NORTHERN LIGHTS

NORTH CENTRAL REGION

*Published quarterly in January, April, July and October
*Subscriptions $2.50 per year
*Send all inquiries to Ray Wendt, Editor, 4834 N. 70th St., Milwaukee, WI 53218

VOLUME XVII | JANUARY 1988 | NUMBER 1

Herschel: The Discovery of Uranus

Can you name the last planet you have seen? Mighty Jupiter, red Mars, the blinding disk of Venus, the majestic rings of Saturn? What about Uranus, Neptune or faint Pluto? While I saw Uranus at the 1987 Texas Star Party easily with no optical aid, the last three are generally telescopic objects. If they are so faint, how were they discovered? Were they found by systematic search, using complex orbital mechanics and advanced mathematics or just blind luck? Well, actually all three! While the discovery of each planet has its own detective story, I want to tell you about Uranus and leave it up to you which method applies.

By 1781, Herschel was becoming a skilled telescope maker. He had recently completed a 7 foot reflector of 6.3" aperture and was using it to make a systematic survey of the entire visible heavens to increasingly fainter magnitudes. During the second such survey, he came across an object which only Herschel, with his increasing observational experience and superior telescopes, could resolve. He was looking in Gemini and... well, allow me to let Mr. Herschel tell the story; go ahead, Bill.

> "On Tuesday, the 13th of March, between ten and eleven in the evening, while I was examing the small [dim] stars in the neighbourhood of H Geminorium, I percieved one that appeared visibly larger than the rest; being struck with its uncommon magnitude [size], I compared it to H Geminorium and the small star in the quartile between Auriga and Gemini, finding it so much larger than either of them, suspected it to be a comet.
>
> The power I had on when I first saw the comet was 227. From experience I knew that the diameters of the fixed stars are not proportionally magnified with higher powers, as the planets are; therefore I now put on the powers of 460 [!] and 932 [!!] and found that the diameter of the comet increased in proportion to the power, as it ought to be...while the stars preserved that luster and distinctness which from many thousand observations I knew they would retain."

The paper this account appeared in was given an unexciting title -- "Account of a Comet" -- because Herschel thought it was unexciting. Several observers, including the "ferret of comets" himself, Charles Messier, had discovered dozens of comets, so why should he think this one was any different?

The actual nature of the object was three or four months in coming as the object's movements were monitored. Astronomer Lexell was one of the first to recognize that the object was no comet, but a planet orbiting the Sun in a nearly circular path about 19 times farther than that of earth and twice that of Saturn!

Herschel was able to tell this object was not a mere star -- AT A GLANCE! A fine testiment to the quality of his telescopes and the observational experience of the observer. Later checks of past positions of Uranus have shown that it was plotted as a fixed star on two atlases and seen, but not recognized, by other "professional" astronomers. Even after its discovery, other astronomers with larger refractors (6-9 inches diameter) reported they could

not identify it! The discovery involved the use of a telescope "of an optical perfection barely credible to contemporary opticians and astronomers, and was in the hands of an observer of such great experience..."

Think of it! No new planet had ever been discovered in historical times so Herschel's achievement is absolutely unique! Even the discovery of planetary satellites, begun with Galileo's epoch making discovery of the four Jovian satellites, ended in 1684 when Cassini discovered a pair of Saturn's moons, Tethys and Dione. It was to be Herschel himself that would resurrect the string by discovering a total of 4 new satellites by 1789.

What effect did the realization that the object was, in fact, a planet have? By this time, Herschel had published two or three scientific papers, so he was known locally in England. Proof of his obscurity to Continental European astronomers is best shown in the ways his name was spelled; Hertschel being one of the closer spellings, Merstnel the worst. (Shades of Hailey, or is it Haley or Haily (Hawley??)....)

Obscurity was not to be one of Herschel's problems from then on. Many distinguished visitors called on him, the Astronomer Royal, Nevil Maskelyne, being among them. By the end of 1781 he was elected a Fellow of the Royal Society, a prestigious honor indeed! He also recieved the Society's highest medal. To top it all off, the following spring he was summoned to the Royal Court to exibit himself and his telescopes to King George III. The outcome was the event that REALLY changed Herschel's future. From the King he recieved an appointment as royal astronomer (not Astronomer Royal) with an annual pension of 200 pounds English. With it, he was able to give up teaching music for a living and devote his seemingly boundless energies to making astronomical discoveries, and discover he did. It probably was the best 200 pounds the King ever spent! Remember, Herschel now is 43 years old!

