PLANETARY AERONOMY WITH LARGE TELESCOPES

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OUTLINE

Why big telescopes?

What does a 10-meter telescope buy you for terrestrial studies?

Sky Spectra - Parasitic Aeronomy

Challenges

Venus Studies

Terrestrial Studies

WHAT DOES A 10-METER TELESCOPE BUY YOU FOR TERRESTRIAL STUDIES?

The data exist, and are generated every night, at all major observatories

The data are available - meet an astronomer

Large modern echelle spectrometers provide:

a. Broad spectral coverage

b. High optical resolution

c. High sensitivity (CCD detection)

d. Data mining operation mode

Telescopes can be viewed as survey instruments

Follow up with other systems

An observatory has multiple instruments

High/low resolution -UV/vis/lR

A dedicated observatory? Good idea for planets,

sky spectra are sufficient for Terra

SKY SPECTRA- PARASITIC AERONOMY

How an astronomer takes data

Capabilities of big telescopes

Keck I, HIRES spectrometer

Wavelength coverage	300-1000 nm
Simultaneous spectral range	200-300 nm
Resolution	40,000+
Usual integration time	50 minutes

CHALLENGES

Data-gathering *vs* data-taking

Fixed position of observatory

Pointing controlled by astronomer

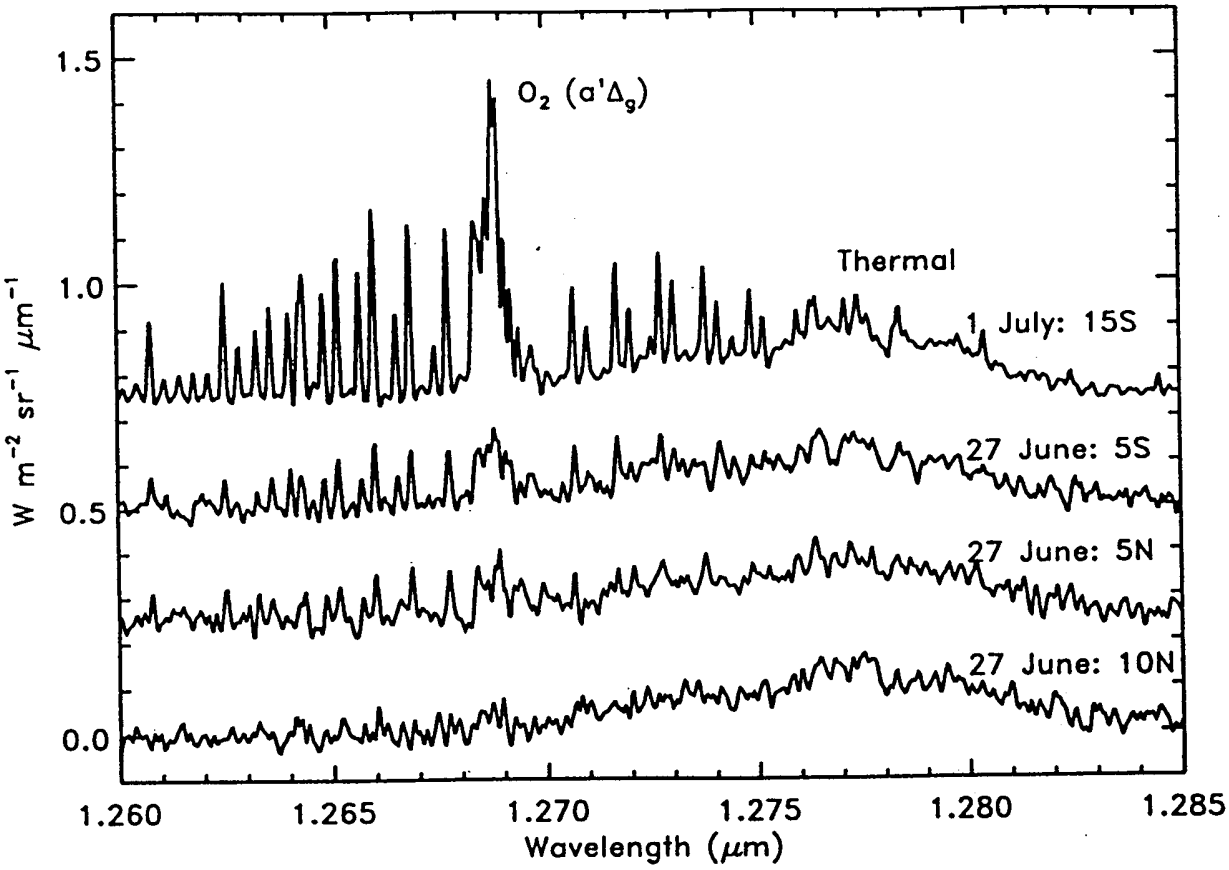
Need to understand how the data has been treated

