

# Why Double Stars ??!!

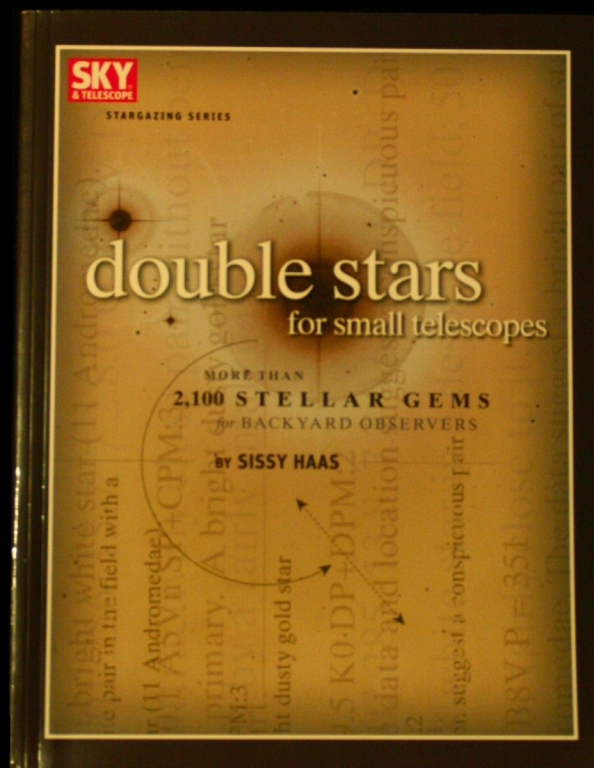


STFA 43 - Albireo

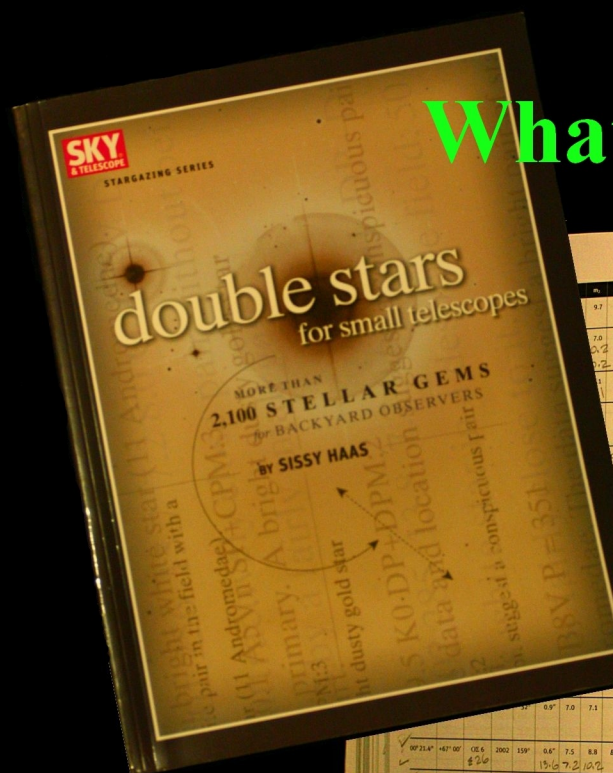
**Why Double Stars ???!**



*Because They are There ??*



# What... no pictures ??

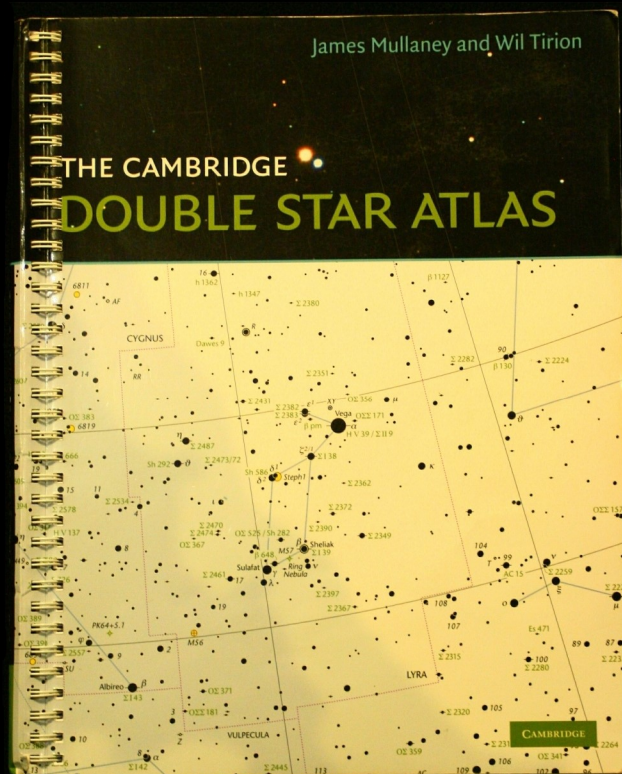


RA	Dec.	Name	Year	P.A.	Sep.	m <sub>1</sub>	m <sub>2</sub>	Spec.	Status	Comments
04°10.0'	+00°42'	S401	2004	138°	0.8"	5.6	6.3	0801 AAV	p-372 pr	125-mm, 200x. Profoundly rigorous! A brilliant snow-yellow star with the outer edge of another star coming out of it. They look like two stars that are almost, but not quite, one.