The naming of the planet Uranus is an interesting one, as is the story behind Pluto's. Being the discover, Herschel had the right to name the new planet. Being the genius that he was, he decided to name it "Georgium Sidus', latin for George's Star, an obvious tribute to his royal patron, George III. I have seen a book or two that make reference to "Georgium Sidus", but the Continental astronomers took objection to the blatant political reasons for the name. At first it was suggested that the planet be called "Herschel", but shortly later it was agreed to name the body in the same manner as the others, so Uranus was proposed and accepted.

But wait just a minute!! How did Herschel get himself into this "mess", anyway? What was he doing snooping around in Gemini? Did he know something that others didn't, or was he looking for something? As a matter of fact, he was. But now I'm getting ahead of myself...

A SIMPLE 8" MIRROR TEST

An 8" telescope is supposed to resolve detail down to 0.57 arcseconds. Double star tests have always been the supreme test of optical quality, even beyond any beyond any bench tests. The stars do not lie. If you are interested in star testing your 8" optics to see if they perform to Dawes' Limit of Resolution, then these doubles listed below are for you. Both of these doubles are separated by 0.6 arc-seconds, and therefore should be split by a quality 8" mirror. Just use the R.A. and Declination for the double and the corres-ponding Sky Atlas 2000 map chart to easily locate these doubles.

DOUBLE STAR	R.A.	DEC	MAG.	SKY ATLAS
7 Tauri	3 34.4	+24 28	6.6,6.7	Chart 4
4 Aquari	20 51.4	-5 38	6.4,7.2	Chart 16

Note: 7 Tauri lies about 2 degrees east of Pleiades.

4 Aquari lies about 7 degrees northeast of Saturn Nebula and is not to be confused with 5 Aquari (very nearby) and brighter than the double.

Longest exposure that will give sharp images without a clock drive
These times apply to any celestial object.

Effective focal length range (mm)	For critical work (in seconds)	Where some blur is tolerable (in seconds)
90–180	2	8
180–350	1	4
350–700	1/2	2
700–1500	1/4	1
1500–3000	1/8	1/2
3000–6000	1/15	1/4
6000 and up	1/30	1/8

Focal length (mm)	Field of view (on 35-mm film	Moon image (mm)	Jupiter image	
			on film (mm)	on ×15 enlargement (mm)
400	3.4° × 5.2°	3.6	–	–
500	2.7° × 4.1°	4.5	–	–
600	2.3° × 3.4°	5.4	–	–
700	2.0° × 2.9°	6.4	–	–
800	1.7° × 2.6°	7.3	–	–
1000	1.4° × 2.1°	9.1	0.2	3.0
1250	1.1° × 1.7°	11	0.25	3.8
1500	0.9° × 1.4°	14	0.3	4.5
2000	41′ × 62′	18	0.4	6.0
2500	33′ × 50′	23	0.5	7.5
3000	28′ × 41′	27	0.6	9.0
4000	21′ × 31′	36	0.8	12
5000	17′ × 25′	45	1.0	15
6000	14′ × 21′	55	1.2	18
8000	10′ × 15′	73	1.6	24
10 000	8.3′ × 12′	91	2.0	30
12 000	6.9′ × 10′	109	2.4	36
14 000	5.9′ × 8.8′	127	2.8	42
16 000	5.2′ × 7.7′	145	3.2	48
18 000	4.6′ × 6.9′	164	3.6	54
20 000	4.1′ × 6.2′	182	4.0	60

Field of view, moon image size, and Jupiter image size for a variety of focal lengths

SPECIAL THANKS TO:

LEE KEITH
TOM QUINN
REFLECTIONS

DEADLINE FOR NEXT ISSUE:
APRIL 1, 1988
NOTE: NORTHERN LIGHTS NOW PUBLISHED IN JANUARY, APRIL JULY, OCTOBER. ARTICLES OF AN ARGUMENTATIVE NATURE ARE WELCOME FOR "COMMENT CORNER".