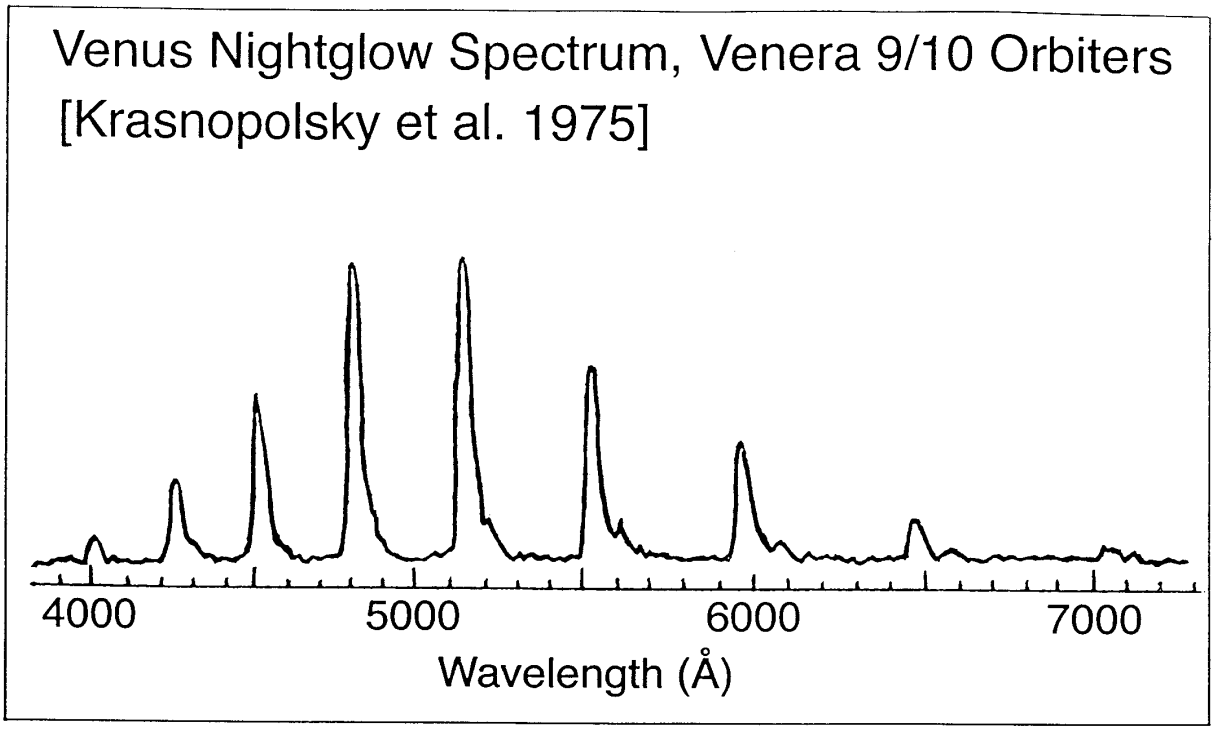
You can't always get what you want

CONCLUSIONS

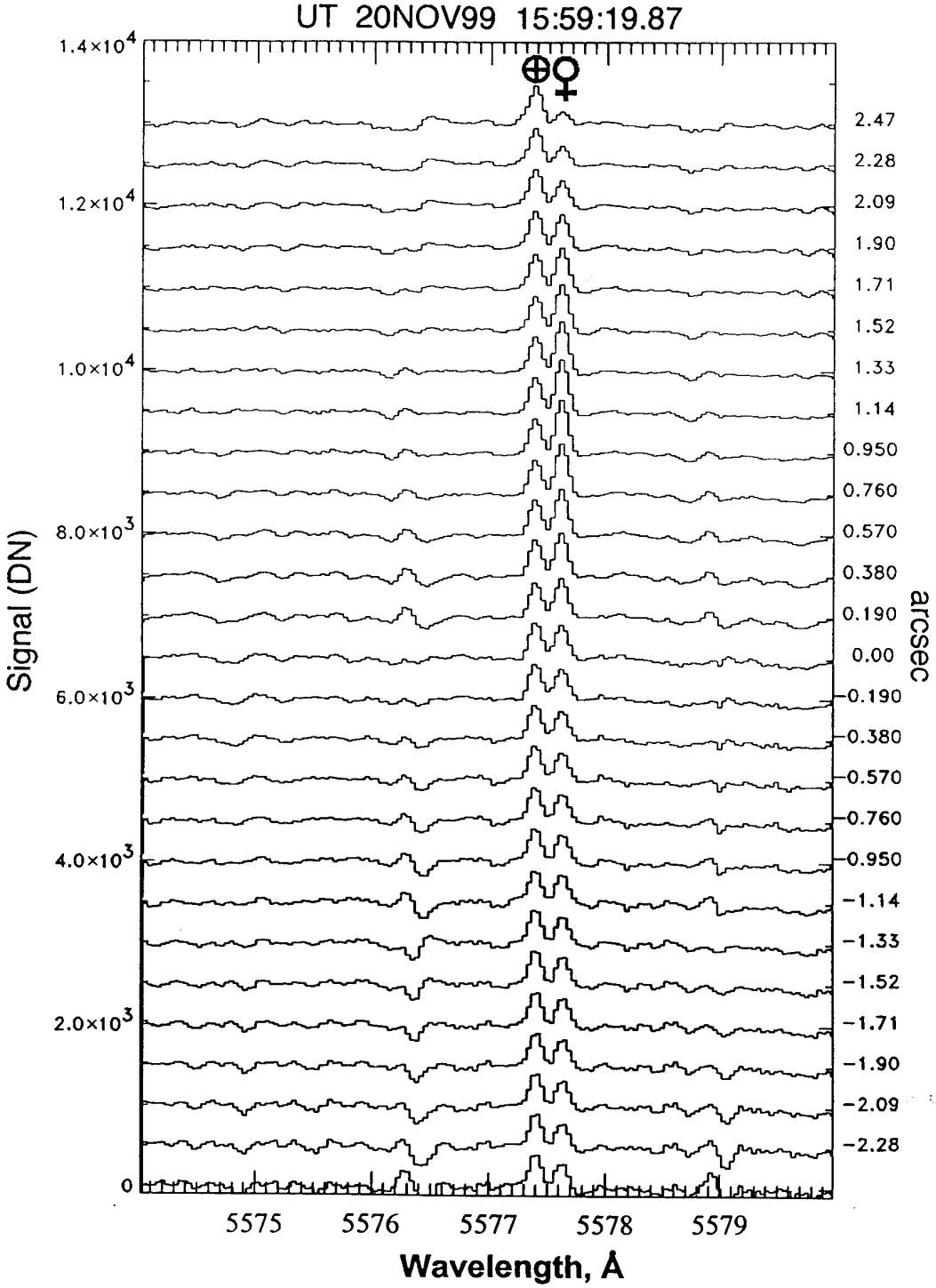
- Terrestrial sky spectra are an existing asset for aeronomers
- There is global coverage at mid- to low-latitudes
- As survey vehicles, sky spectra are unsurpassed
- Broad spectral range provides the Big Picture
- Optical resolution provides the Little Picture
- Aeronomy community must find ways to use such instruments for planetary work