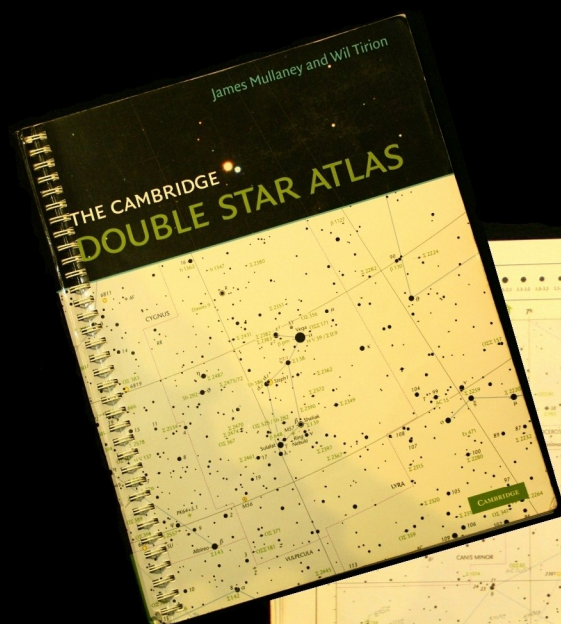
  

RA	Dec.	Name	Year	P.A.	Sep.	m <sub>1</sub>	m <sub>2</sub>	Spec.	Status	Comments
00°21.9'	-23°00'	R 1957								
		A 961	1999	26°	6.0"	7.7	9.1	60	binary	Gould, 175 mm. An "attractive uneven pair, golden yellow and dull red, in a field of scattered stars."
00°27.7'	-18°25'	A 1968	2003	233°	31.1"	7.3	8.0	PEV		Gould, 175 mm, 45x. An "easy wide pair in a thin field, deep yellow and dull yellow."
00°30.8'	-09°07'	12 Cr								
		A 8	1998	200°	11.0"	6.0	10.8	WU11		Smyth, A "triple yellow, bright blue... beautiful, but more difficult to see."
00°34.5'	-04°33'	S 29								
		A 6 C	2000	45°	19.8"	7.1	8.6	G19		Gould, 175 mm, 45x. A "quite good. This is a larger star in a thin field - a mid-yellow star with a wide and easy, dull yellow companion. Webb, "Yellow white, bluish."
00°52.2'	-22°31'	Stage 3	2000	249°	1.9"	7.6	8.4	PEV	p-binary	Gould, 175 mm, 45x. A "light yellow pair, with a faint companion to the south, the field is sparse."
00°52.7'	-24°00'	B 734	1998	347°	10.8"	5.6	5.6	K101		Gould, 175 mm, 100x. "Nice effect. This bright golden star has a small companion near, and moderate stars are scattered in the field." Ferguson, 150 mm. "Yellow white, very faint blue."
00°53.2'	-24°47'	WNO 1	2002	7°	5.4"	6.6	9.2	PEV 9	binary	Gould, 175 mm, 100x. An "elegant uneven pair, pale yellow and dull brown; some moderate stars in the field (about 1" north is a 5th-magnitude star)."
00°58.2'	-15°41'	S 390	2002	216°	6.4"	7.8	7.9	PEV 7	binary	Gould, 175 mm, 45x. An "easy, bright, and attractive even pair, pale yellow in color; the field is thin, with a scatter of moderate stars."
00°59.4'	-00°47'	S 20	2003	337°	28.3"	7.8	9.0	K101 III		"The data suggest an exactly spotted pair, about 1 1/2" west-southwest of 26 Cr1 (below). Gould, 175 mm, 45x. An "easy wide pair, deep yellow and only, in a broad scatter of stars."
01°03.8'	-01°22'	26 Cr1	2003	254°	15.9"	6.1	9.5	F19		Gould, 175 mm, 45x. An "easy and attractive wide pair. It is a bright light yellow star with a dull, spectral (possibly yellow) companion." Smyth, "Pale yellow, blue tint." Webb, "Pale yellow, blue."
01°07.2'	-01°44'	S 31	2002	316°	4.6"	7.4	8.6	PEV	binary	Gould, 175 mm, 45x. "Good pair. A fairly close pair, light yellow in color, in a moderately starry field."
01°08.8'	-10°15'	η Car	2003	305°	257.7"	3.6	10.5	K1301		Smyth, "A bright star with a companion in a barren field... yellow, field."





# Ahh ..... Charts !!











# What constitutes a "double star" ??

HJ 3945



Guess what .... a double star !!