Expected magnitude limit in a 5-minute exposure on ISO 200 film (assuming a 50-mm f/2 lens reaches magnitude 10.0)

Lens	Approximate diameter	Magnitude limit
400-mm f/5.6 300-mm f/4 200-mm f/2.8	70 mm	12.2
300-mm f/5.6 200-mm f/4 135-mm f/2.8 100-mm f/2	50 mm	11.5
200-mm f/5.6 135-mm f/4 100-mm f/2.8 75-mm f/2	35 mm	10.7
100-mm f/4 75-mm f/2.8 50-mm f/2	25 mm	10.0
75-mm f/4 50-mm f/2.8 35-mm f/2	18 mm	9.3
50-mm f/4 35-mm f/2.8 28-mm f/2	13 mm	8.6
35-mm f/4 28-mm f/2.8 24-mm f/2.8	9 mm	7.8
28-mm f/4 24-mm f/4 18-mm f/2.8	6.5 mm	7.0

PUNS, QUIPS AND QUOTES:

"If I have been able to see farther than others, it was because I stood on the shoulders of giants." ---Sir Isaac Newton

"And in today already walks tomorrow."
---Samuel Coleridge

"Our lifetime may be the last that will be lived out in a technological society."
---Isaac Asimov

"I'd rather wake up in the middle of nowhere than in any city on earth."
---Steve McQueen

STAR FIND

A B V Y Z H O I A D M N A L E M B C A D L S U P O N A C A N
V L A V U T M I R Z A M I V Z A C A I E D L Q O P O N I A O
O P O E A C C T X L H R C A M L D B A Y M E B S U T A N W E
Q A W B C R P D H C E A L U L H O O I X M I E R W V T O Z N
A D R V E P W B X U L L U P O E U P I Y N Q H A O A C I P S
L L E B C N M C V P U X Z C D N E R T E Z A C T R R A G I T
E P M A B C E D B C A P H W G A T C G L W D P E A M S K N A
R V C A L M N D H H L I T U V A B L T D S S S L V L E G I R
T L A B C O E U A V P A L B L C A L D E B A R O N M G A N U
Q D Z A V H Z L P E H L H L C A L X G H Q M P W S Q I Z T C
P P D V E C A Q R W E T E M P O D R C N A N I L A K N E M H
N V Z Q W X C M E Z R B N P E R E C Y M V H A A K P U B C B
M E I S S A S D A V A P D C T L R R A N R E H C A S S P R A
E R C O P I T Z Y L T C E A L I A I R A I R G A E P O U I H
C D A K U O R G A T Z J L S P E M A F M L I Y A S J P K N O
A B C R A L H I F Y H L E T O C I S A I P H A L S R T H D T
P O L A R I S V U W L G P O X D N H P R O R K E T R E Z R A
E M A D E U L V R S I Z T R W P I T E F T V O O G U U B U H
L I U J L N M I U E H C A B A C N E T A T I K P H E W C V T
L Y O U U I I E D I Q M E P M D I H I K R H J A U D U V E A
A I G D N P R S O Y A S T K Z R E O S U E N O M I S T X S N
U E G T J O A F R C G L U X O N I H A L R Y E C P B G A U L
R D A U D E E M A S B O N J Q T W I C O N Z J B A W R P E E
B K U K L X W P M V V K P I L A K J U S H E R A T A N N G C
A A H C T K L G A C T O A M T H K A H P G A E S K G D F L T
Z O B A L G O L W B L Y E R F A C T F K Q S C N Z H T U E M
E M O N E P O L G U T D U K U F K H Z B O M E R Q N H E T F
Y K N A G B W O S U R U T C R A O P A L O M N O R S O P E P
S A K N A C T B A W Z T U O I T Z A Z E B M M C N U B C B T

STAR FIND STARS

ACAMAR
ACHERNAR
ALDEBARON
ALDERAMIN
ALGENIB
ALGOL
ALHENA
ALMACH
ALNITAK
ALPHERATZ
ALTAIR
ANKAS
ANTARES
ARCTURUS
ARNEB
ATIK
BELLATRIX
BETELGEUSE
CANOPUS
CAPH
CAPELLA
CASTOR
CURSA
DENEB
DENEBOLA
ELNATH
FURUD
HAMAL
MEBSUTA
MEISSA
MENKALINAN
MENKAR
MINTAKA
MIRA
MIRFAK
MIRZAM
NIHAL
POLARIS
PROPUS
PULLUX
REGULUS
RIGEL
RUCHBAH
SAIPH
SCHEDAR
SEGINUS
SHERATAN
SIRIUS
SPICA
VEGA
ZAURAK