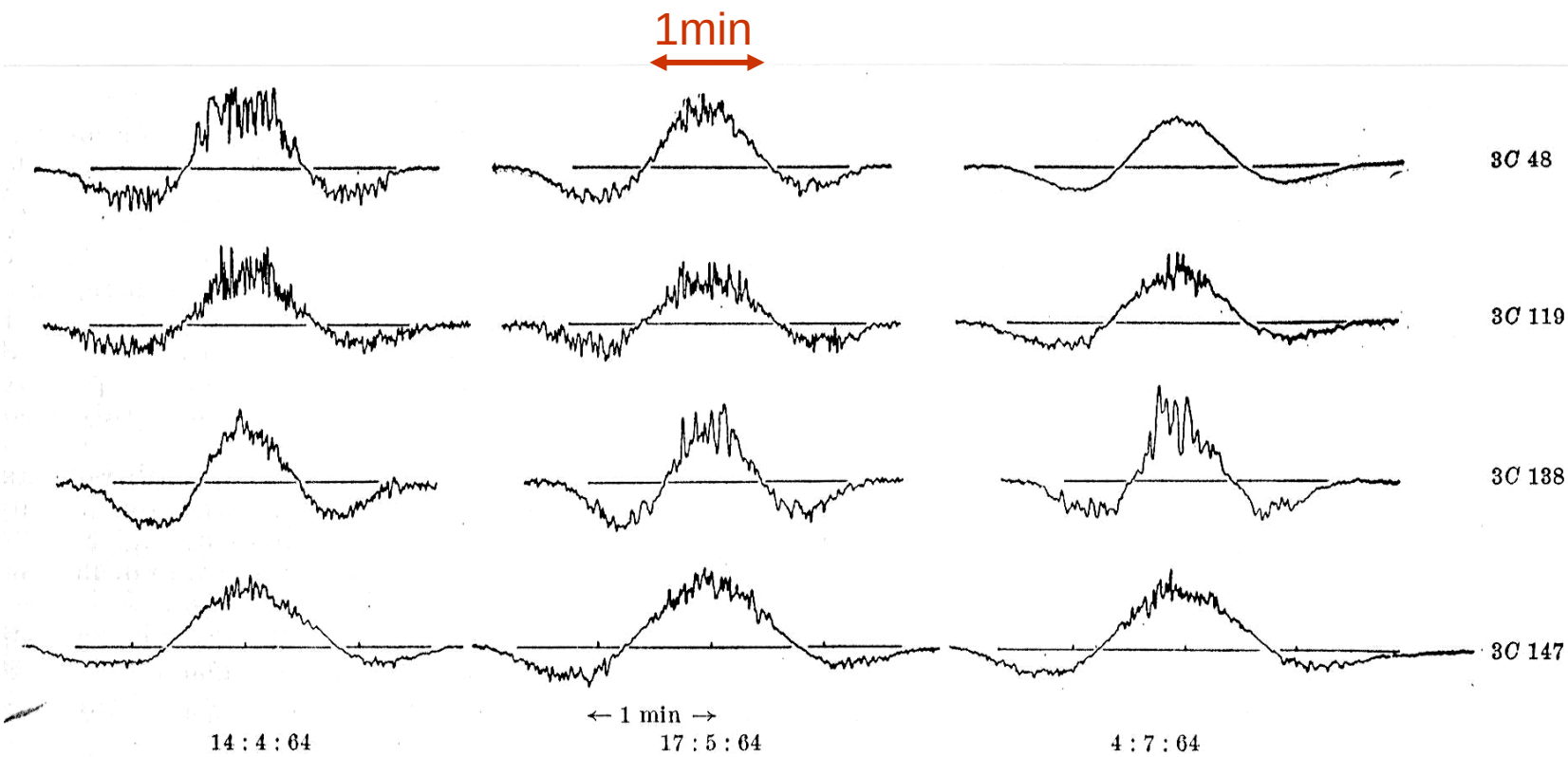
Jocelyn Bell



NATURE September 19, 1964

INTERPLANETARY SCINTILLATION OF SMALL DIAMETER RADIO SOURCES

By Dr. A. HEWISH, Dr. P. F. SCOTT and D. WILLS
Mullard Radio Astronomy Observatory, Cavendish Laboratory, Cambridge



NATURE September 19, 1964

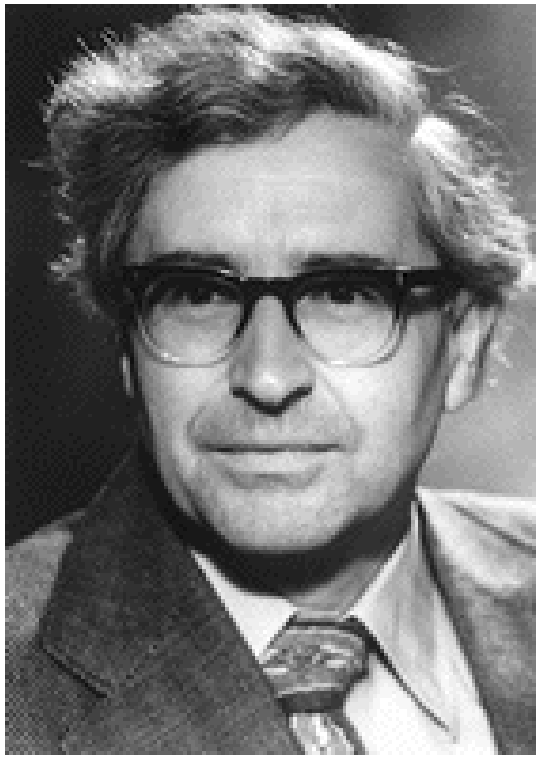
INTERPLANETARY SCINTILLATION OF SMALL DIAMETER RADIO SOURCES

By Dr. A. HEWISH, Dr. P. F. SCOTT and D. WILLS
Mullard Radio Astronomy Observatory, Cavendish Laboratory, Cambridge

DURING a series of observations at a frequency of 178 Mc/s carried out in June 1962 and July 1963 (ref. 1) unusual fluctuations of intensity were noticed when recording the sources 3*C* 119, 3*C* 138 and 3*C* 147. The measurements were being made in order to derive accurate positions for a number of radio sources and entailed repeated transit observations using the large 178 Mc/s interferometer at Cambridge. For several days in succession these three sources, and in particular 3*C* 138, gave an irregular record akin to severe ionospheric scintillation, while about 85 others did not. We thank Margaret Clarke for pointing this out and also for noting that 3*C* 119 and 3*C* 147 were known to have exceedingly small angular diameters.