NGC 2169 aka STF 848 + STF 844  
"37 Cluster"







## Aladin Sky Atlas - Univ. of Strasbourg



**A digital sky image generated on "Aladin"  
from the "University of Strasbourg" website.**

**So .... what am I going to offer here ??**

**I am going to pull back one or two layers of  
a very large onion that I call,**

**"double Star Astronomy"**

**To do otherwise would be impossible in a  
single lecture !!**

**The Disclaimer !!**

**I am no expert on the subject and would suggest that  
I know enough to be slightly dangerous and quite  
prepared to be having to extract my foot from my mouth !!**



# The Goal !!

**To hopefully excite many of you into taking up an interest that has provided me with literally thousands of hours of fascination and learning and the opportunity to "contribute" !!**

HJ 607 + HJ 608 aka Algedi  
HJ 2943

## The Ancients

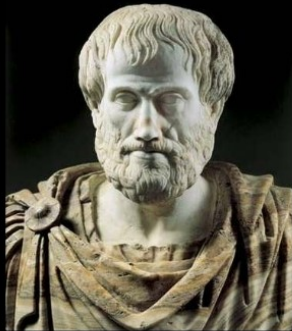
<b>Aristotle</b>	<b>Greek</b>	<b>384 - 322 BC</b>
<b>Aristarchus</b>	<b>Greek</b>	<b>310 - 230 BC</b>
<b>Hipparchus</b>	<b>Greek</b>	<b>190 - 120 BC</b>
<b>Ptolemy</b>	<b>Greek</b>	<b>85 - 165 AD</b>

## The Renaissance

<b>Copernicus</b>	<b>Pol-Germ</b>	<b>1473 - 1543 AD</b>
<b>Tycho Brae</b>	<b>Danish</b>	<b>1546 - 1601</b>
<b>Galileo</b>	<b>Italian</b>	<b>1564 - 1642</b>
<b>Johannes Kepler</b>	<b>Germ.</b>	<b>1571 - 1630</b>

## The Age of Enlightenment

<b>Sir Issac Newton</b>	<b>English</b>	<b>1642 - 1727</b>
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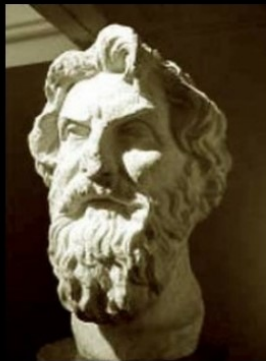


Britannica.Com

## Aristotle

384 - 322 BC

Greek philosopher who proved the Earth was spherical and believed Earth was the centre of the Universe.



totallyhistory.com

## Aristarchus

310 - 230 BC

Greek philosopher who was the first person to suggest that the sun was the centre of the Universe, a full 1.750 years before Copernicus did !

His theory was considered far too radical !!



en.wikipedia.org

## Hipparchus

190 - 120 BC

- Greek mathematician who is considered the greatest of all the ancient astronomers.
- He compiled the first known star catalogue.
- He devised what may be the first known scale • to define the brightness of stars.
- He measured the earth to moon distance to be 29.5 Earth diameters. Phenomenal for the day when one considers the actual measurement to be 30.
- Perhaps his greatest discovery was that of the wobble of the earth's axis, caused by the gravitational pull of the moon and sun !





en.wikipedia.org

## Ptolemy

85 - 165 AD ?

- Mathematician & astronomer of Greek decent living in Eygypt.
- Using the extensive observations of Hipparchus, developed a model that predicted the movement of the sun, moon, planets and stars on an "Earth Centered" universe. This model was one of the longest upheld scientific theories in history and the cornerstone of astronomy for 1500 years.