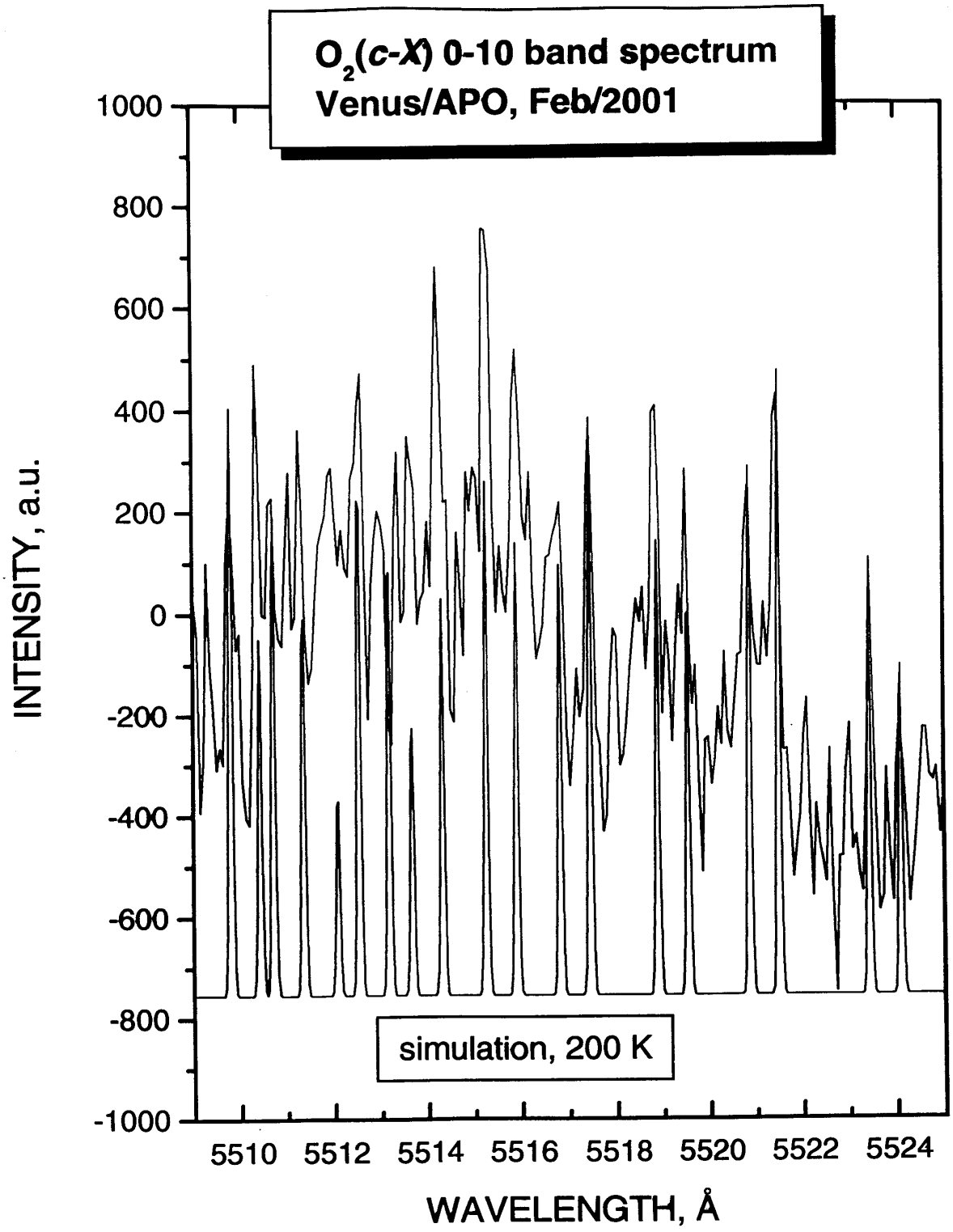
SPECTRA OF THE $O_2(a^1\Delta g - X^3\Sigma \tilde{g})$ IR ATMOSPHERIC 0-0 BAND IN THE VENUS NIGHTGLOW (CFHT, 1991) [Crisp et al., 1996]