43yrs from

interplanetary scintillation discovery



Antony Hewish

ノーベル賞1974年
電波天文学における先駆的研究
（パルサーの発見に果たした決定的な役割）

Jocelyn Bell

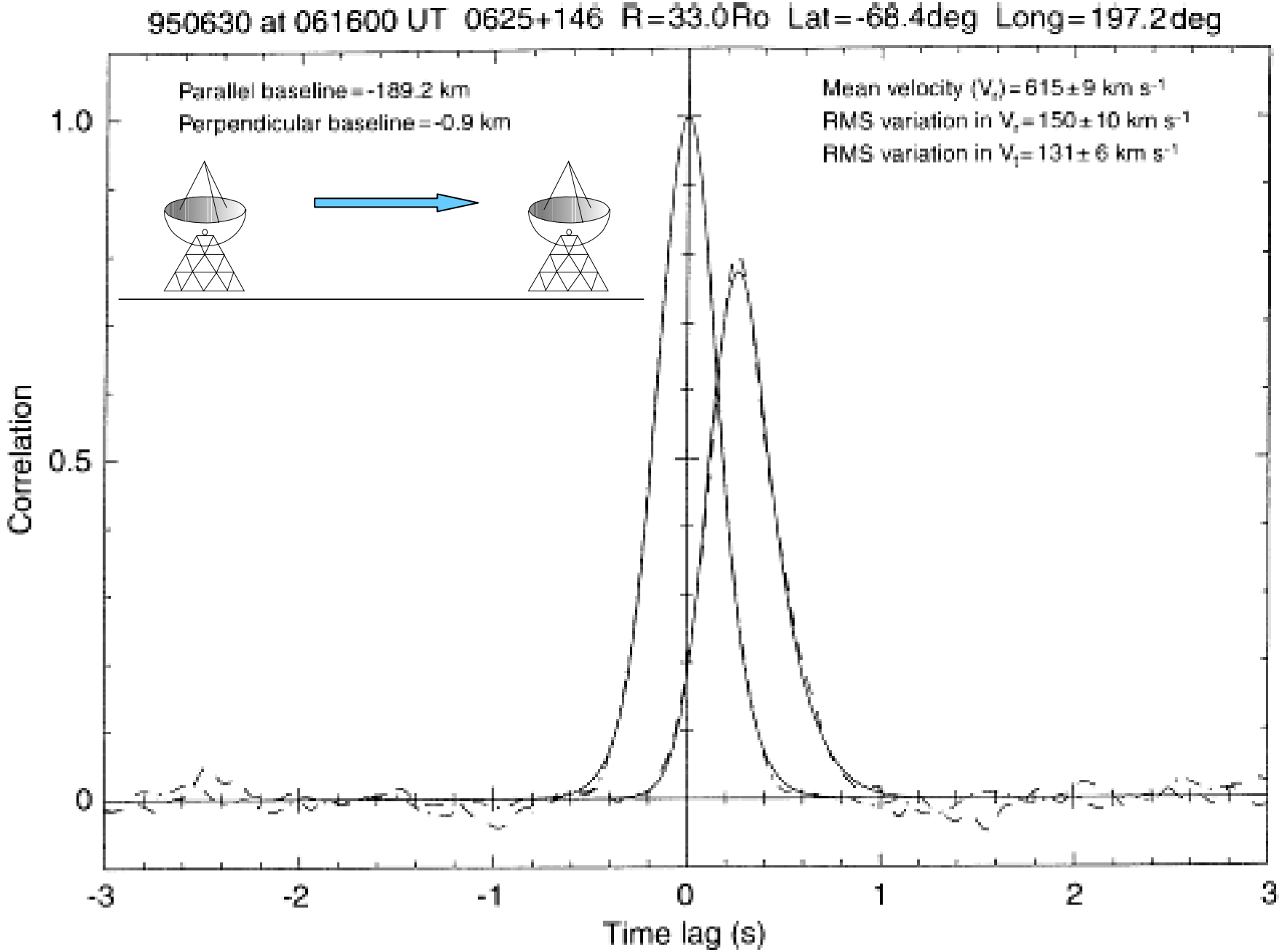
Margaret Clarke

そしてIPS発見から 5年後

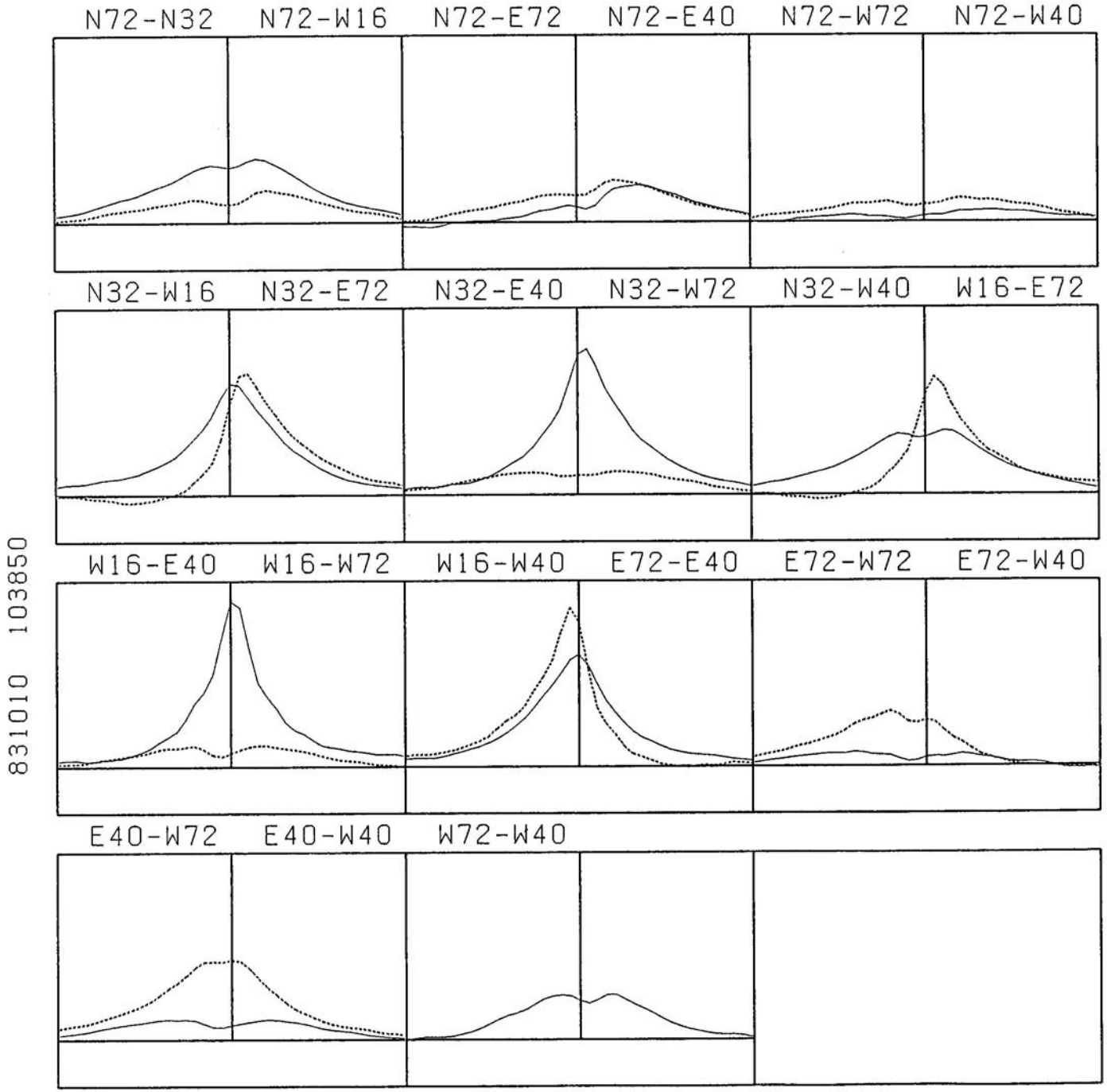
空電研究所にてIPS観測の開始

Very Large Array

Very Large Array



After Breen et al., 1996


N72-N32
N72-W16
N72-E72
N72-E40
N72-W72
N72-W40
N32-W16
N32-E72
N32-E40
N32-W72
N32-W40
W16-E72
W16-E40
W16-W72
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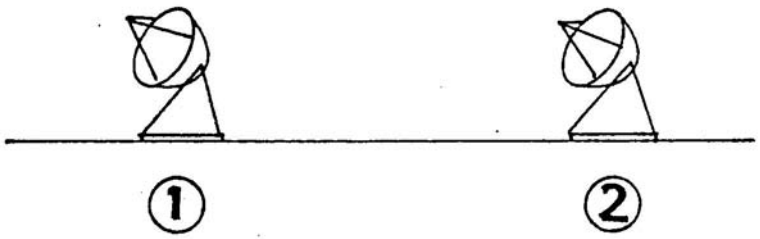
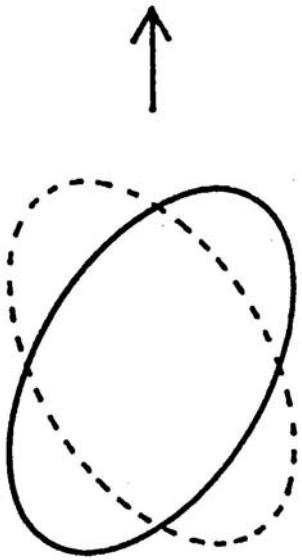
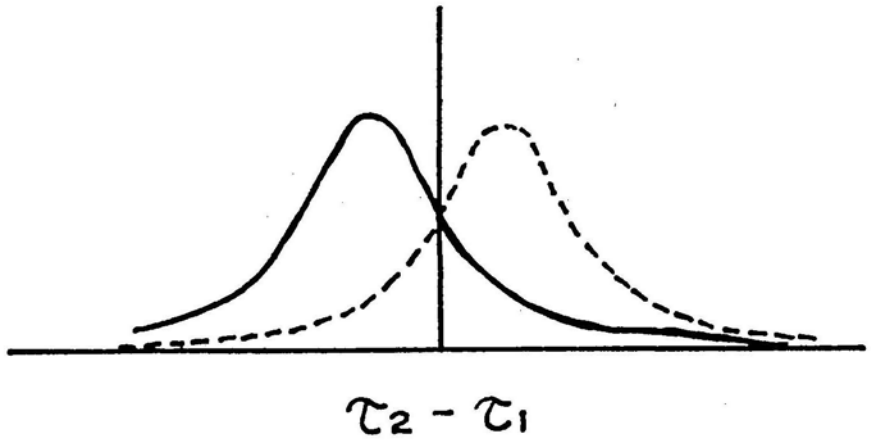
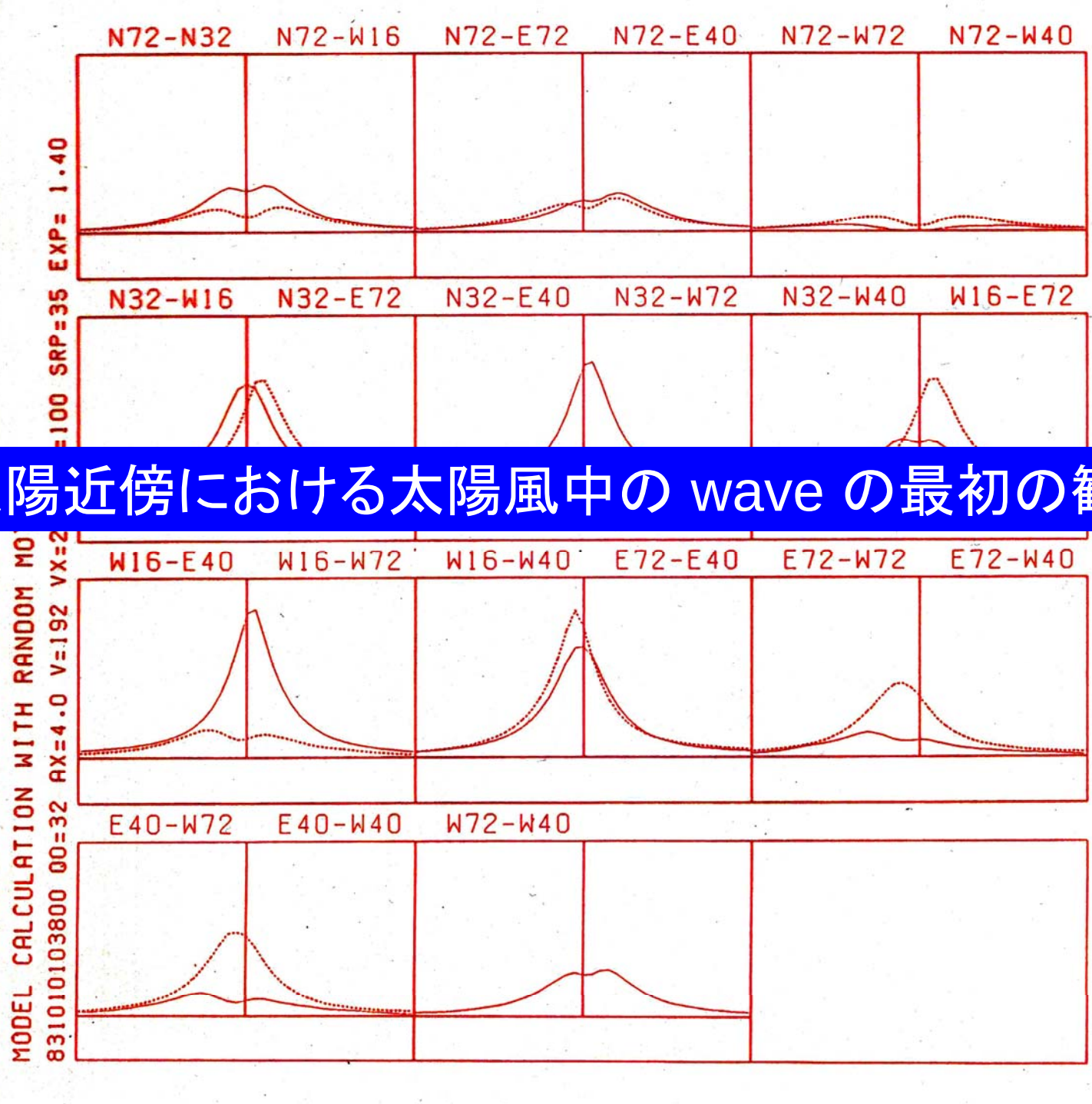
E40-W72
E40-W40
W72-W40
831010 103850