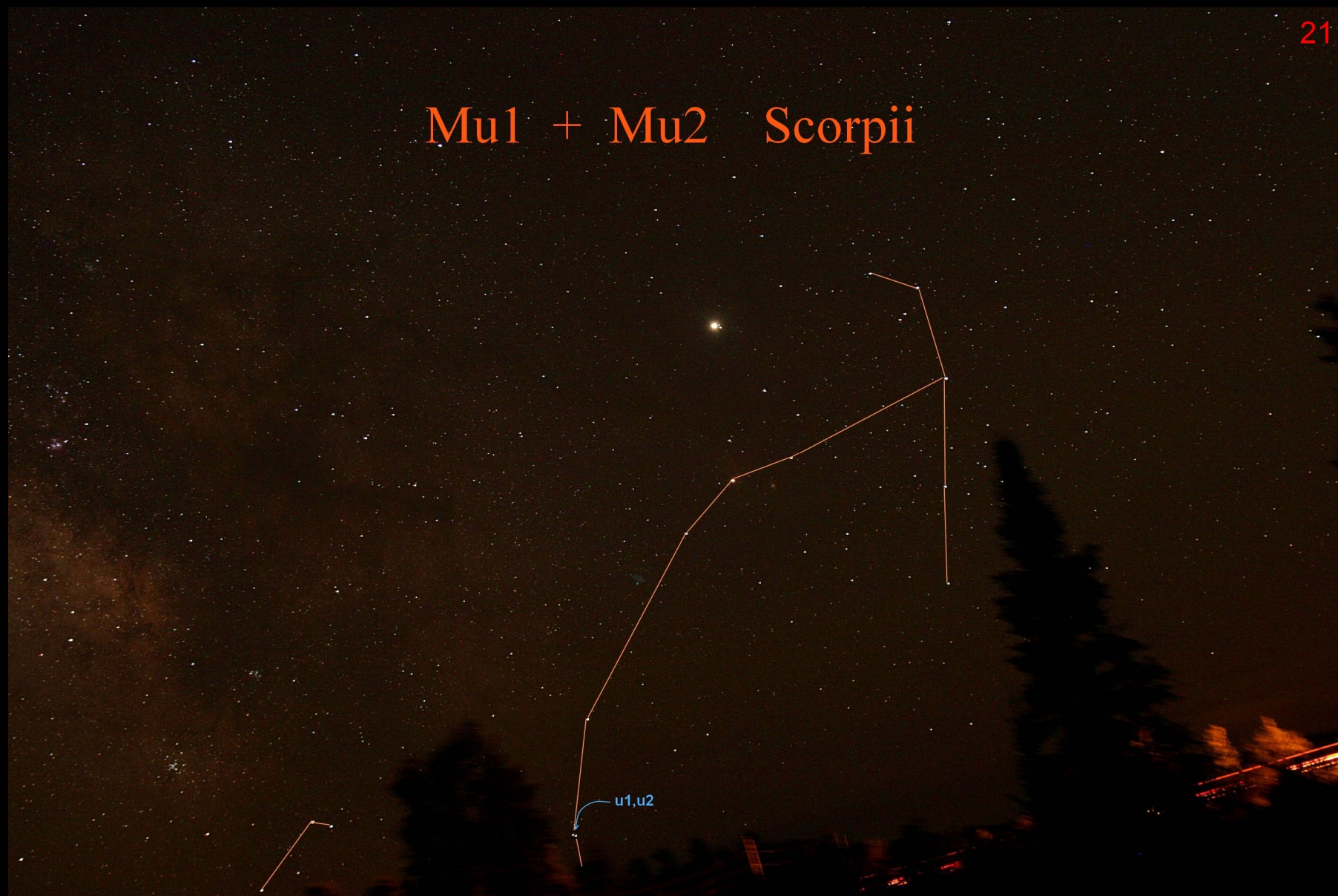
With Ptolemy, we get the first references in  
written form of a curiosity for

"Double Stars" !!