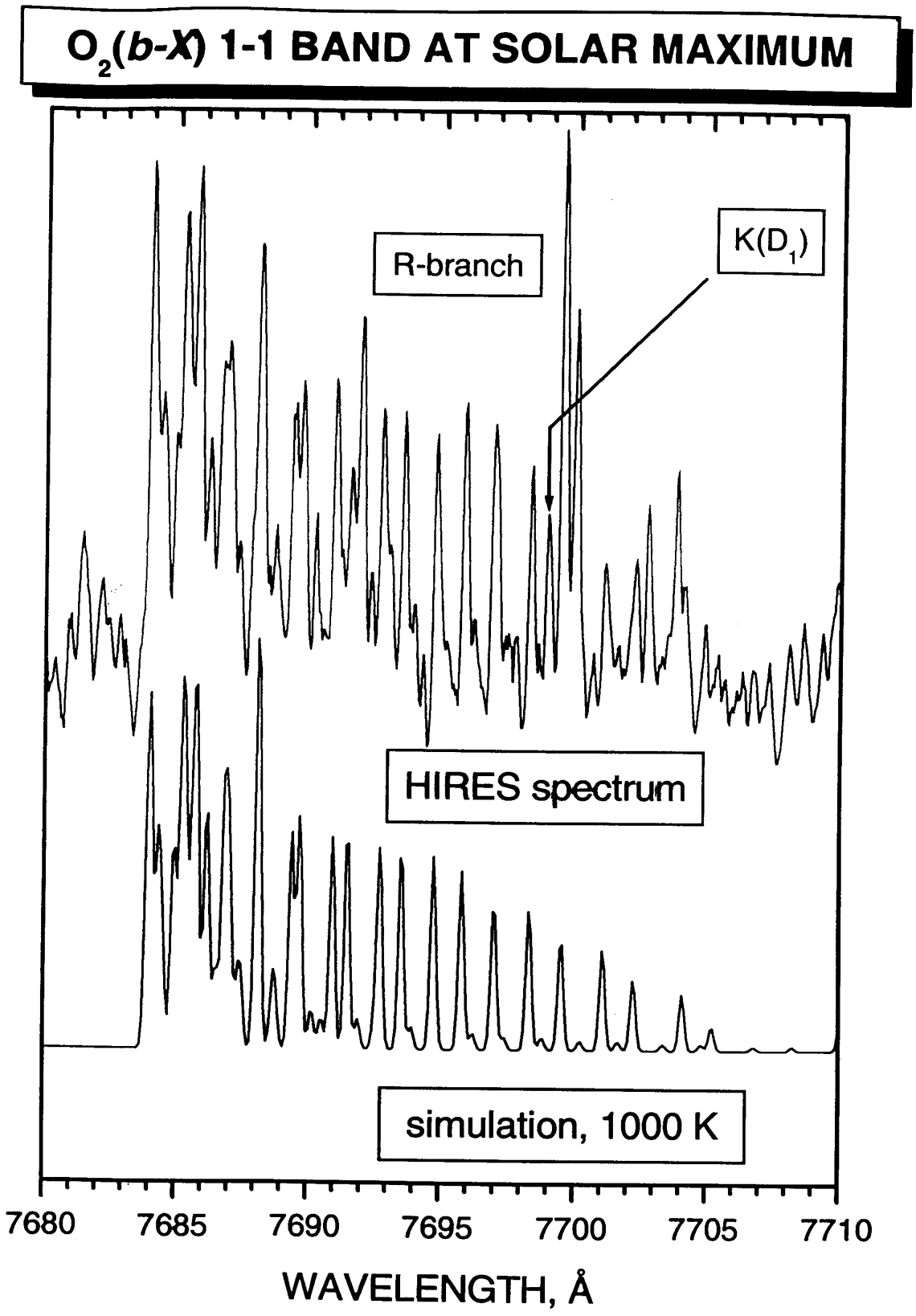


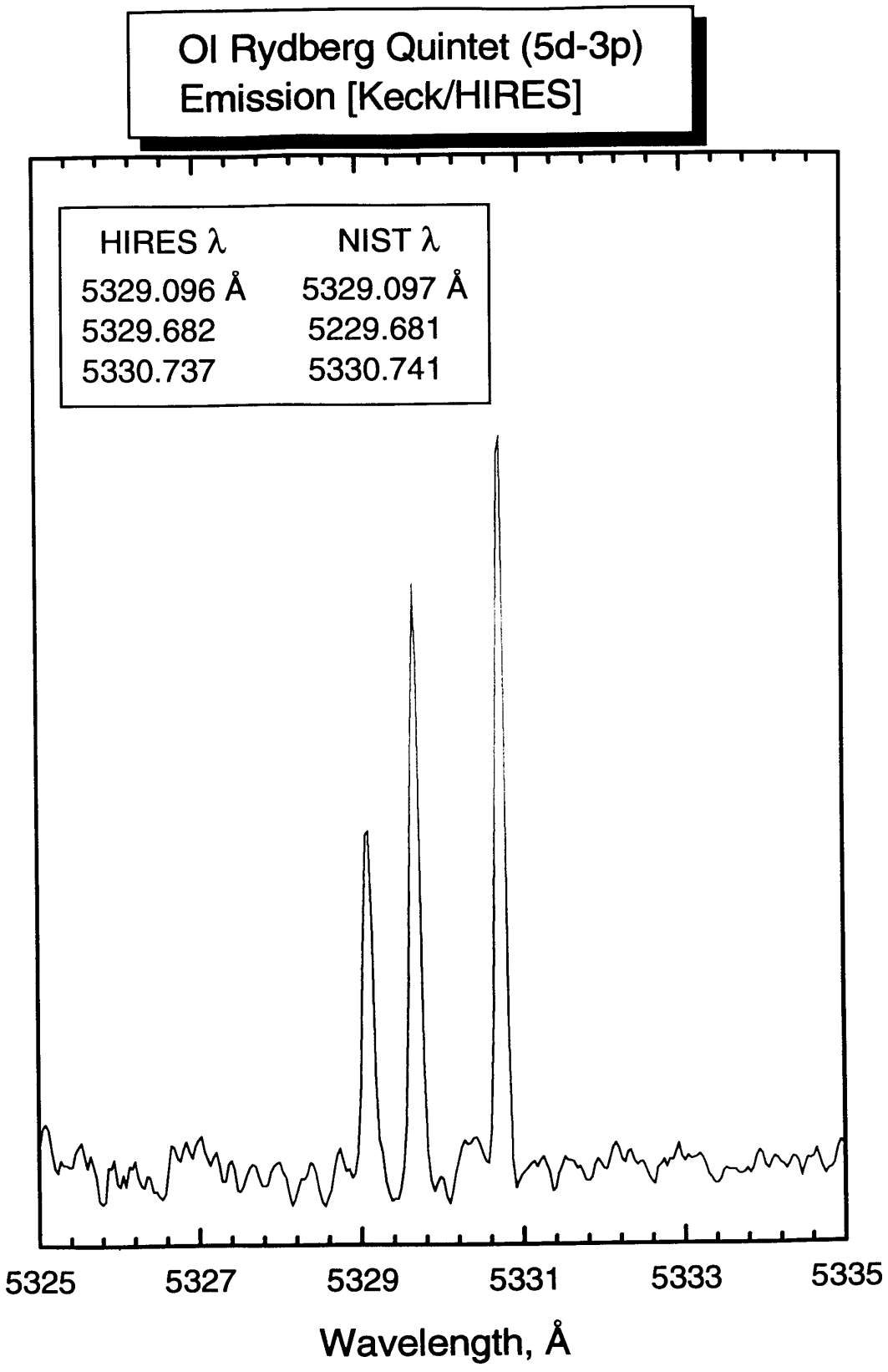

Venus Nightglow Spectrum, Venera 9/10 Orbiters
[Krasnopolsky et al. 1975]
4000
5000
6000
7000
Wavelength (Å)