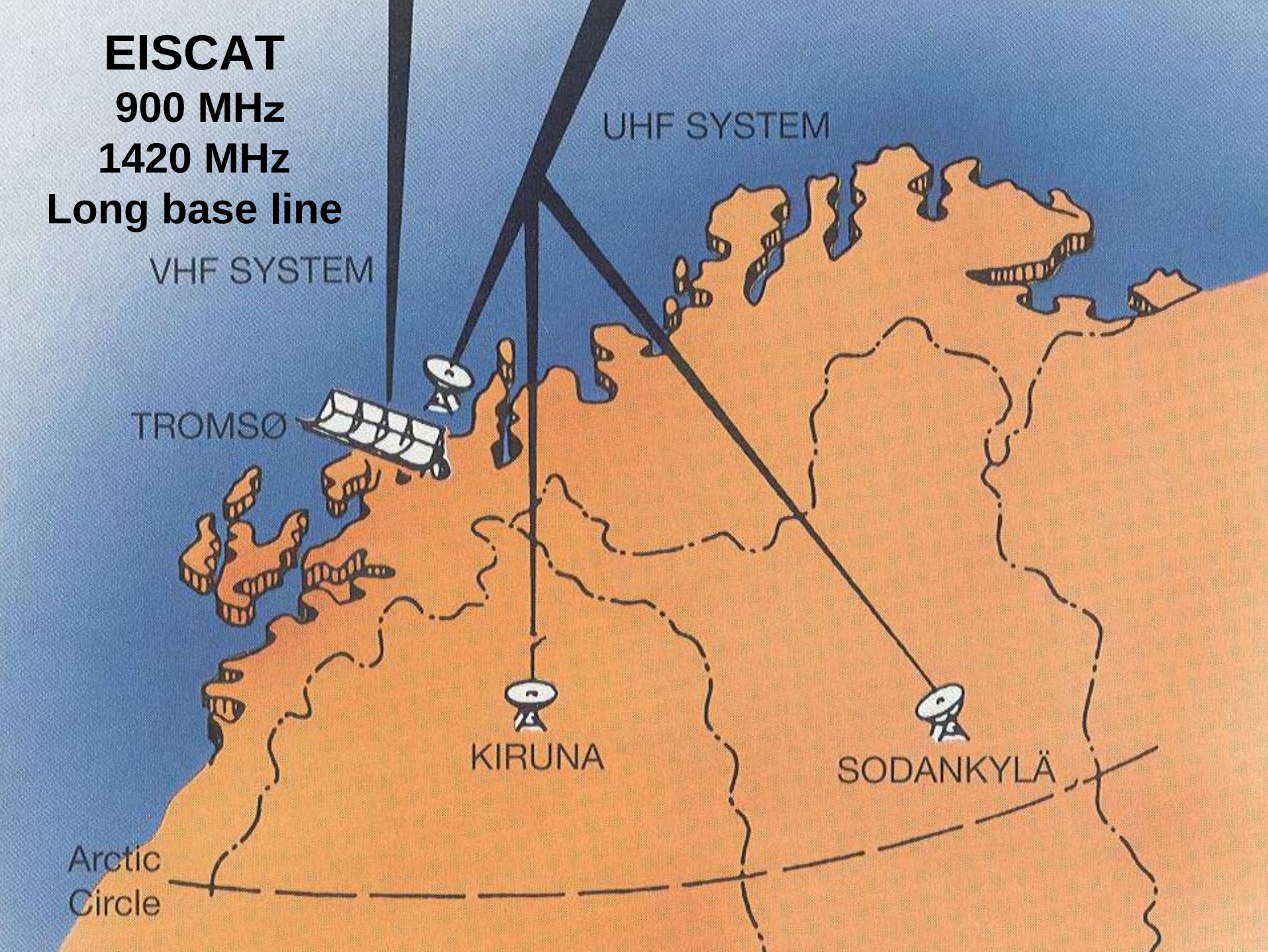

①
②

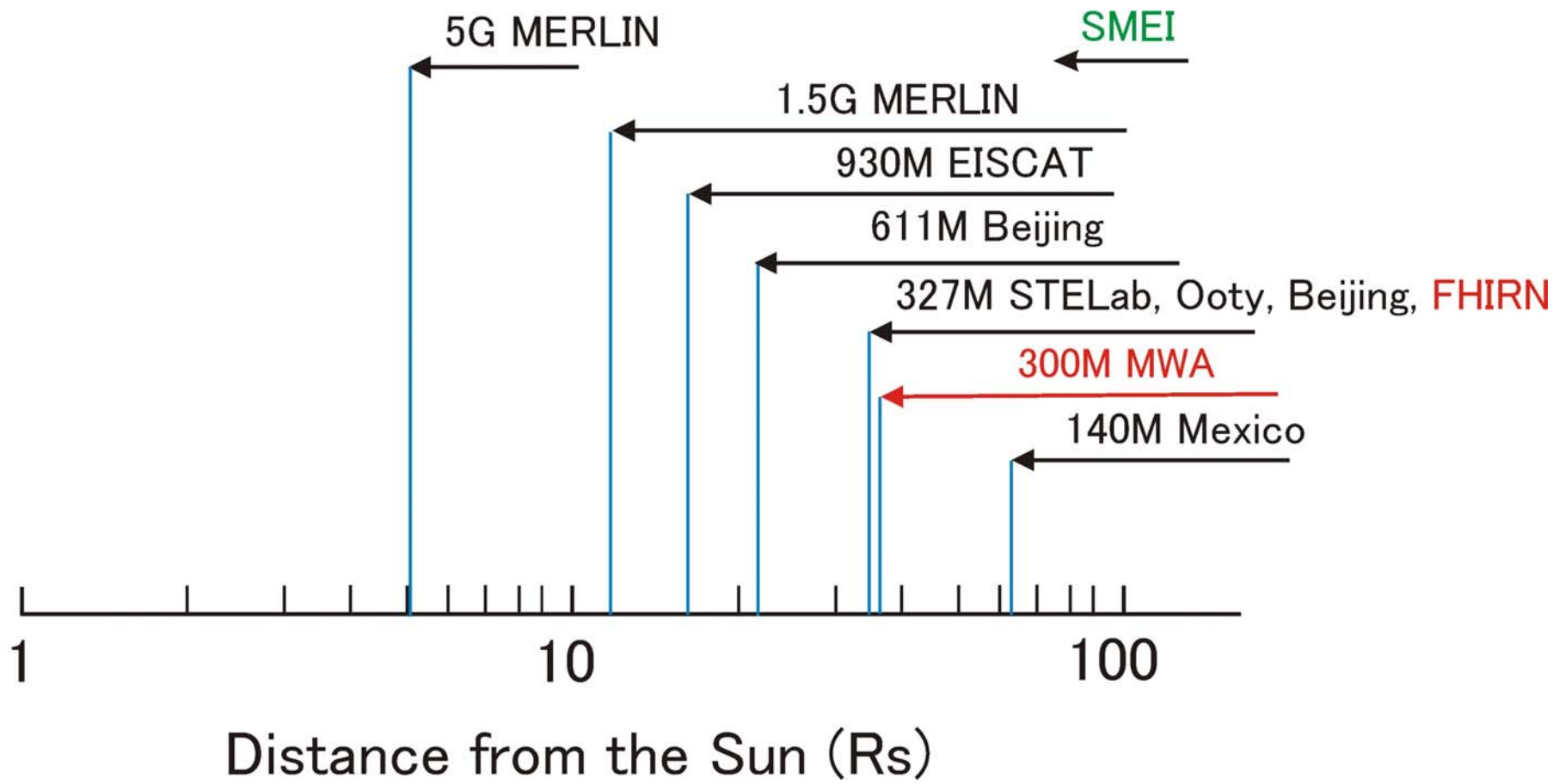


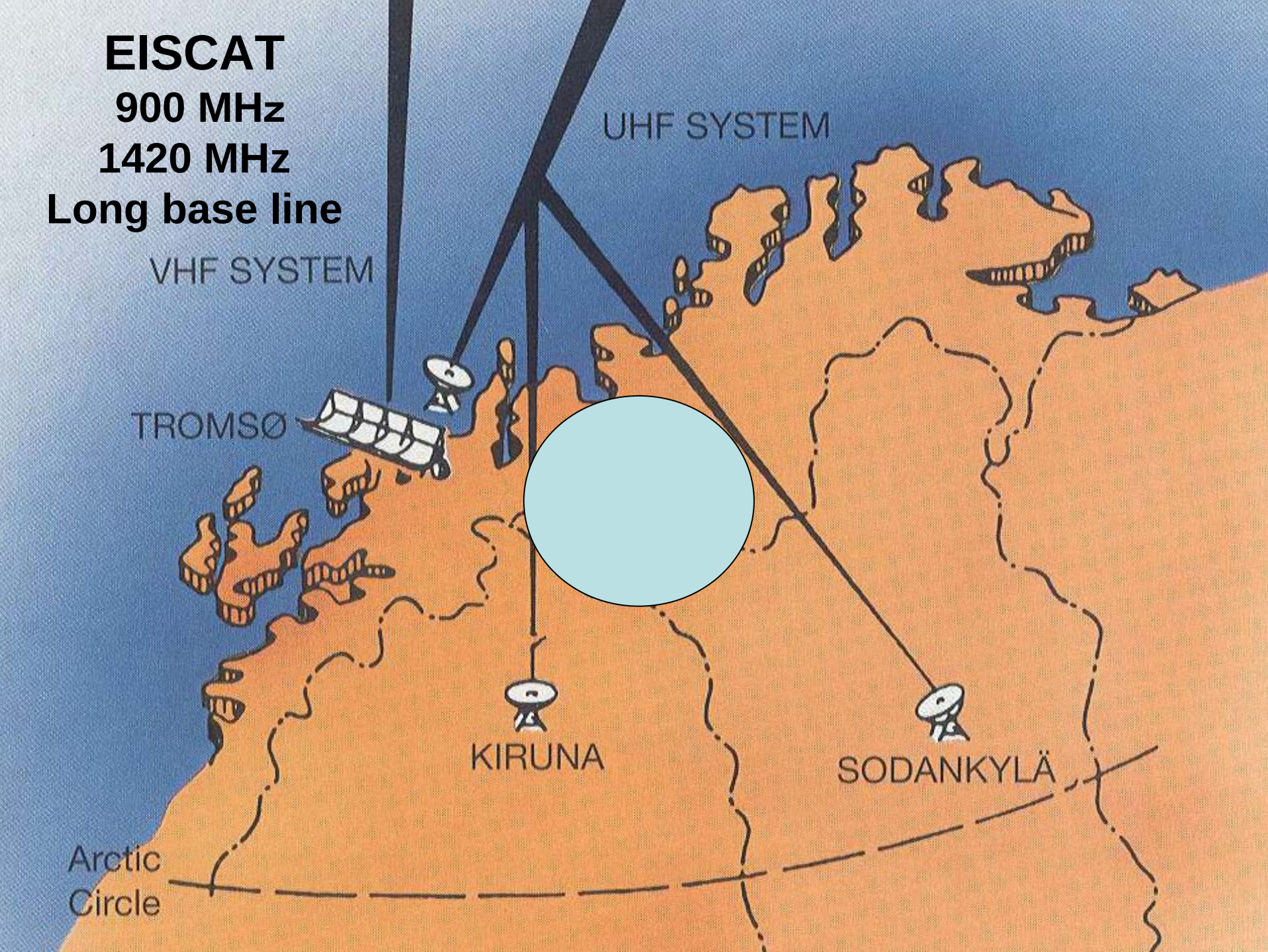

$\tau_2 - \tau_1$



太陽近傍における太陽風中の wave の最初の観測


EISCAT
900 MHz
1420 MHz
Long base line
UHF SYSTEM
VHF SYSTEM
TROMSØ
KIRUNA
SODANKYLÄ
Arctic
Circle


5G MERLIN
SMEI
1.5G MERLIN
930M EISCAT
611M Beijing
327M STELab, Ooty, Beijing, FHIRN
300M MWA
140M Mexico
1
10
100
Distance from the Sun (Rs)


EISCAT
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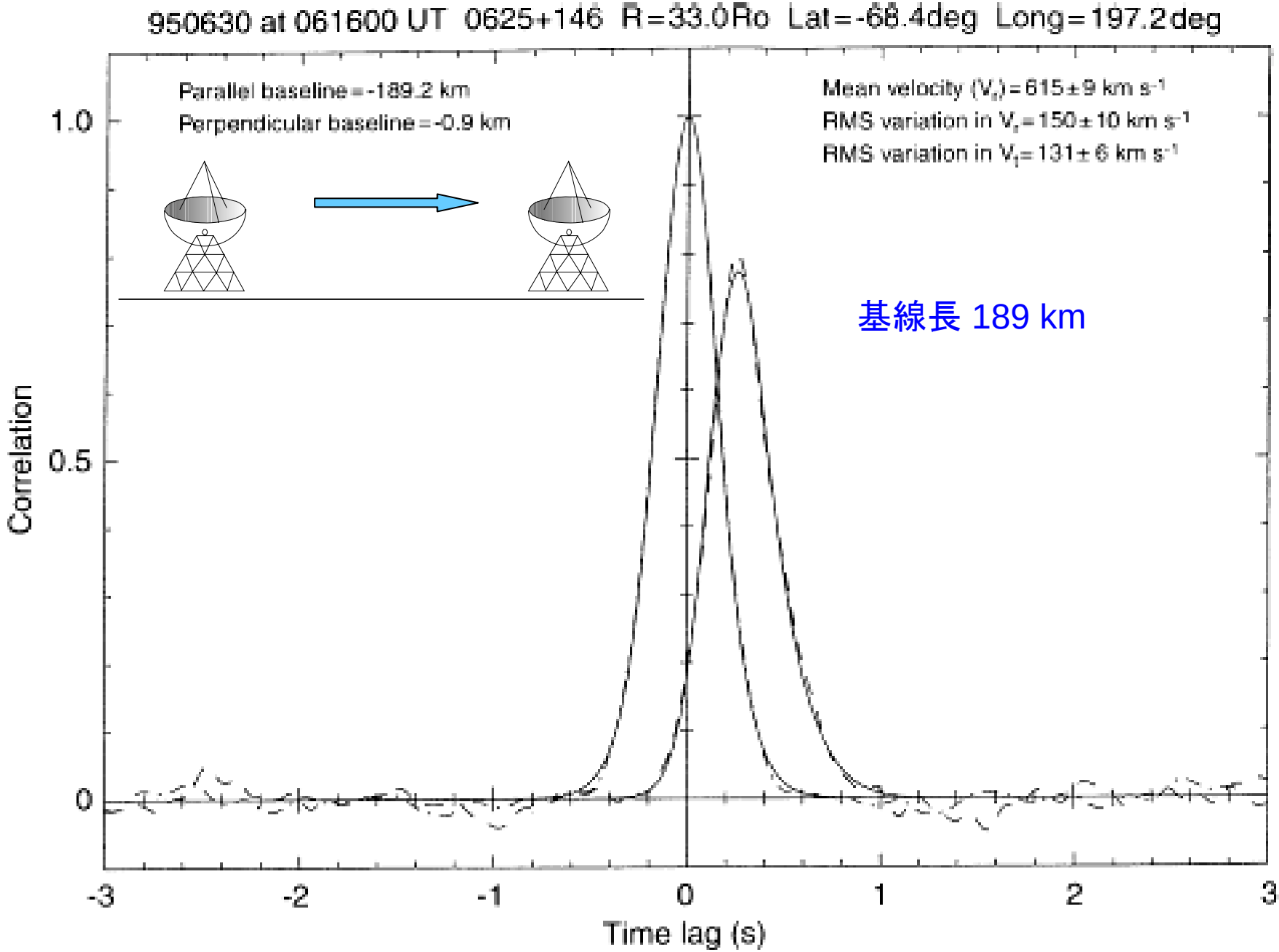
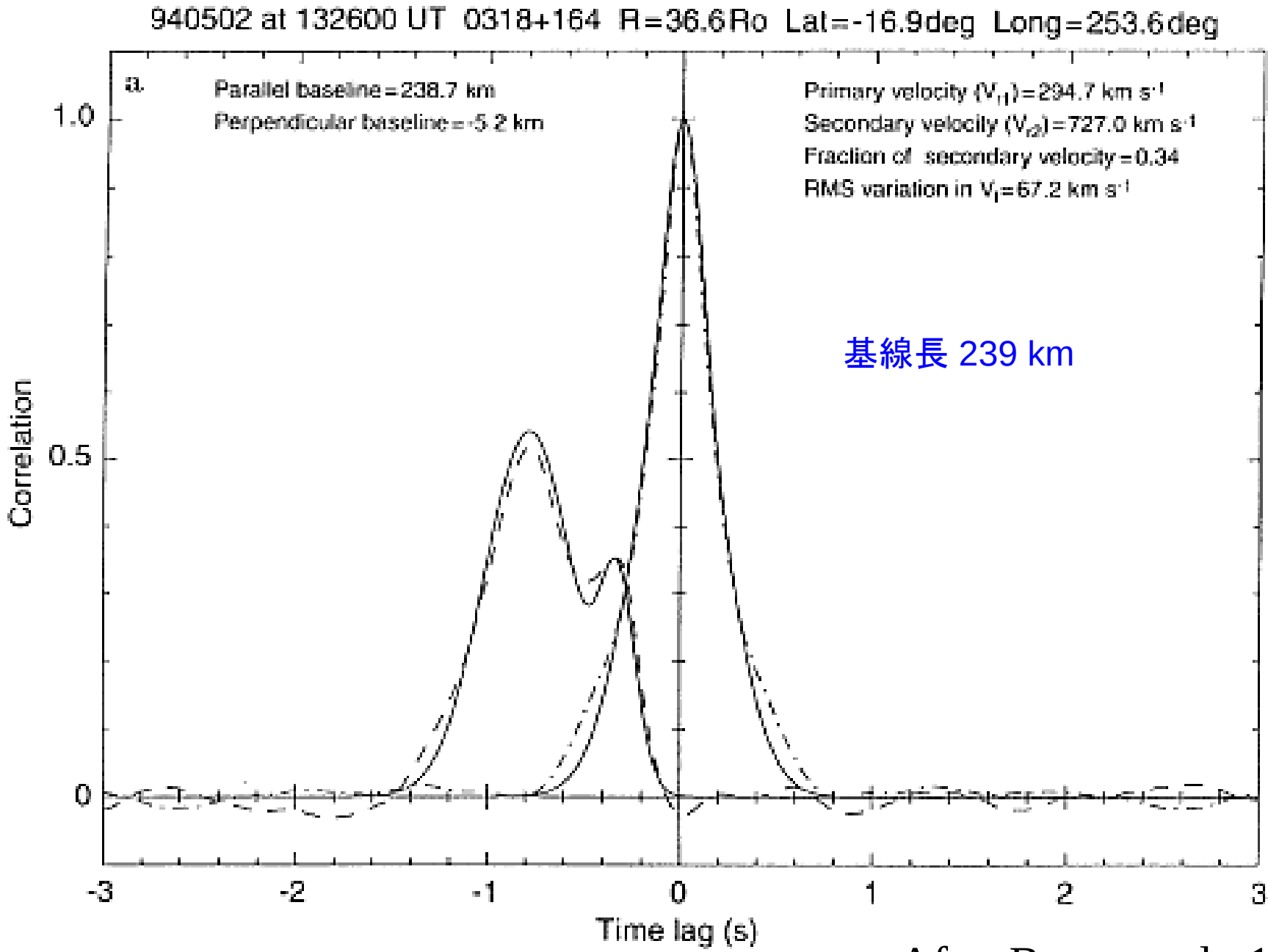
UHF SYSTEM
VHF SYSTEM
TROMSØ
KIRUNA
SODANKYLÄ
Arctic
Circle