HJ 3780



# Mu1 + Mu2 Scorpii

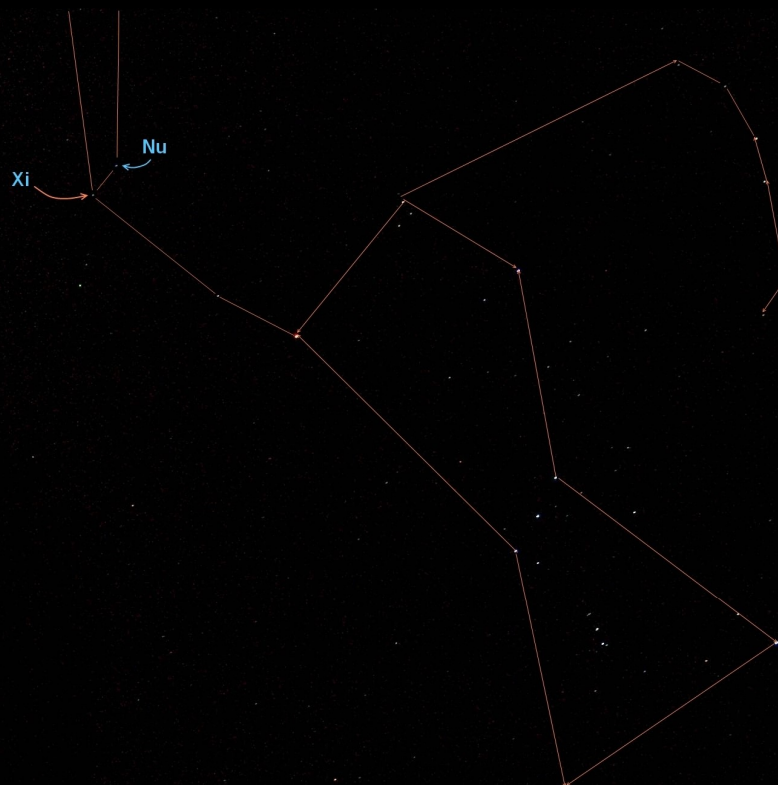




# Nu1 + Nu2 Sagittarii

v1,v2





Xi + Nu Orion



# Mu1 + Mu2 Scorpii

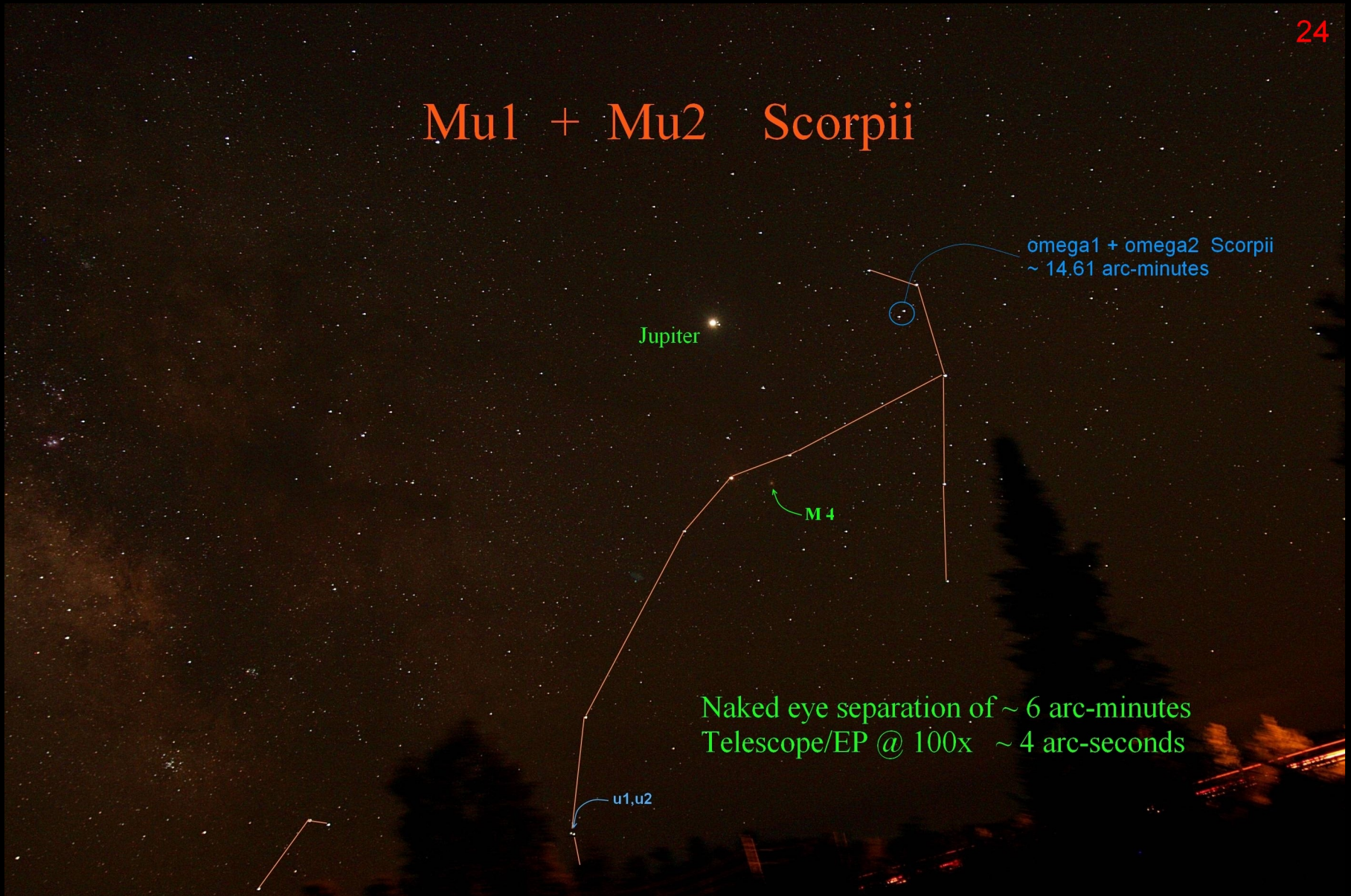
Jupiter

omega1 + omega2 Scorpii  
~ 14.61 arc-minutes

M 4

Naked eye separation of ~ 6 arc-minutes  
Telescope/EP @ 100x ~ 4 arc-seconds

u1,u2



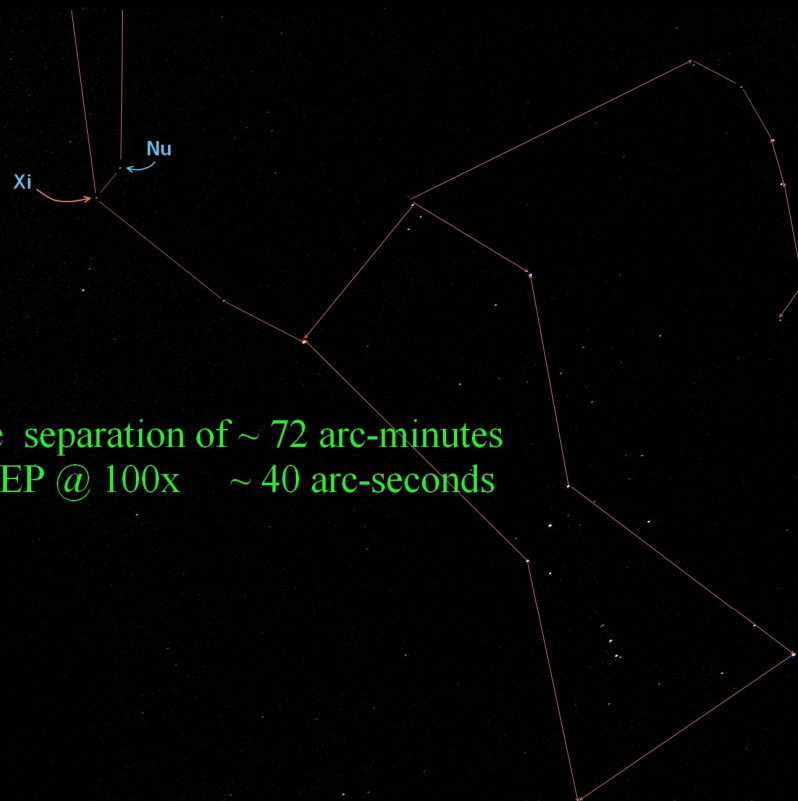


# Nu1 + Nu2 Sagittarii

Naked eye separation ~ 14 arc-minutes  
Telescope/EP @ 100x ~ 9.5 arc-seconds

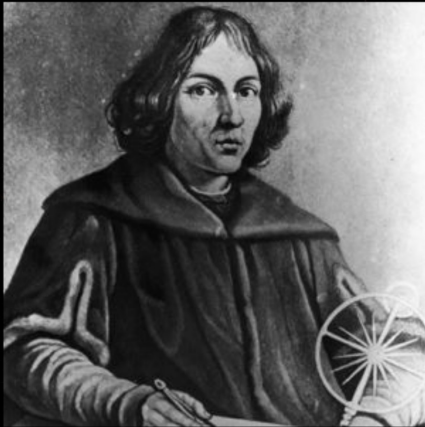






Naked eye separation of ~ 72 arc-minutes  
Telescope/EP @ 100x ~ 40 arc-seconds

Xi + Nu Orion



Biography.com

## Nicholaus Copernicus

1473 - 1543 AD

- Mathematician and Astronomer
- A Renaissance thinker of Polish-German heritage who turned the world upside down with his "Sun Centered" model of the Universe in his book ,
  - "De Revolutionibus Orbium Coelestium"
  - (on The Revolutions of the Celestial Spheres)
- Polyglot and Polymath ... he was a "Universal Man", his expertise spanned many disciplines including canon law, astronomy, medicine, the classics, translation, politics, economics and mathematics.



Biography.com

## Tycho Brahe

1546 - 1601

- Danish Astronomer who made the most accurate celestial observations of his time.
- In 1575, the King of Denmark enticed the now famous Brahe to stay in Denmark by offering him his own island and financial support for his research in astronomy.
- Brahe was not a supporter of the Copernican "Sun Centered" universe but rather postulated that the Sun and Moon orbited the earth while the 5 planets orbited the Sun.
- His contributions to astronomy were enormous.
- He designed & built instruments that revolutionized astronomical instrumentation.





en.wikipedia.org

## Galileo

1564 - 1642

- Italian polymath .... central figure in the transition from Natural Philosophy to Modern Science and in the transformation of the Scientific Renaissance into a Scientific revolution.