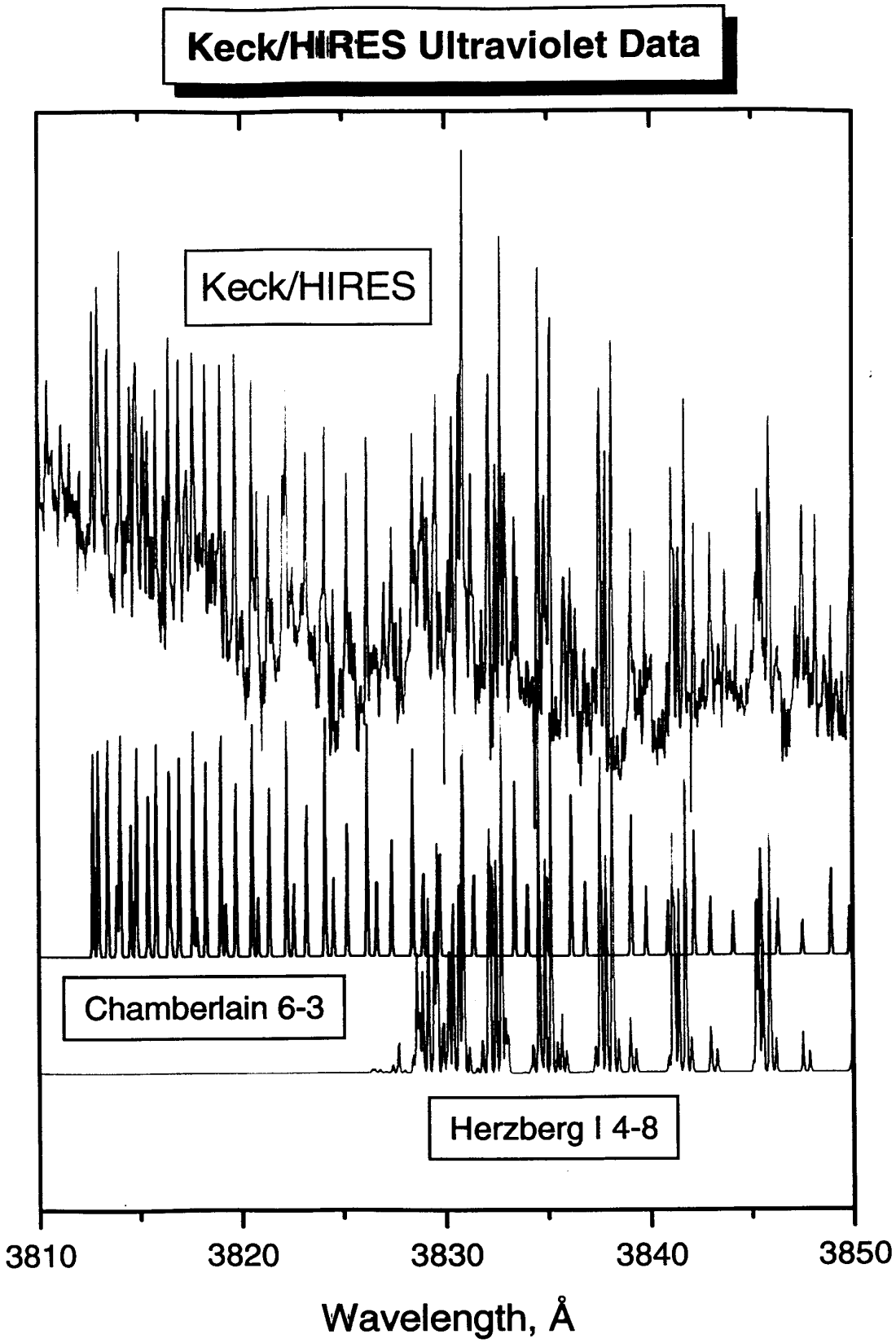
OXYGEN GREEN LINE SPECTRA FROM KECK/HIRES, VENUS AND TERRESTRIAL

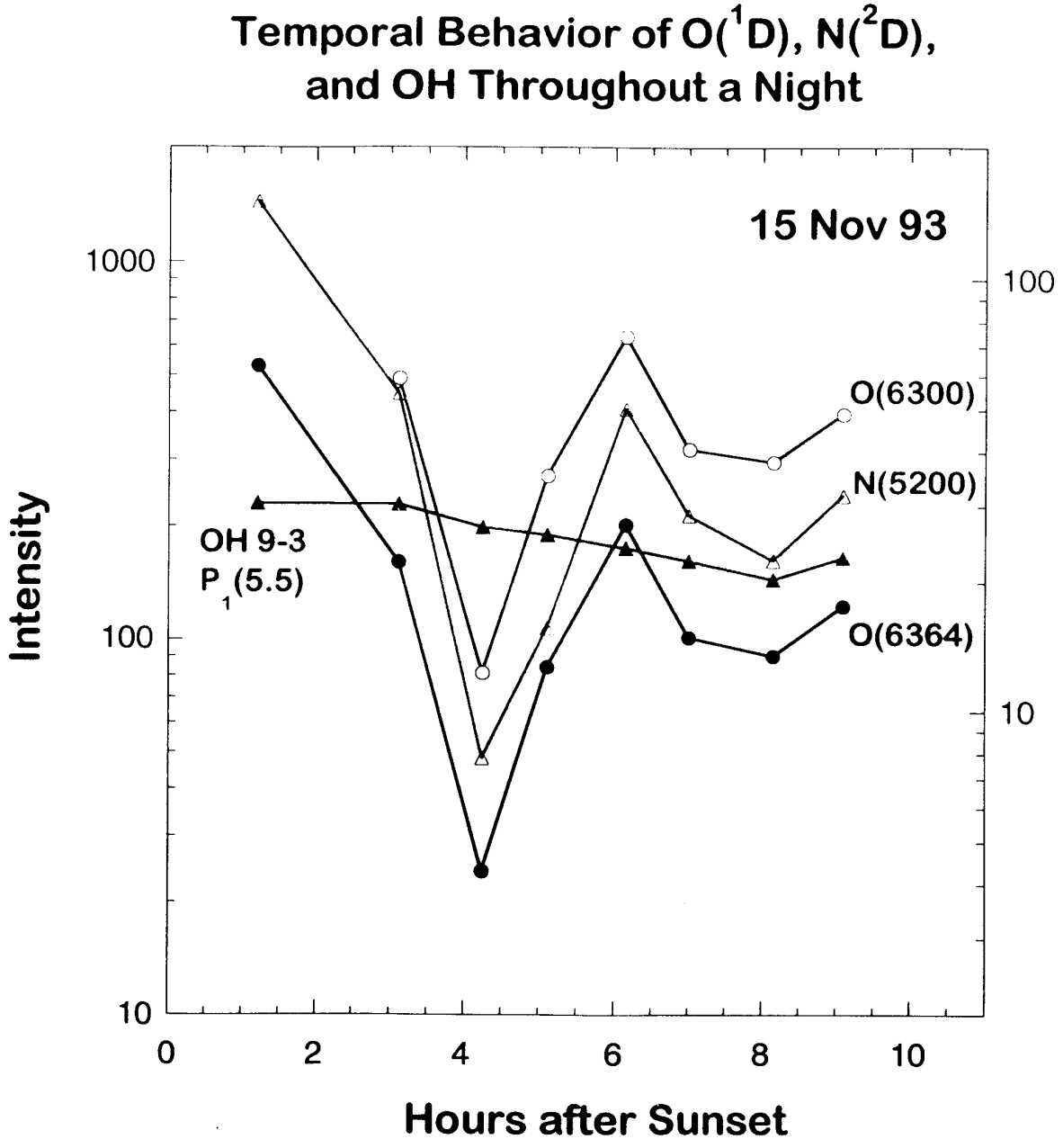



O2(c-X) 0-10 band spectrum
Venus/APO, Feb/2001
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
INTENSITY, a.u.
simulation, 200 K
5510
5512
5514
5516
5518
5520
5522
5524
WAVELENGTH, Å


O2(b-X) 1-1 BAND AT SOLAR MAXIMUM
R-branch
K(D1)
HIRES spectrum
simulation, 1000 K
7680
7685
7690
7695
7700
7705
7710
WAVELENGTH, Å


OI Rydberg Quintet (5d-3p)
Emission [Keck/HIRES]
HIRES λ
NIST λ
5329.096 Å
5329.097 Å
5329.682
5229.681
5330.737
5330.741
5325
5327
5329
5331
5333
5335
Wavelength, Å


Keck/HIRES Ultraviolet Data
Keck/HIRES
Chamberlain 6-3
Herzberg I 4-8
3810
3820
3830
3840
3850
Wavelength, Å


Temporal Behavior of O(1D), N(2D), and OH Throughout a Night
15 Nov 93
1000
100
10
100
10
Intensity
O(6300)
N(5200)
OH 9-3
P1(5.5)
O(6364)
0
2
4
6
8
10
Hours after Sunset

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