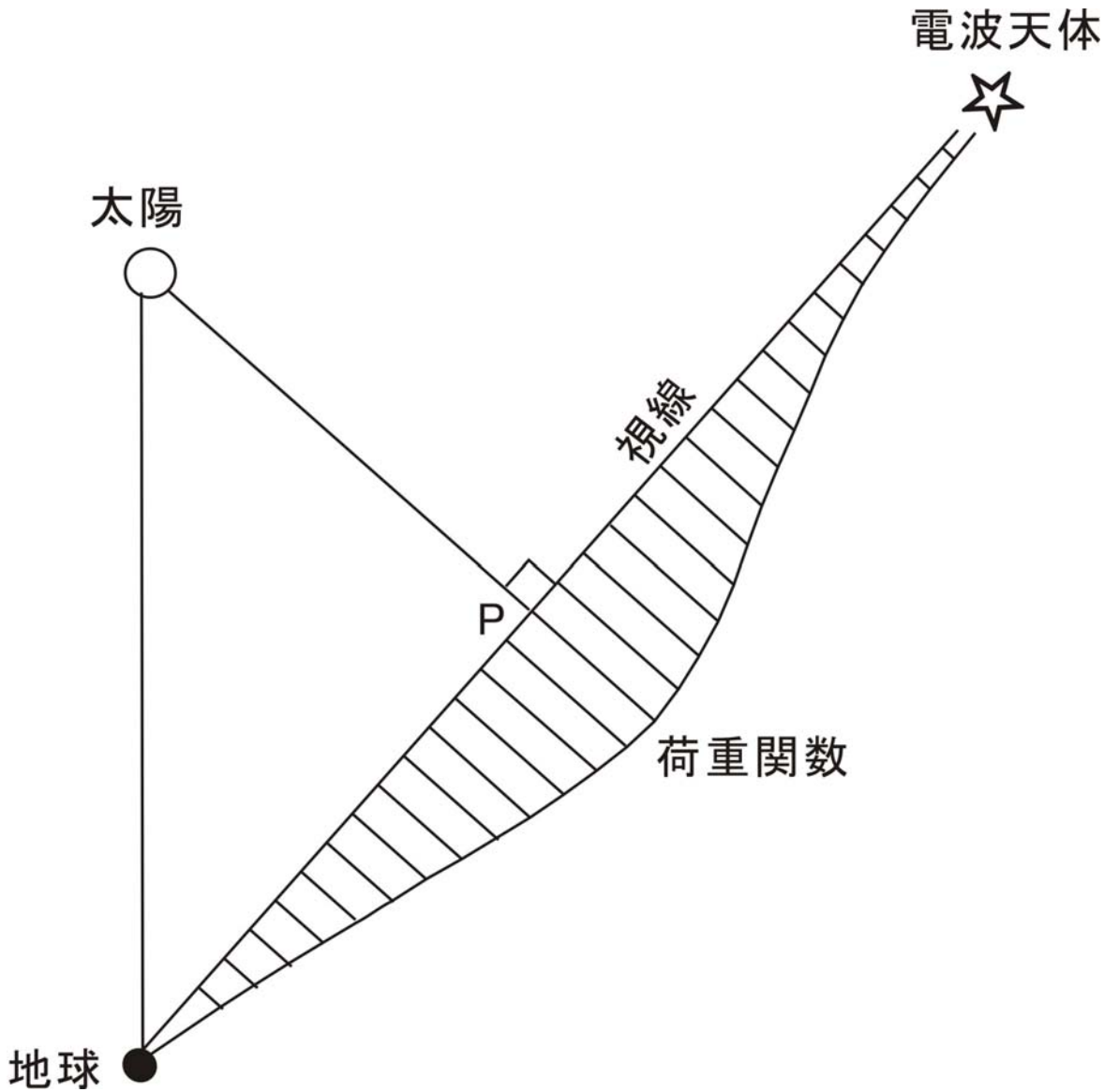


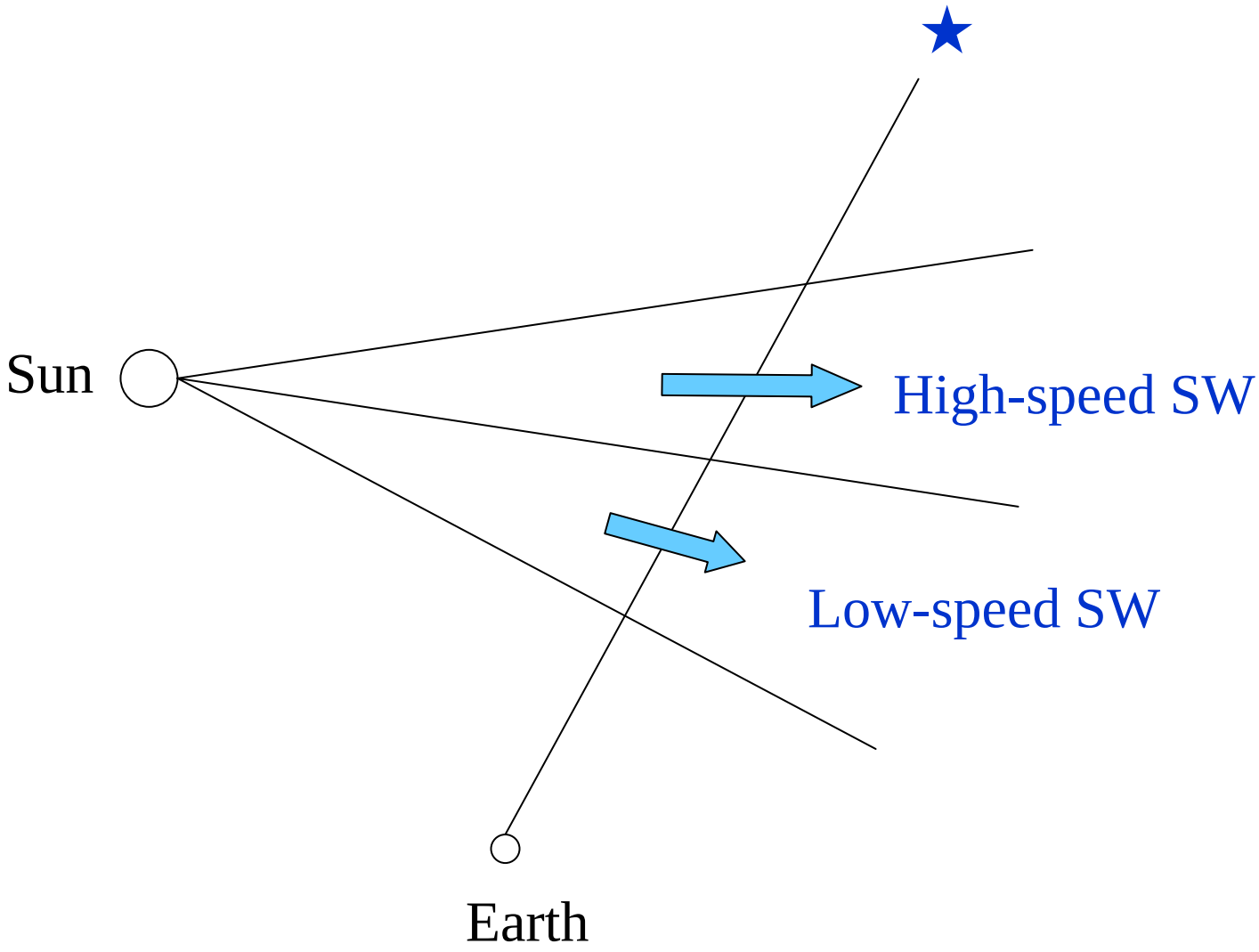
After Breen et al., 1996

アンテナの都合で、予定のベースラインでの観測ができない．．．．．



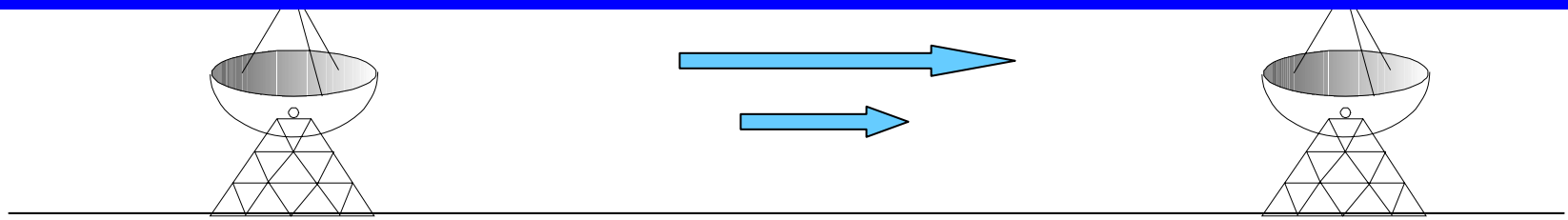
After Breen et al., 1996

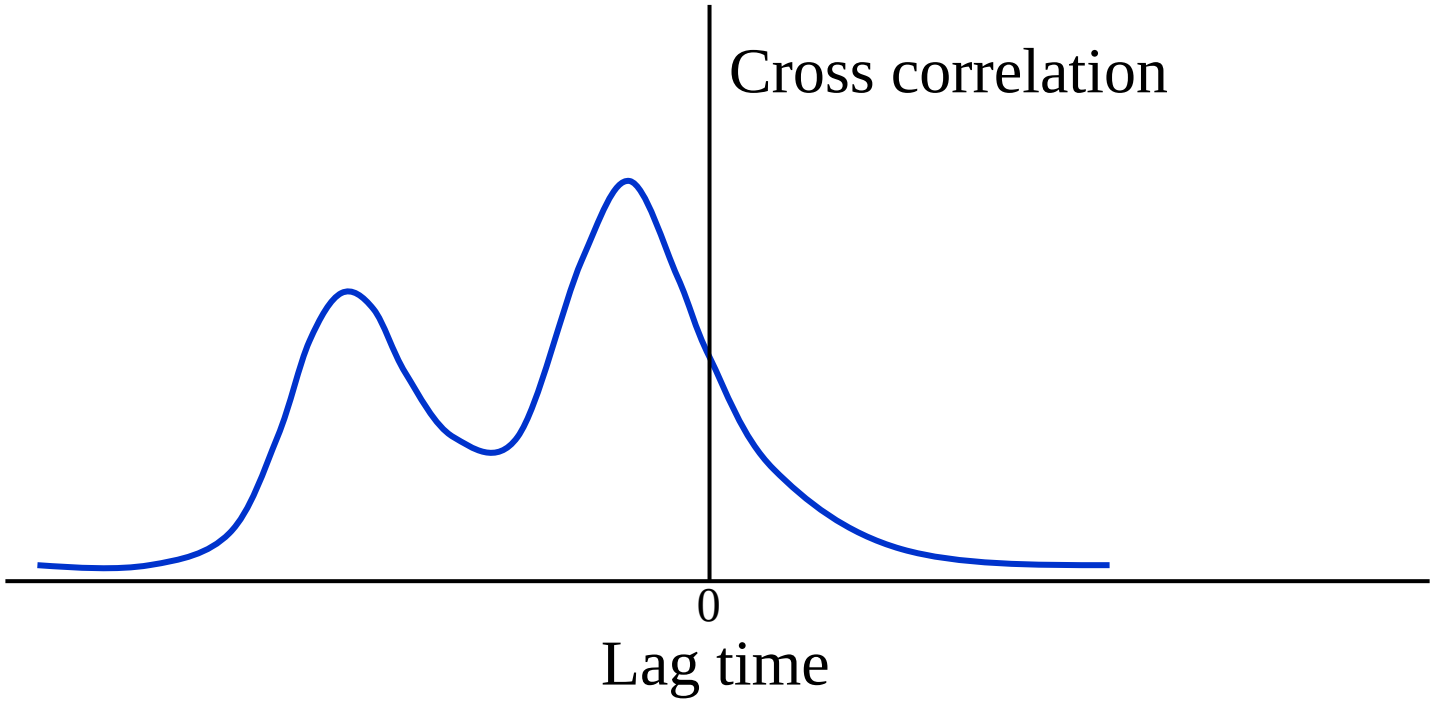

電波天体
太陽
視線
P
荷重関数
地球

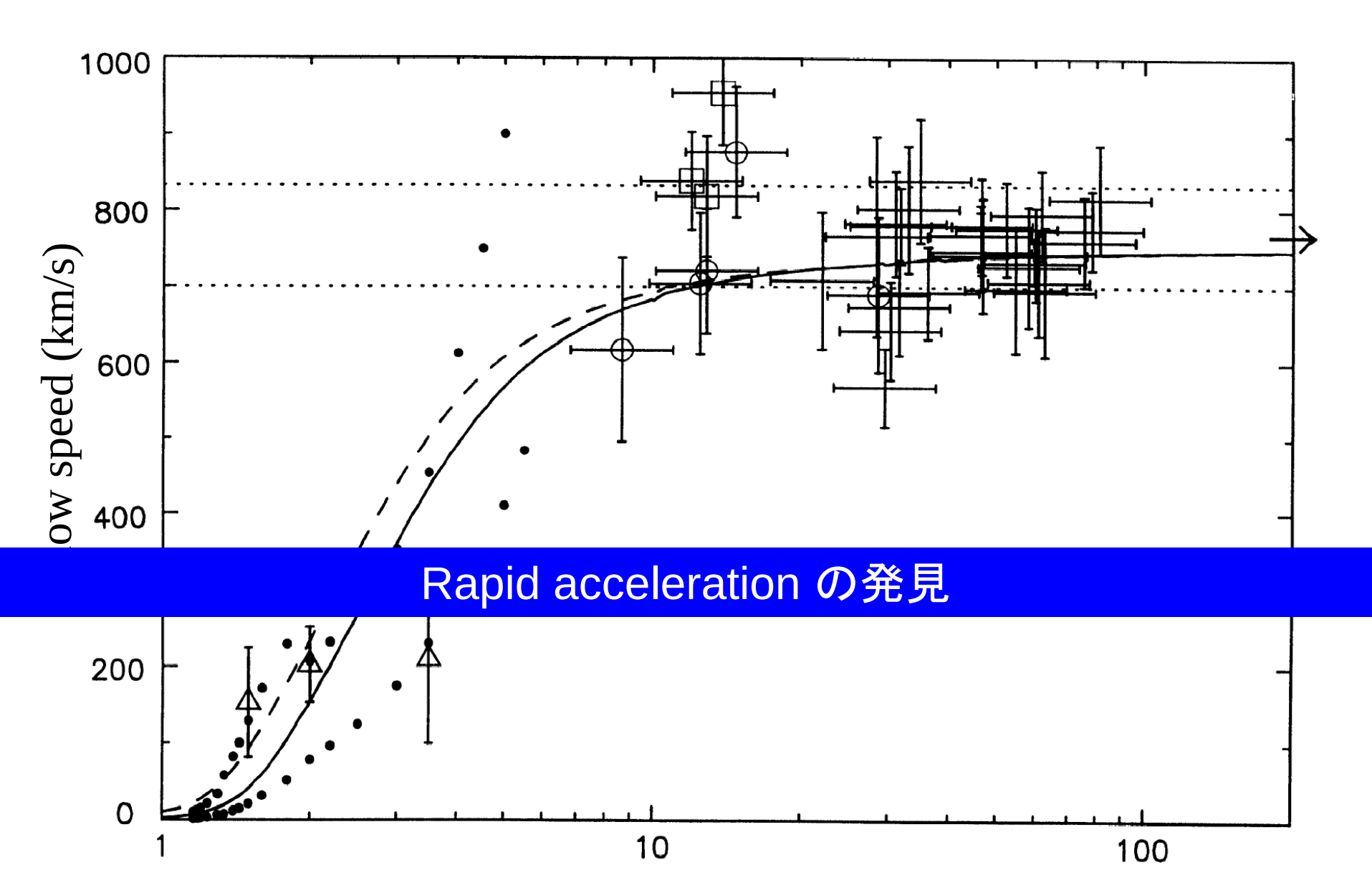

Sun
High-speed SW
Low-speed SW
Earth

Long base line observation

高速風と低速風を分解可能に







Rapid acceleration の発見

Grall et al., *Nature* (1996)