- Galileo supported the Copernican "Helio - Centric" model of the universe, but unlike Copernicus, was considered a heretic and spent his later years under house arrest.
- Built his first telescope in 1609 based on the design of a Dutch optician. Upon turning his new telescope to the heavens later that year, his new discoveries included the four brightest moons of Jupiter, the phases of Venus and began the analyses of sun-spots. He also discovered something unusual about Saturn but his telescope lacked the power to discern the true nature of the rings.



en.wikipedia.org

## Johannes Kepler

1571 - 1630

- Tycho Brahe's assistant and student
- Building on the detailed and accurate astronomical records, he developed his 3 laws of Planetary Motion.
- He believed in the Copernican "Helio-Centric" universe but could not reconcile Brahe's observations to fit a circular orbit. With a slight adjustment to an elliptical orbit he found that Brahe's observations could be better explained. This led to his first law of planetary motion.
- He invented an improved version of the refracting telescope which is referred to the "Keplerian Telescope".
- Kepler was a much sought after astrologer. At this time, there was no clear distinction between astronomy and astrology.
- In spite of a long working relationship between Kepler and Tycho Brahe, Brahe was very protective of his records thinking that Kepler would cheat him out of any financial gains.

## Johannes Kepler

cont'd

- From the Tycho Brahe data/measurements, Kepler developed "Rudolphine Tables" which provided the data to calculate planetary positions for any past or future date.
- He was born pre-mature and was a sickly child throughout his youth. But his sharp mathematical mind impressed all those who came in contact with him.
- A childhood bout of small-pox left him with weak vision and crippled hands, limiting him in the observational aspects of astronomy.

" Though frail of body, but robust in mind and spirit, Kepler was scrupulously honest to the data ! "





en.wikipedia.org

## Sir Issac Newton

1642 - 1727

- Discovers that white light comprises all colours of the spectrum and postulates that light is made of particles. In 1672, Newton publishes "Opticks: A treatise of the reflections, refractions, inflections and colours of light".
- In 1687, after much encouragement from Edmund Halley, Newton publishes his most important work, "*Philosophiae Naturalis Principia Mathematica*", Mathematical Principles of Natural Philosophy, or simply "Principia". In it, Newton lays out his three laws of motion that become the foundation for his theory of "Universal Gravitation".
- Along with Gottfried Leibniz, Newton is considered the co-creator of the mathematical principles of Calculus.
- In 1668 he builds the first reflecting telescope which provides better images than the early refractors, a Newtonian telescope.
- Eradicated any doubts that the *Helio-Centric* model was correct.



With a new theory of "Universal Gravitation"

the phenomenon of "Double Stars"  
is about to take flight !!

STF 747 + STF 752 + STF 754



en.wikipedia.org

## Christian Mayer

1719 - 1783

- Czech-German astronomer and teacher of physics and mathematics. Upon expressing a wish to become a Jesuit priest, a career choice not supported by his father, he left his home in Moravia and relocated to Mannheim Germany.
- Mid 1750's, Mayer is appointed "Court Astronomer" at Mannheim.
- In 1781 he publishes his catalogue of double stars. The english translation is "Discovery of all Hitherto Discovered Doubled Stars".
- His main instrument was a 8' Birdian Wall Quadrant. The telescope was made by Peter Dollond and provided a magnification of 85x.
- Available documents of the time would indicate that Mayer was the first person to explore the notion of "Binary Stars".





en.wikipedia.org

## Sir William Herschel

1738 - 1822

- German born English astronomer and musical composer. Music was his daytime job with astronomy his nights passion.
- Herschel was an amateur astronomer since he had no formal training. He is without a doubt, the greatest visual astronomer.
- Since he could not afford a good telescope...in reality there was nothing of quality with high power, he began to construct his own. In his lifetime, he built 400, ranging in lengths of 6' to 40' and mirrors up to 48" diameter.
- His sister Caroline joined him in 1772 and was his constant companion. It is important to note that without Caroline's assistance, his output for all his endeavors would have been greatly reduced.
- His favourite scope was his 20'. Based on Newton's design, it did not have a secondary mirror. Instead, his mirror was tilted slightly within the tube to send the focused image to the side of the open end of the tube where the eyepiece was positioned.

H VI 40



en.wikipedia.org

## Astronomy : His Legacy

- Discovered and catalogued 2,446 "Deep Space" objects, primarily galaxies and nebula. William's son, John Herschel, added another ~2,600 items and publishes a combined catalogue of over 5,000 objects. This catalogue will later become the foundation and represents the greater portion of what we now know as the "New General Catalogue", a.k.a. the NGC.
- Discovered and catalogued 805 double stars.
- Built 400 telescopes    In 1781 discovers the planet "Uranus".
- In 1784, Herschel began systematically studying the shape of the Milky Way. He "formulated a picture or map of the Milky Way, which was quite remarkable in his time, and which even now is not wildly wrong".

## Herschel's Musical Legacy

- Composed more than 200 works including 24 symphonies, 14 concertos and 30 sonatas for orchestra, organ, voice and ensemble.

**STF 546**  
( H II 54)





wikiwand.com

## Sir John Herschel

1792 - 1871

- English polymath, mathematician, astronomer, chemist, inventor and experimental photographer. Like his father William Herschel, he was an amateur astronomer.
- Investigated colour blindness and & the chemical power of ultra-violet light.
- Instituted the use of Julian days and named seven moons of Saturn and four moons of Uranus. During the years of 1821 thru 1823, he re-examined along with Dr. James South, the catalogue of double stars (805) originally prepared by his father.
- Sir John Herschel has 12 children.
- He held a number of positions in the The Royal Astronomical Society and won many prestigious awards. Loosing, by a very slim margin, an election for president of the the Royal Society, the loss due primarily to an internal struggle between the traditionalist and the reformers (of which he was one) he decided to go to South Africa to survey the skies of the southern hemisphere.

HJ 3945



en.wikipedia.org

## Sir John Herschel

con'd

- In late 1833, Herschel and his young family arrive in Capetown ... a 20' telescope in tow. The move to South Africa is as much an opportunity to get away from the pressures and politics of the science community as it is a chance to further the scope of the deep sky survey of his father.
- While in South Africa, Sir John catalogues a further ~2,600 deep sky objects as well as a significant volume of the 5,617 double star systems attributed to him.
- In 1835, he observes the return of Halley's Comet and the records would indicate that during these observations, Herschel determines that there is a repulsive force that is exerting a force on Halley's comet which will be later determined to be the solar wind. He also made the significant discovery that gas was evaporating from the comet.
- His wife Margeret is also a talented artist. Together she and John produce 131 beautiful colour illustrations of the flora of the Cape. During this period, he has a chance encounter with the ship HMS Beagle and spends some time with Charles Darwin. It is a curiosity as to who inspired who to complete the illustrations of flora.
- Sir John and his growing family return to England in 1838 .