STELab の観測分解能は悪い！！！

STELab 327MHz

R_F=150 km

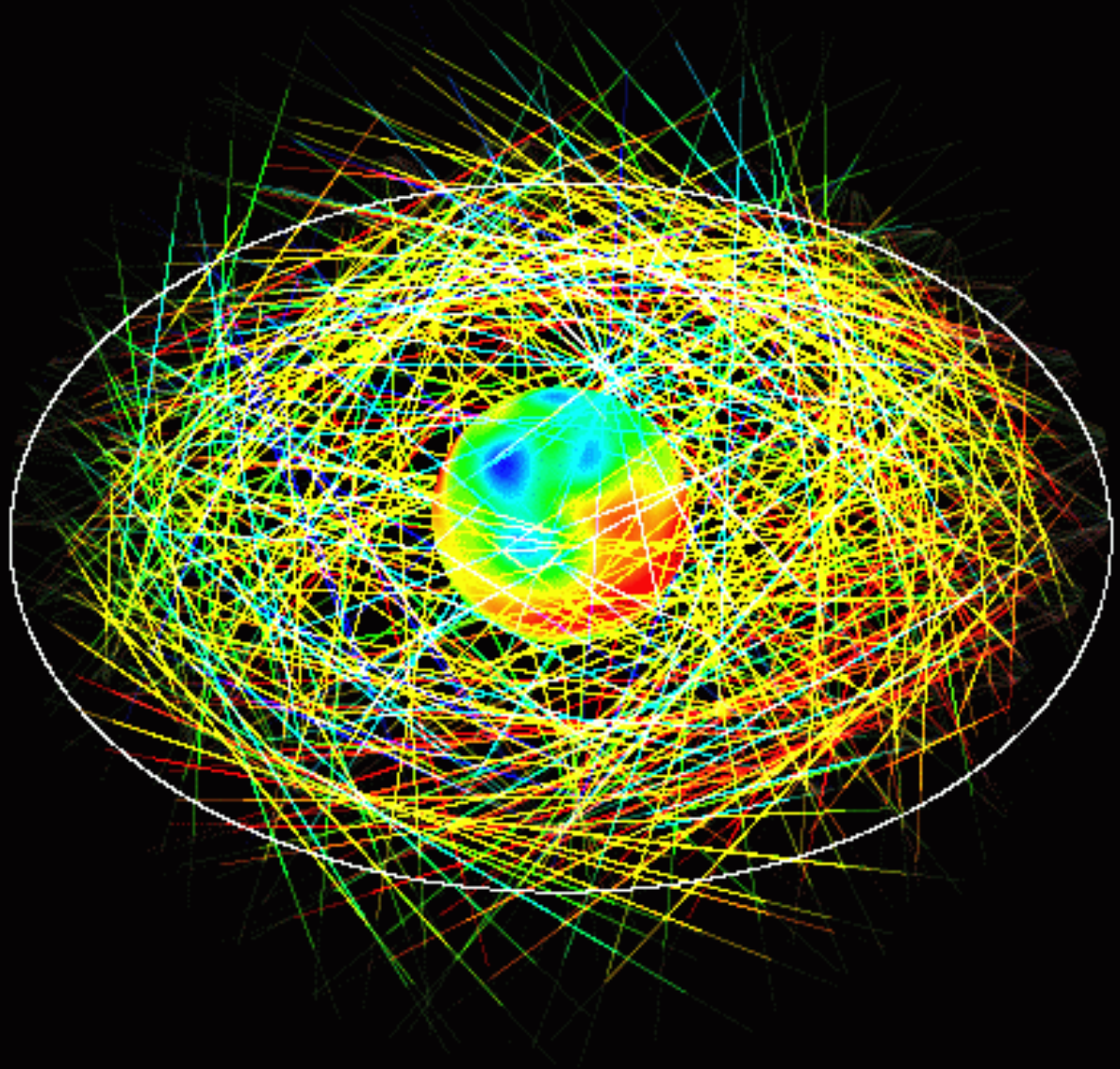
base line =100km

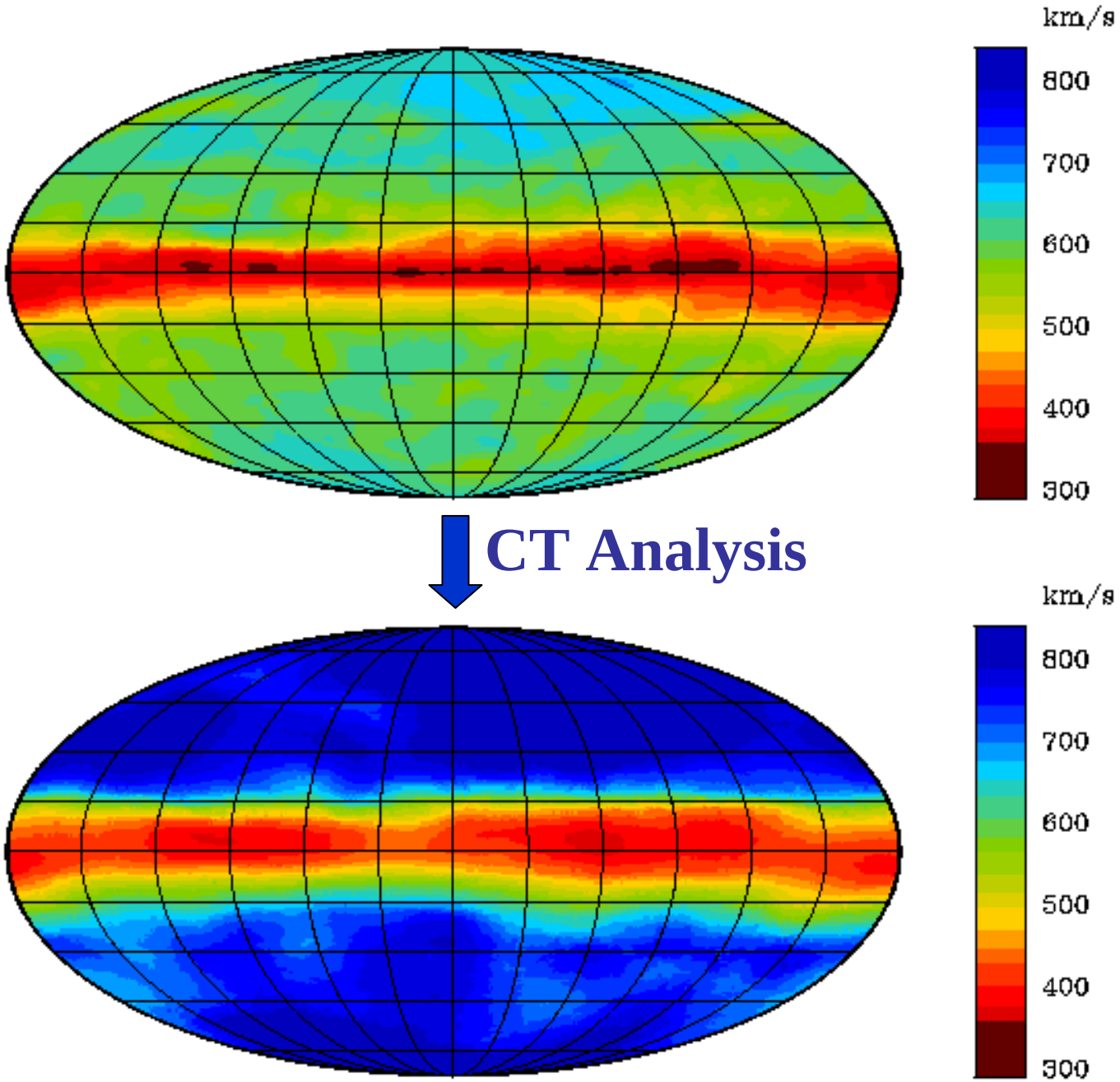
EISCAT 930MHz

$R_{F=}$ 90km

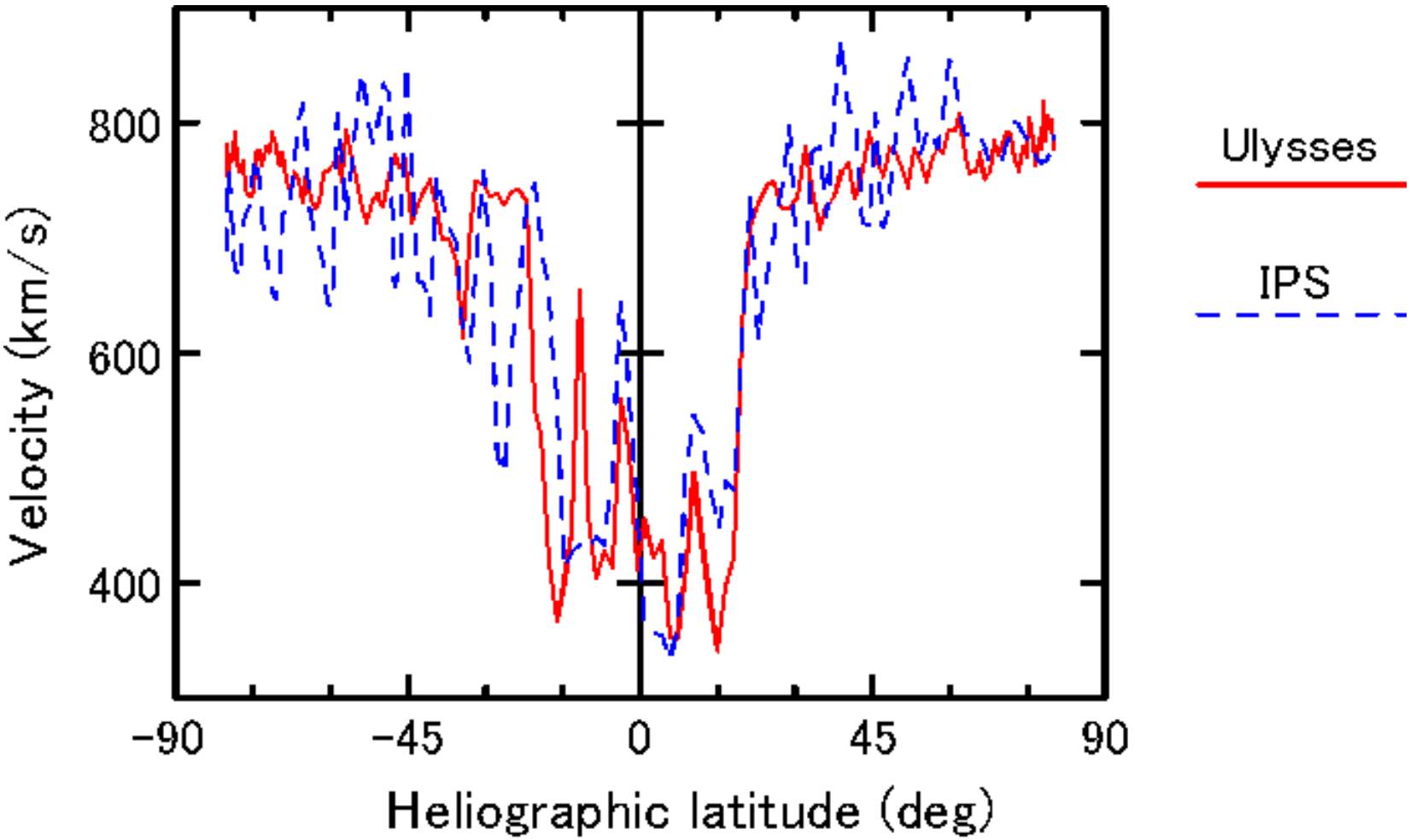
base line = 380 km

Line of sights in one solar rotation

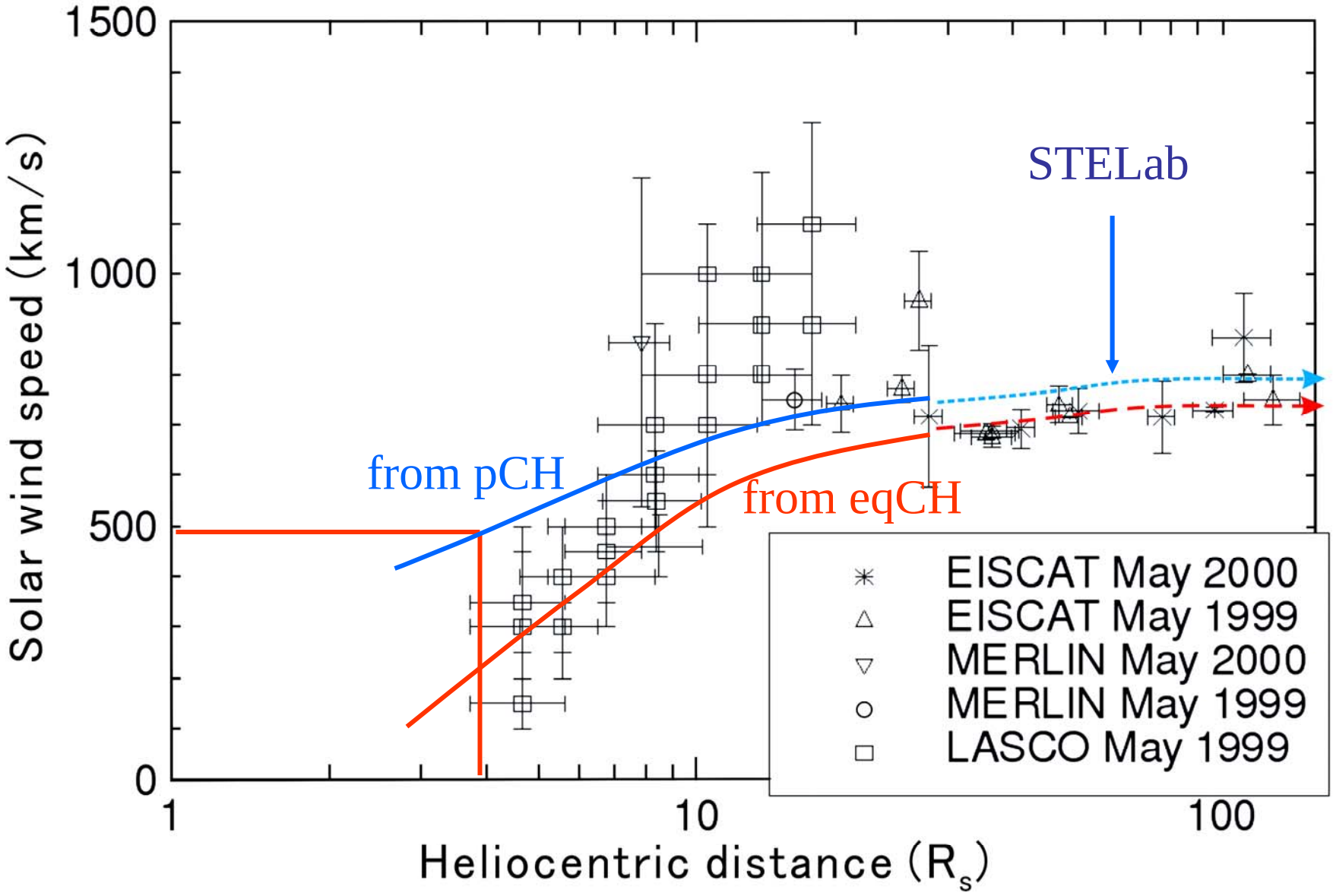



km/s
800
700
600
500
400
300
CT Analysis
km/s
800
700
600
500
400
300

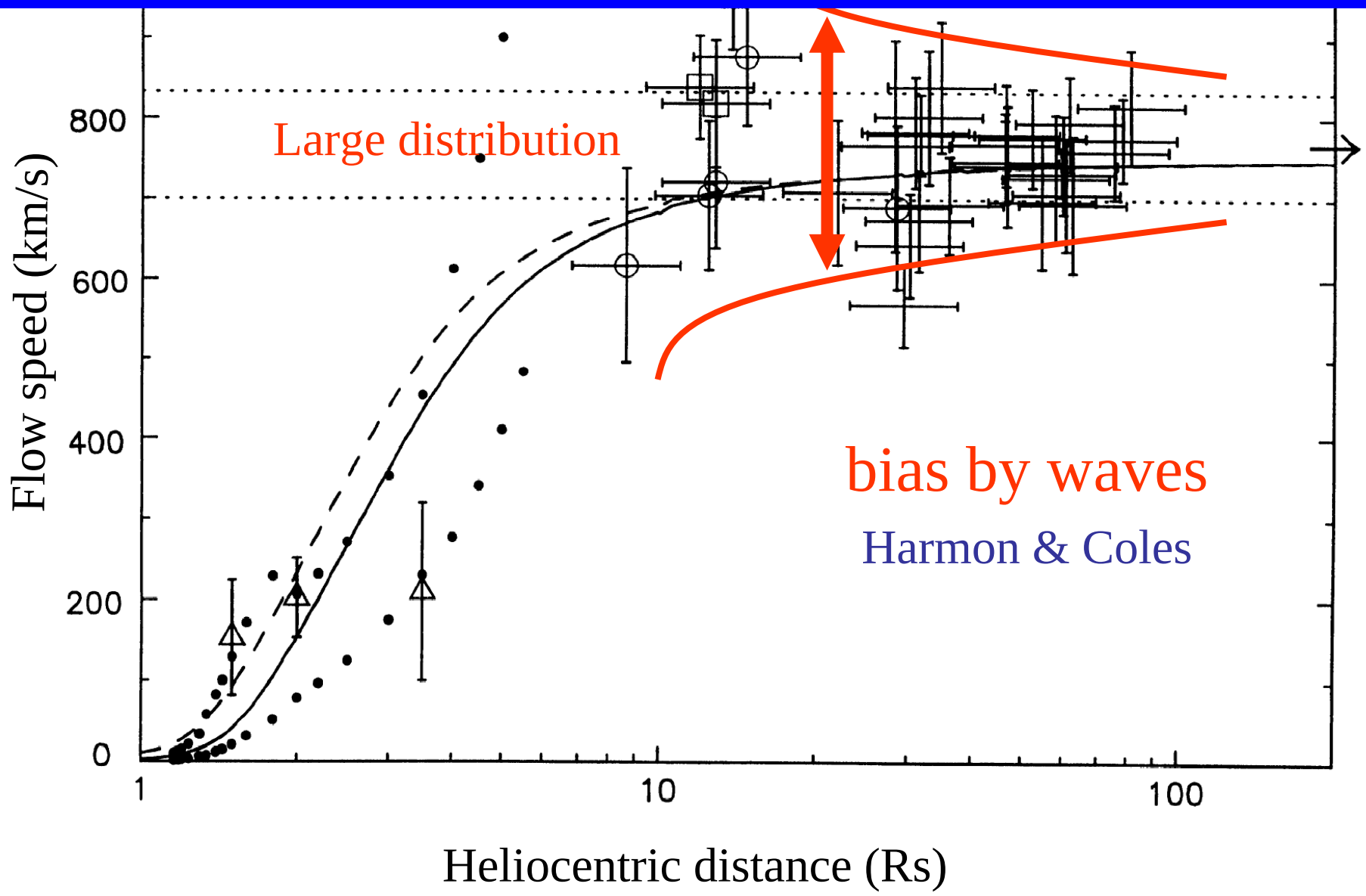
トモグラフィー法の開発に成功



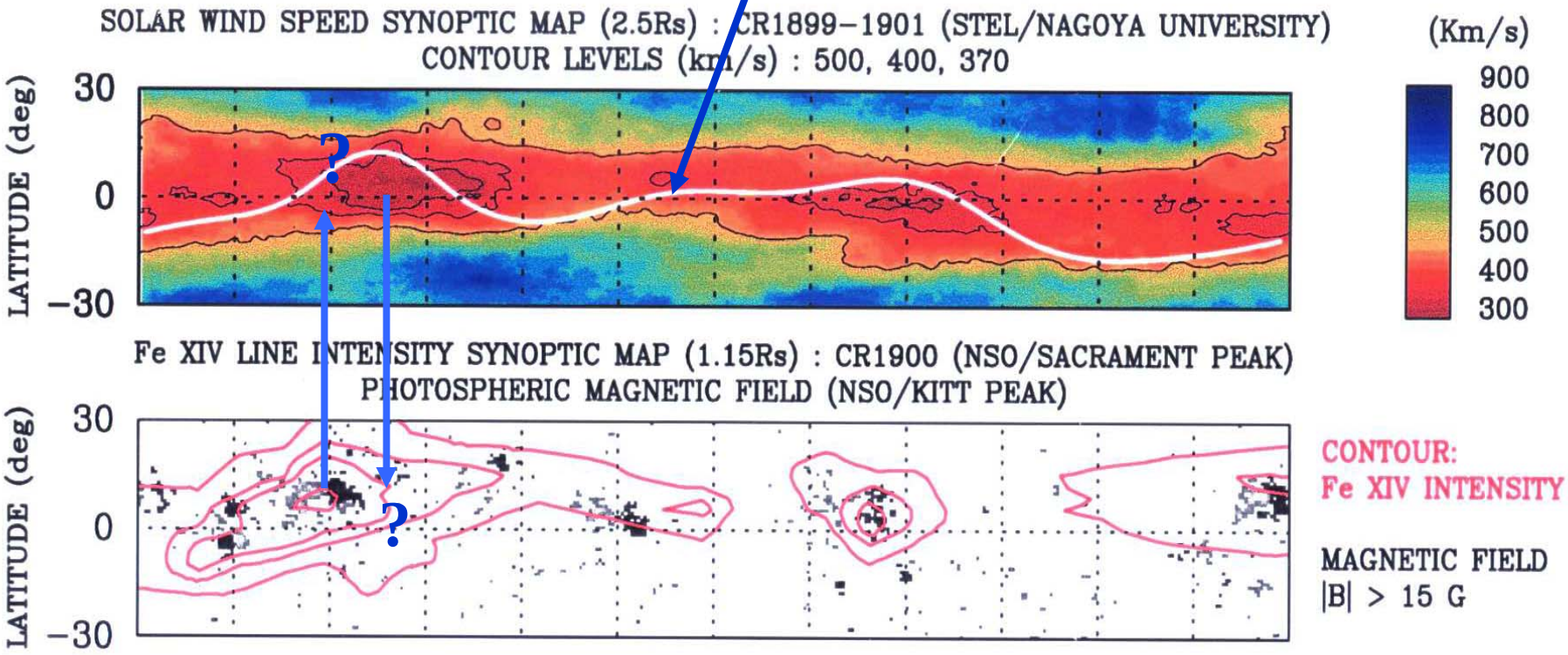
本当に rapid acceleration?



Nature の功罪


Large distribution
bias by waves
Harmon & Coles
Flow speed (km/s)
0
200
400
600
800
1
10
100
Heliocentric distance (Rs)

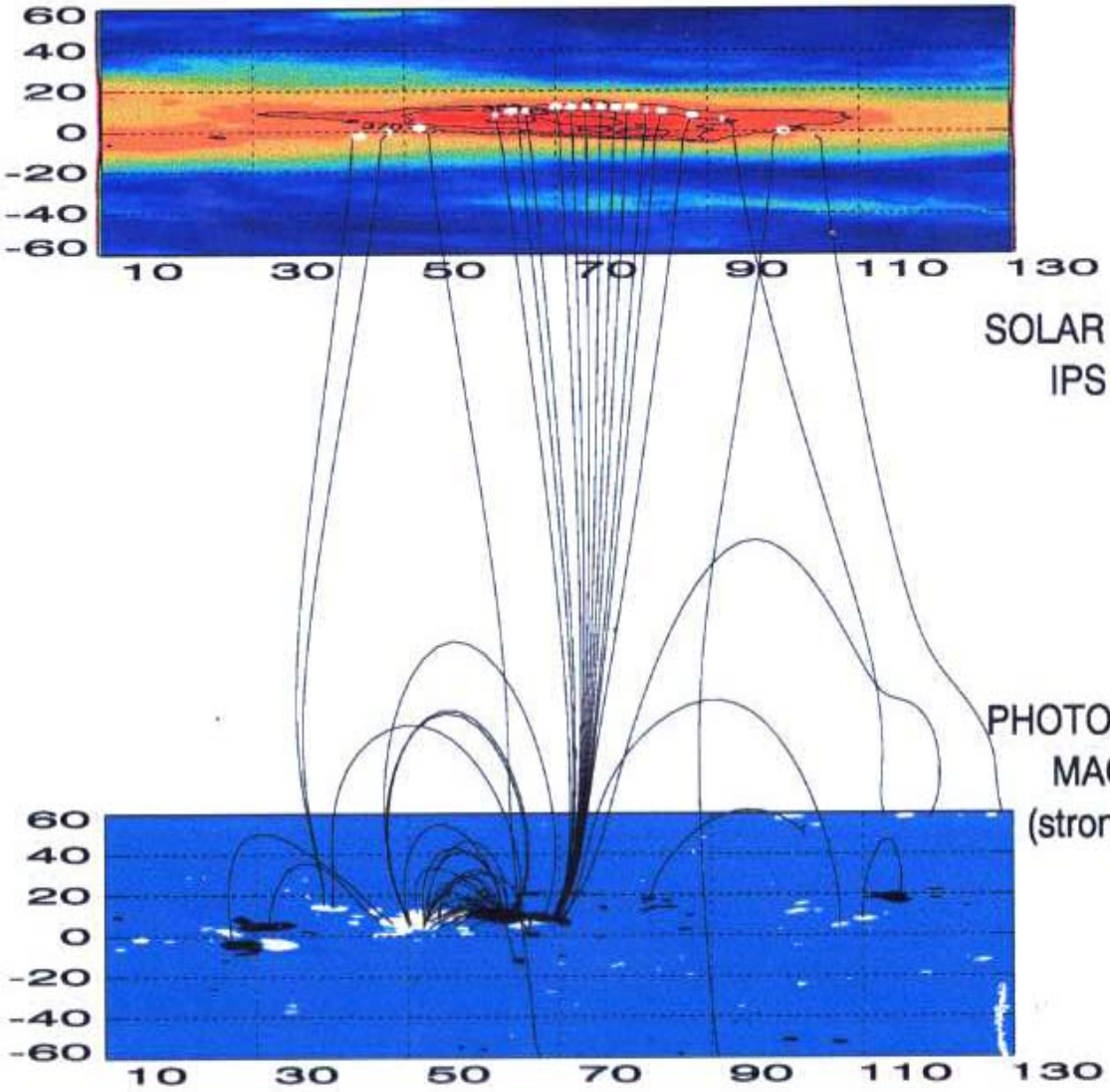
potential field neutral line



after Kojima et al., 1999

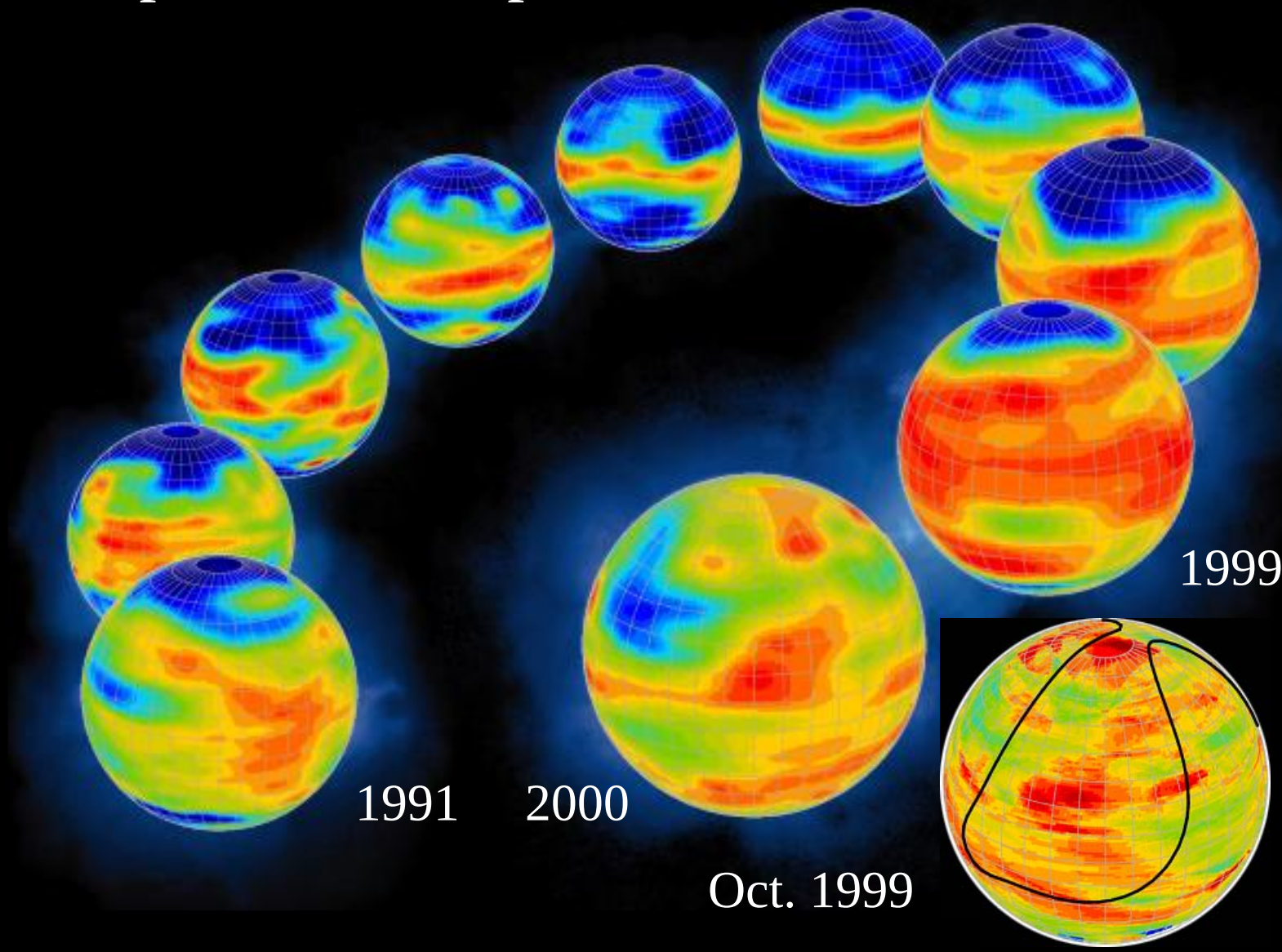
CARRINGTON ROTATION NUMBER : 1900

Very slow wind originates from the vicinity of an active region.



after Kojima et al., 1999

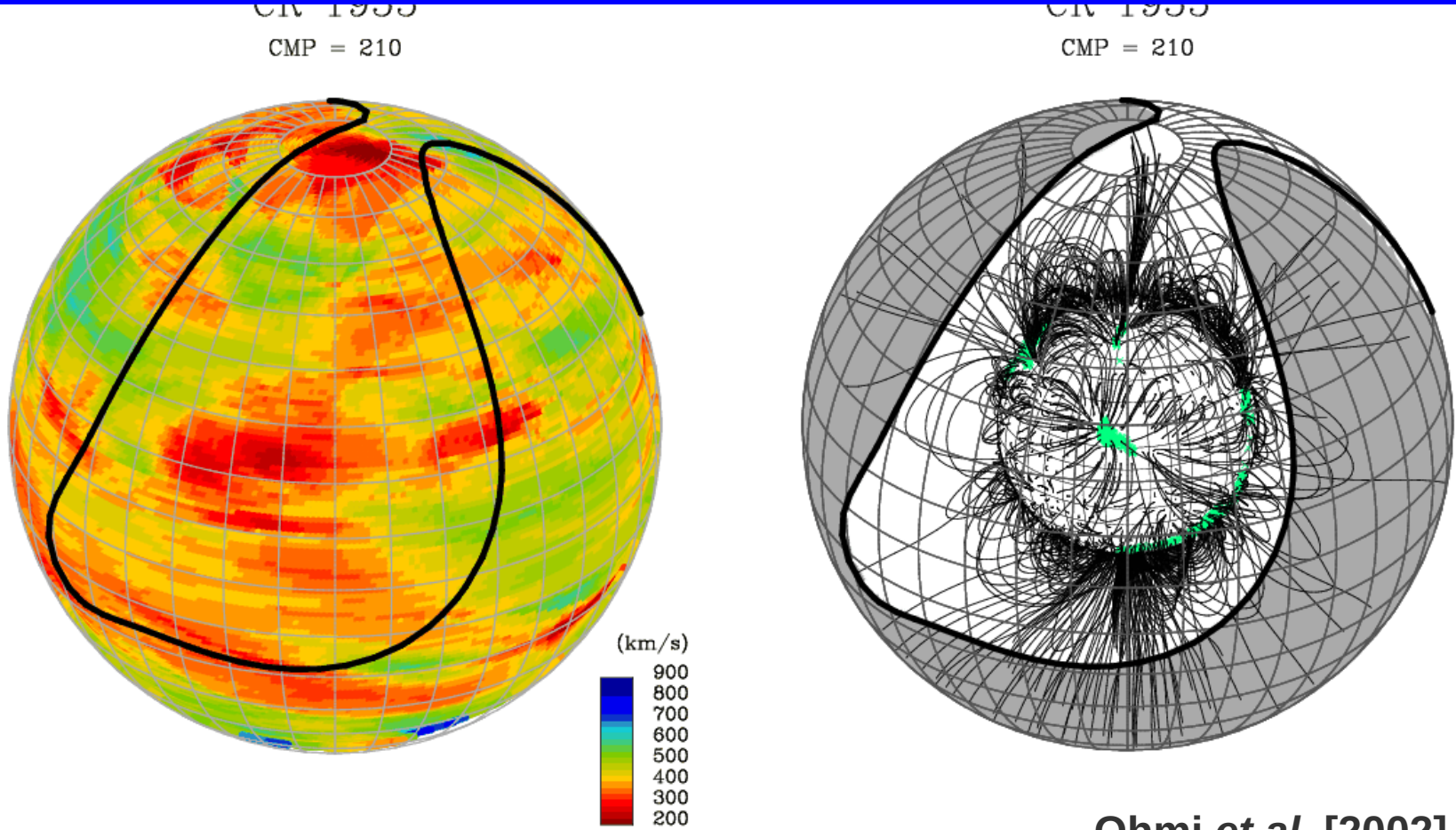
dependence on polar coronal hole scale size



Polar Low-speed Solar Wind at Solar

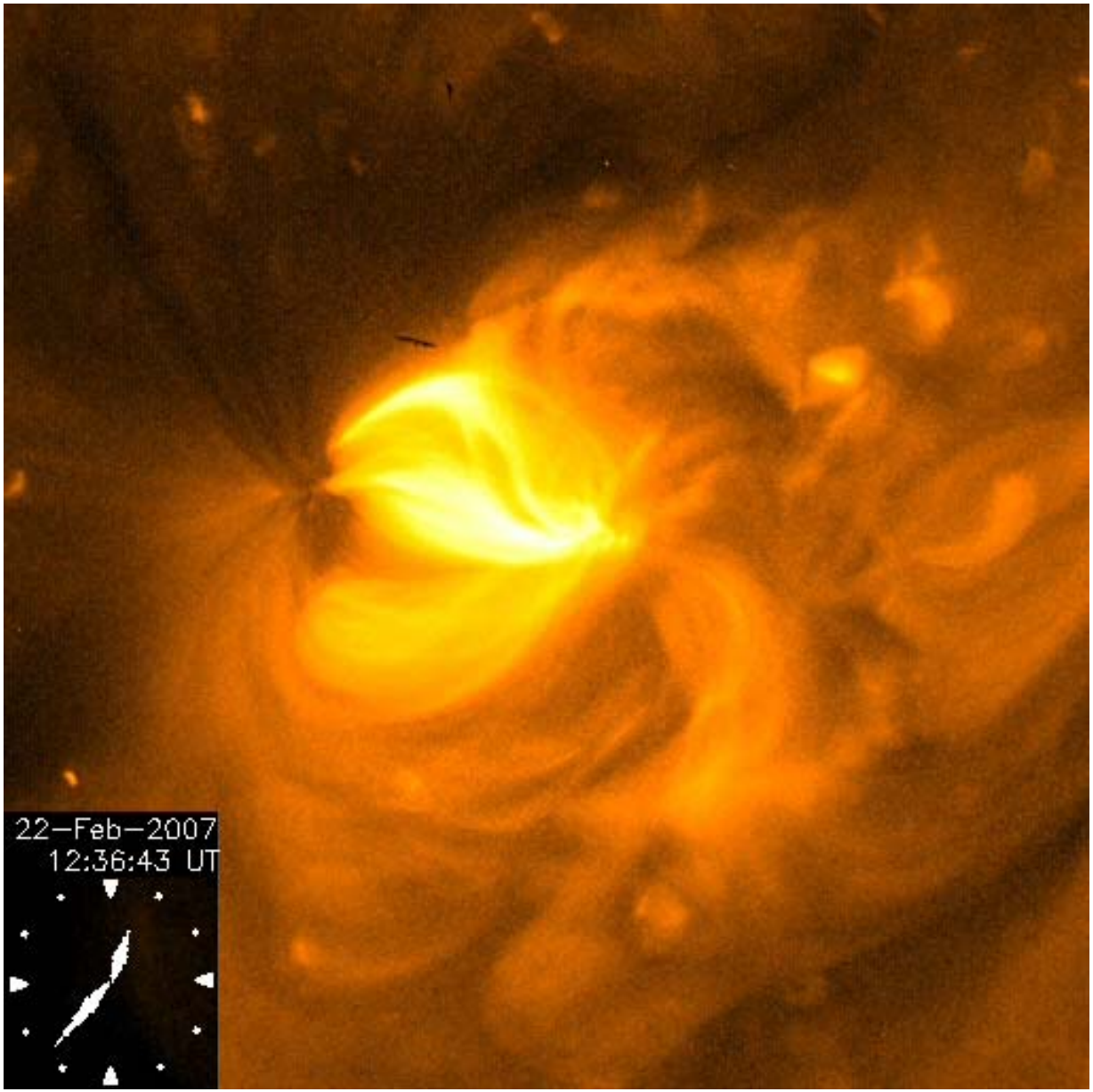
Very slow solar wind とその源の発見

大見智亮



Ohmi *et al.* [2002]

Hinode Continuous Upflow of Plasmas



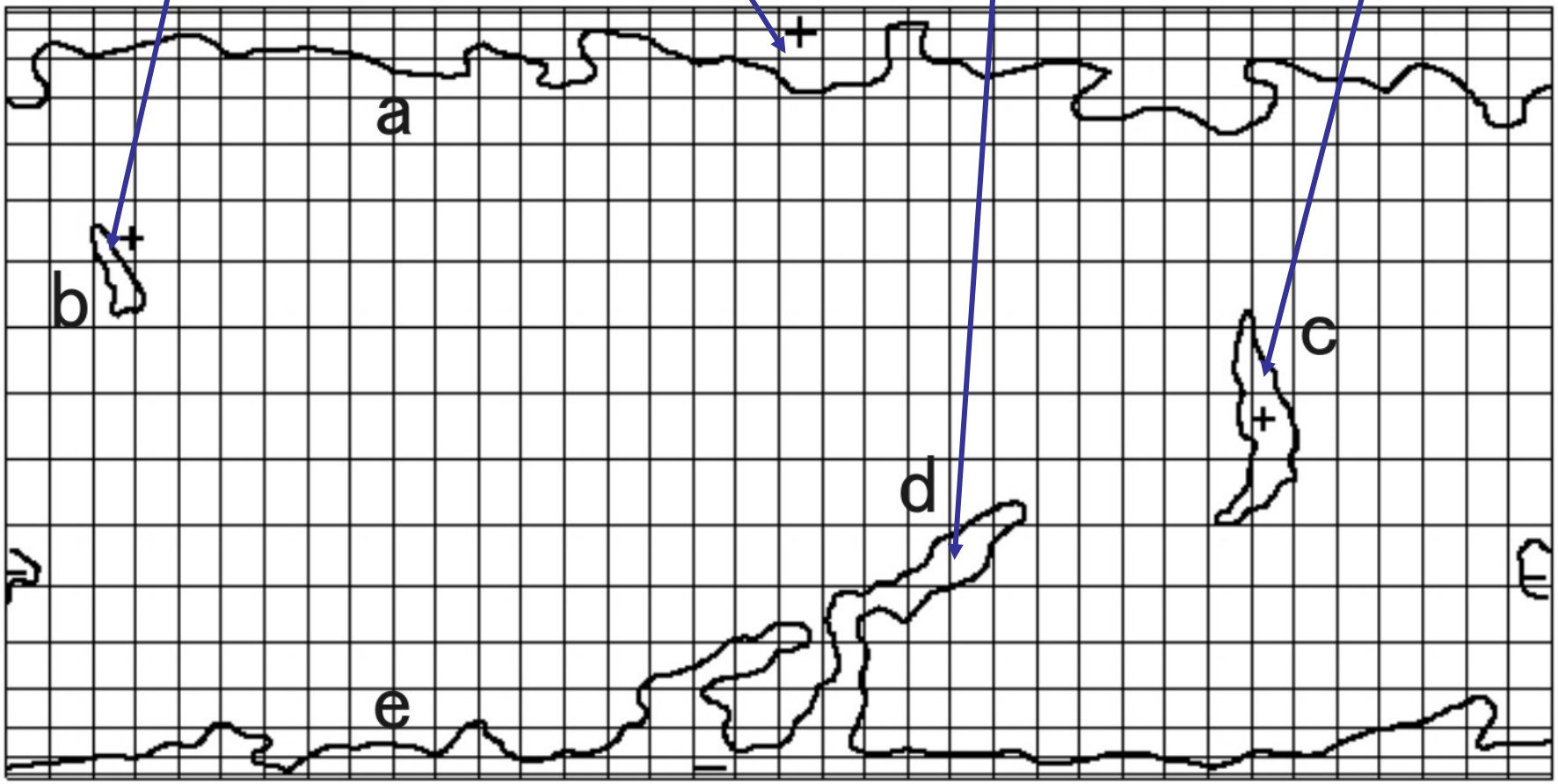
CH size

B weak
medium expansion

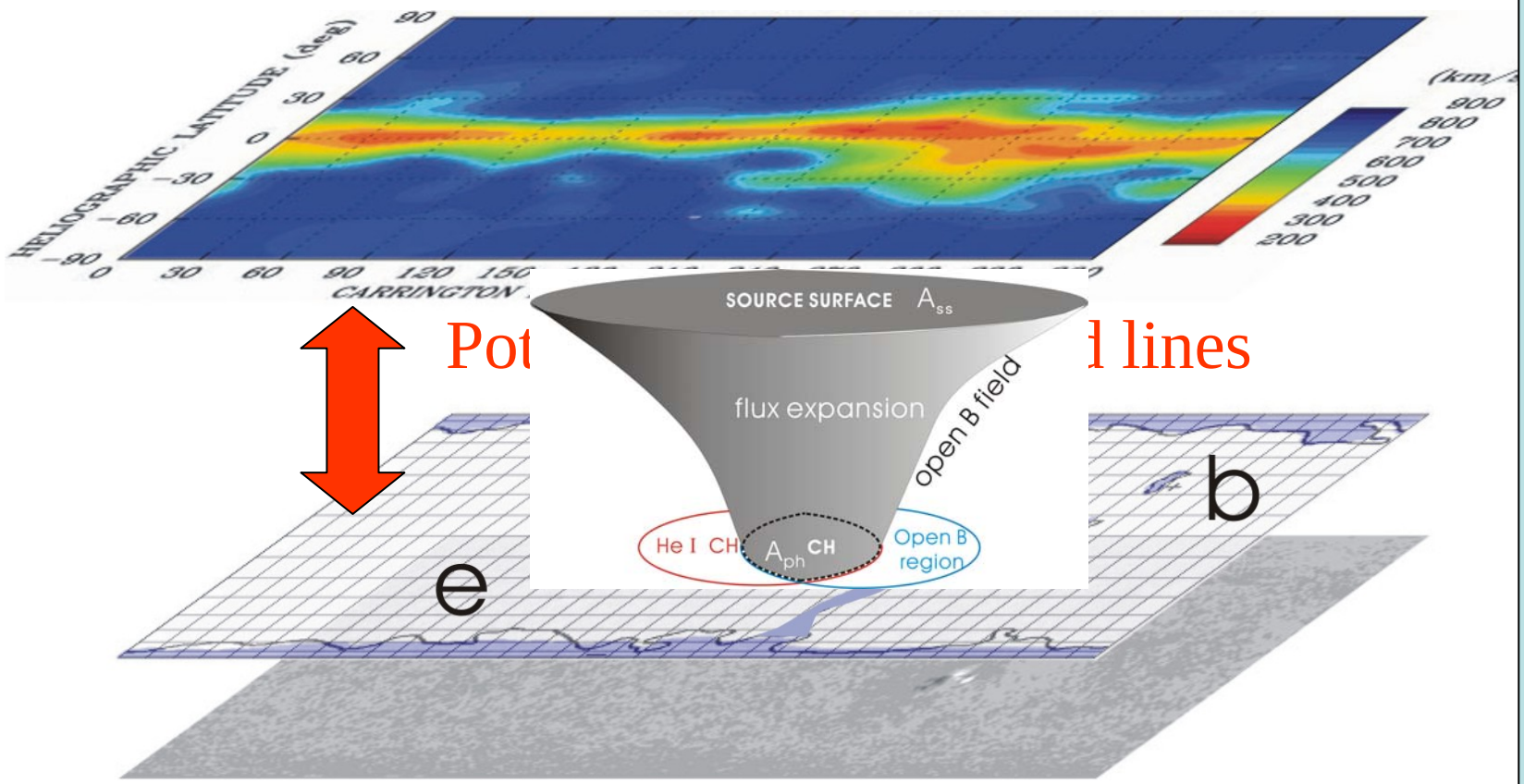
B 10G
small expansion

B weak
small expansion

B 20G
large expansion



V-map on the source surface from IPS tomography



V

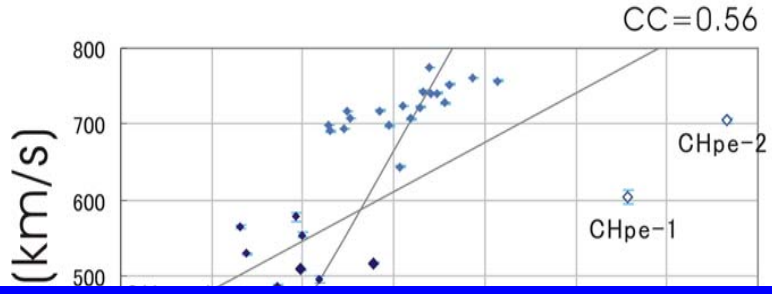
f

Bp

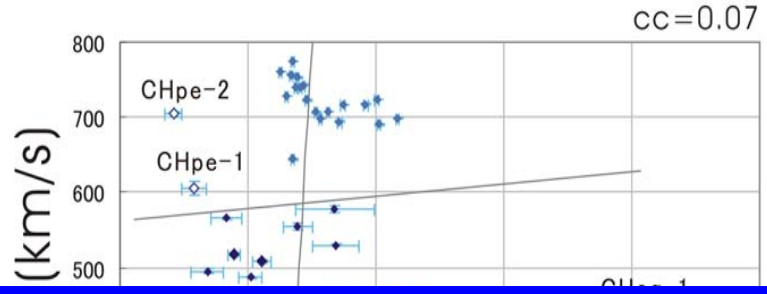
Photospheric magnetic field intensity

Data from the National Solar Observatory (NSO) at Kitt Peak

Flux expansion rate f



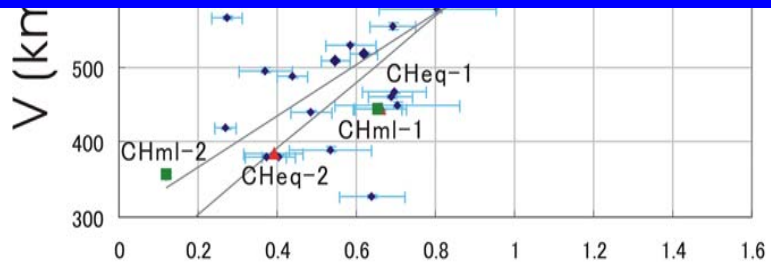
Magnetic field intensity B



太陽風加速を決めるコロナ物理量

「磁場強度／磁束管拡大率」の発見

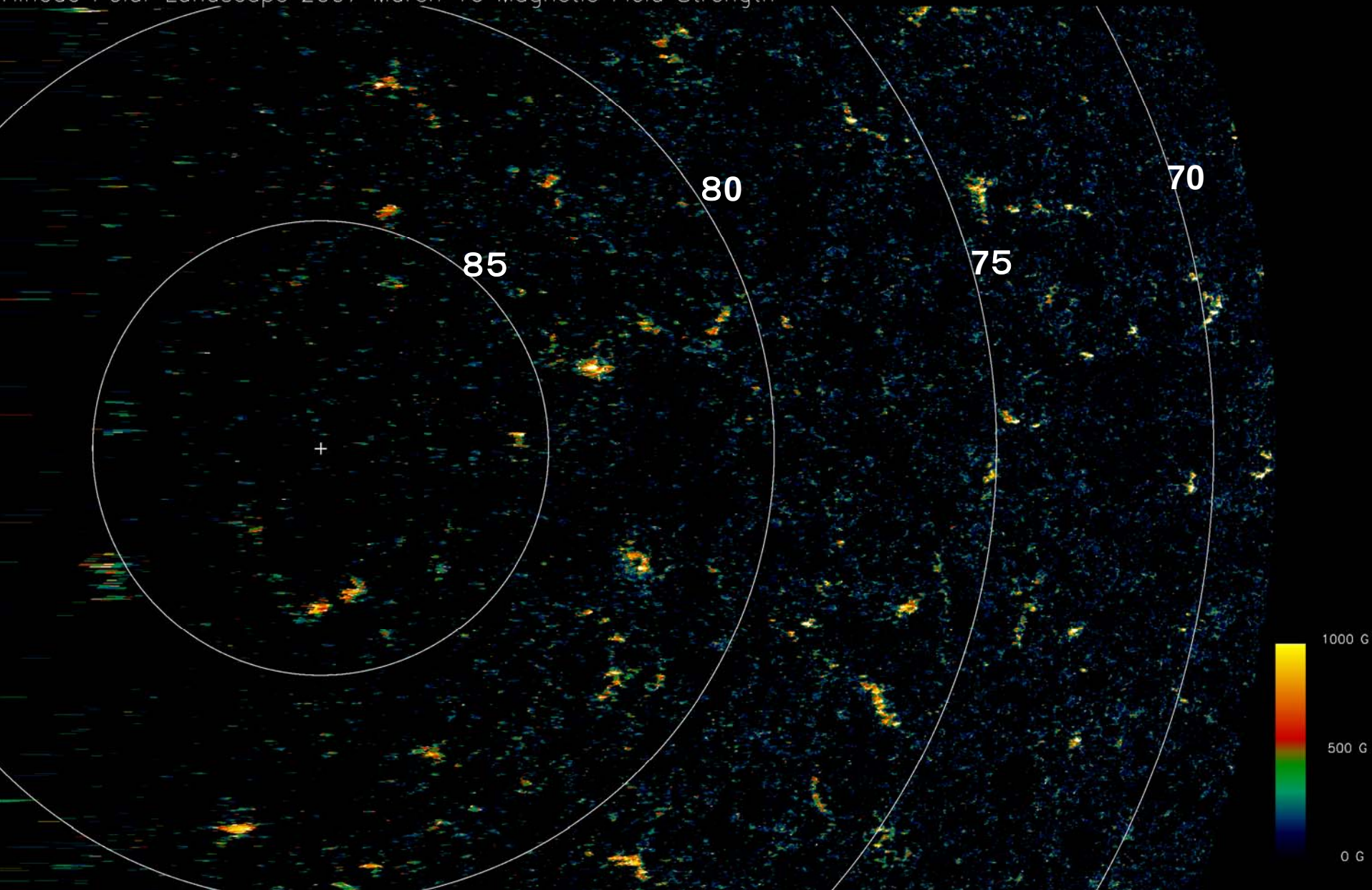
平野将也・馬場大介・伊藤大晃



B/f

極のkG強磁場

「ひので」による太陽極磁場の観測

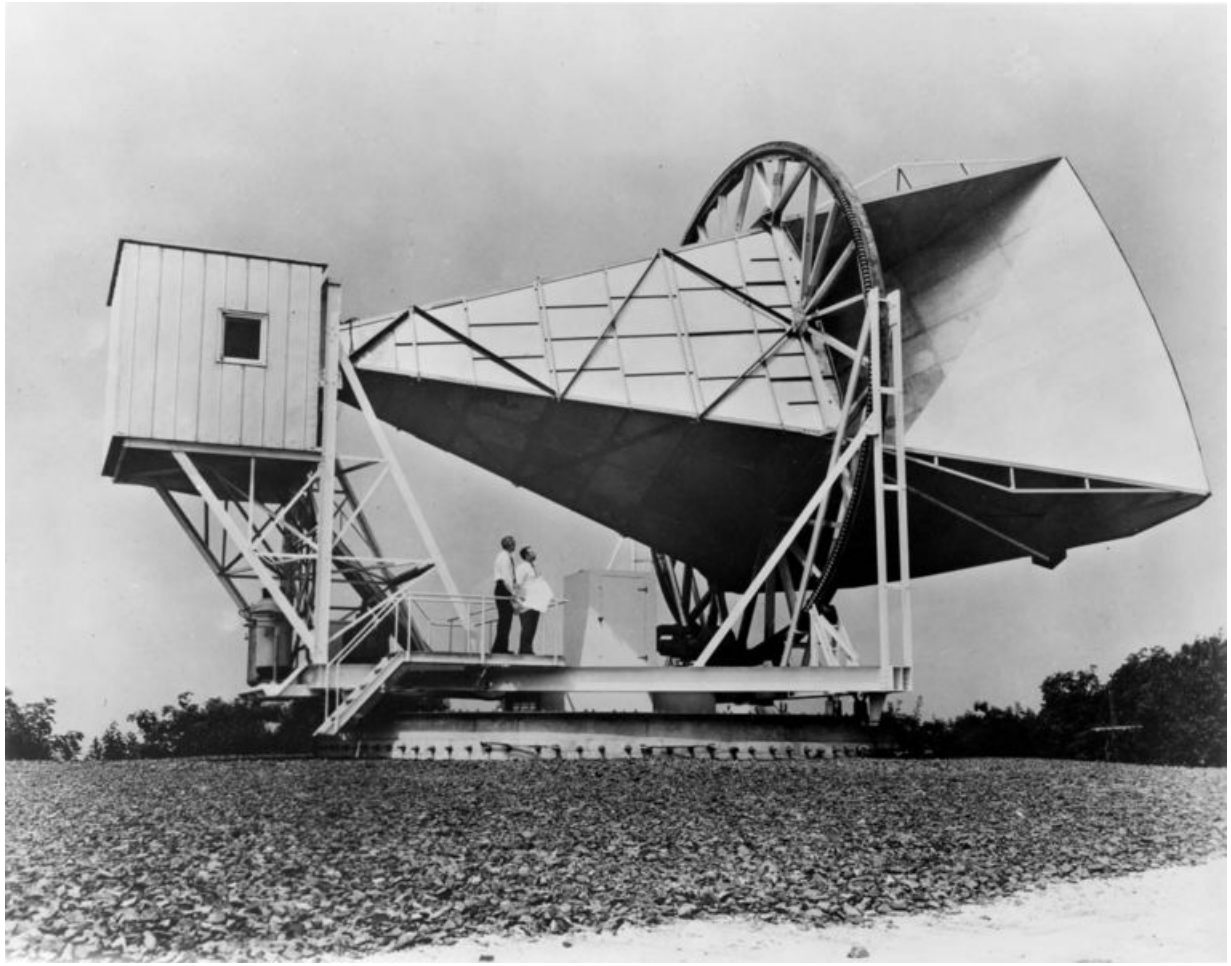


高速太陽風の起源

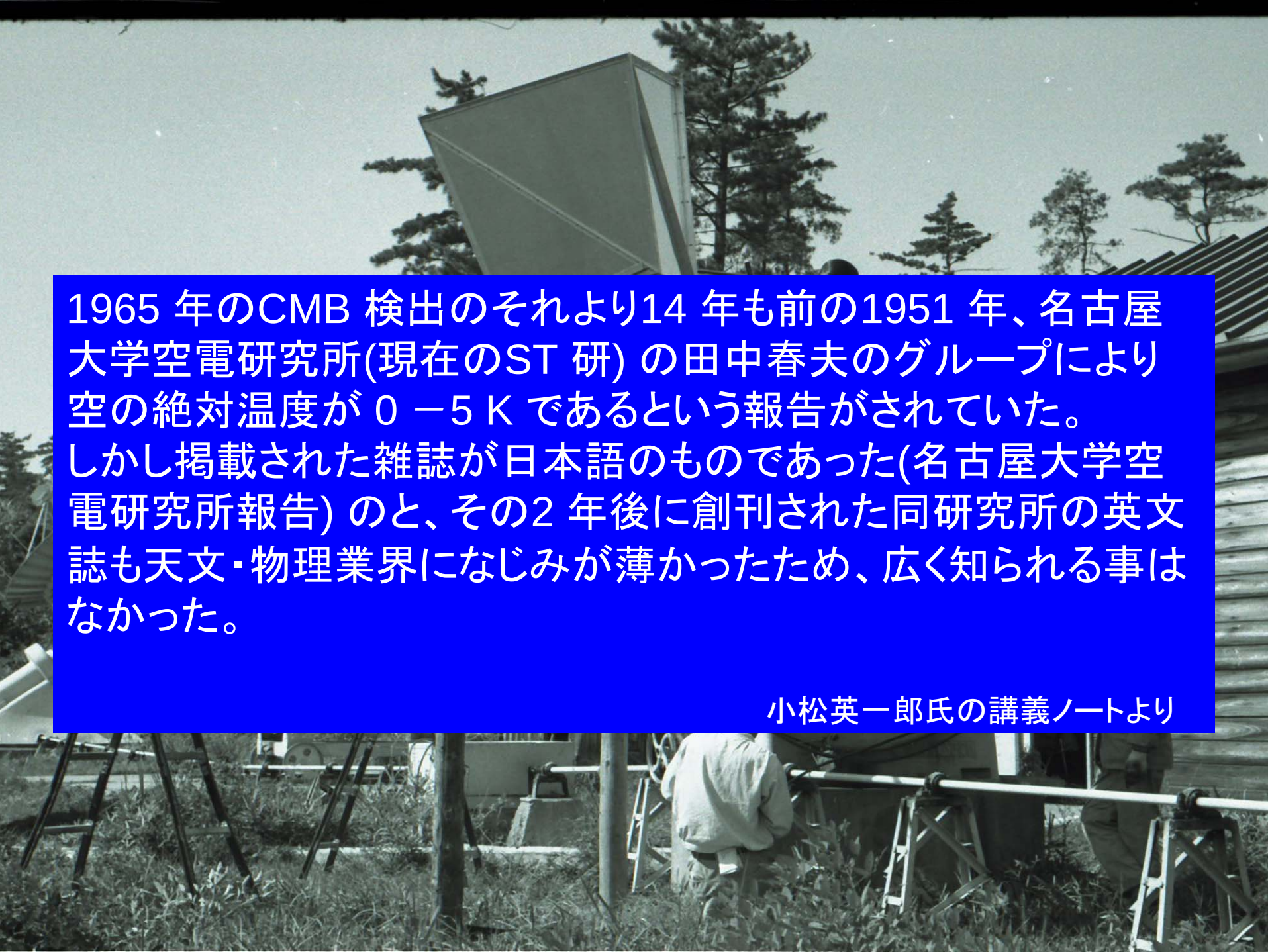
- 「ひので」の観測により極磁場の分布や配位は、従来のイメージよりかなり異なる。

- ゆえに、自動的な結論として、高速太陽風は、少数のkG磁場パッチから来ていることになる。

常田佐久氏の ppt より



1964-65 : Arno Penzias and Robert Woodrow Wilson measure the temperature to be approximately 3 K.



1965 年のCMB 検出のそれより14 年も前の1951 年、名古屋大学空電研究所(現在のST 研) の田中春夫のグループにより空の絶対温度が 0 －5 K であるという報告がされていた。
しかし掲載された雑誌が日本語のものであった(名古屋大学空電研究所報告) のと、その2 年後に創刊された同研究所の英文誌も天文・物理業界になじみが薄かったため、広く知られる事はなかった。

小松英一郎氏の講義ノートより

天才とは九分九厘が汗、一分だけが霊感

エジソン

成功の秘訣は、、、運・鈍重　根気

今日は、昨日を背負い、
明日を孕んでいる

ライプニッツ


みなさん
ありがとうございました
そして
さようなら