## Sir James South

1785 - 1867

- Surgeon and amateur astronomer.
  - In 1816, he relinquished his medical practice to dedicate his energies to astronomy full time.
  - A founding member of the Royal Astronomical Society.
- •
- South is best remembered for his legal battle with Edward Troughton, renowned scientific instrument maker. After acquiring the largest refractor lens of the day, a ~12" diameter lens ground by Robert-Aglae Cauchoix, Troughton was hired to build an equatorial mount. In spite of Troughton's best efforts, South was unsatisfied. The courts awarded Troughton his full costs at which point, South destroyed the mount.

**S 550**



## Sir James South

cont'd

- After the 7 year long court case, 1831 to 1838, the battle had taken its toll. James South lost his enthusiasm and his astronomical work went into decline.
- His double star work included a list of 380 observed and published with Sir John Herschel during the period of 1821 to 1823. This was followed in 1835 with a second catalogue of 458 double stars of which 160 were new discoveries. This was carried out near Paris...a chance to get away from the ongoing court battle with Edward Troughton.





britannica.com

## Friedrich Georg Wilhelm Struve 1793-1864

- German-Russian Astronomer. Started his studies in philosophy but very quickly took up his passion for mathematics and astronomy. Prior to defending his doctoral thesis, he was given the task of installing the astronomical equipment in the newly (1810) constructed observatory and within 2 years was named its director. His first works, as was the case for most observatories of the time was the accurate mapping of the stars.
- The years from 1816 to 1852, Struve was engaged in the surveying of the meridian that ran through the Tartu Observatory, a total length of ~3000 km extending from the Arctic Sea to the mouth of the Danube with an accuracy of +/- 12 metres.
- Struve was married twice and the children numbered 12, plus 4 nephews that he became responsible for. He was instrumental in the home-schooling of his children. He was the first of five generations of world renowned astronomers with the Struve name.
- In 1822, was one of three astronomers to measure stellar parallax.

STF 761 +  
STF 762



britannica.com

## Friedrich Georg Wilhelm Struve

cont'd

- Struve followed closely the double star work of the Herschels and to a lesser degree James South. Much of his early work involved the remeasurement of the Herschel systems that showed strong gravitational influence.
- In 1835, Struve was tasked with supervising construction of the new observatory at Pulkovo which was to become the world's premier observatory and launch Struve to the top of the astronomic profession, in particular the newest field of astro-physics.
- The Tartu and Pulkovo observatories housed 3 of the best and largest refractors of the time .... the 9.5" Fraunhofer on a new german equitorial mount, the first with a clock drive, designed by Fraunhofer, the 15" (1839) made by Fraunhofer's successor, Georg Mertz and the great 30" (1885) refractor constructed by Alvan Clark & Son.

**STF 2892**



britannica.com

## Friedrich Georg Wilhelm Struve

cont'd

- Because of the highest tech instruments available to him for the times, FGW Struve could be described as the premier double star observer of all time.
- His major publication entitled, "Stellarum duplicium et multiplicium mensurae micrometricae", contains the micrometric measurements of 2,714 double star systems.
- The Washington Double Star Catalogue contains over 3,200 Struve systems having the "STF....STFA....STFB" prefix.

**STF 1616**



## Other Notable Double Star Observers

James Dunlop	1793 - 1848
Otto Wilhelm Struve	1819 - 1905
Sherburne Wesley Burnham	1838 - 1921
Rev T.E. Espin	1858 - 1934
W.J. Hussey	1862 - 1926
Robert Grant Aiken	1864 - 1951
Robert Jonckheere	1888 - 1974
Willem van den Bos	1896 - 1974

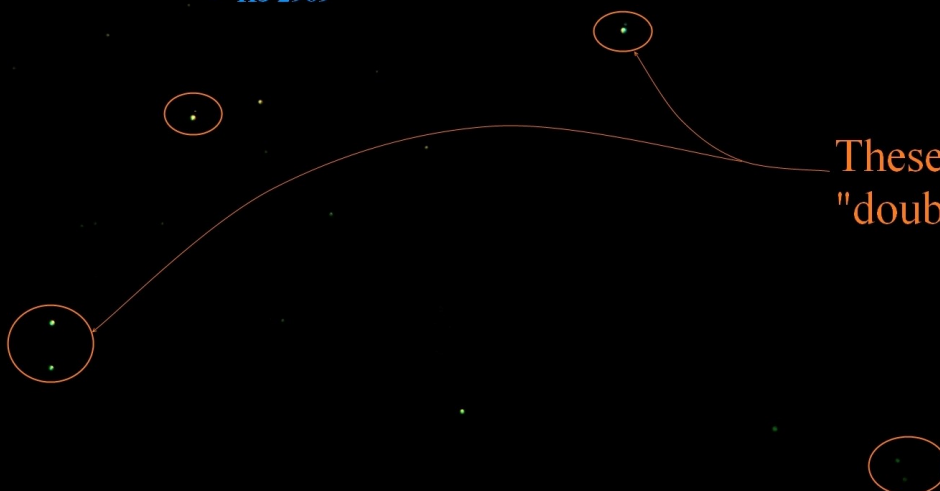
# What constitutes a "double star" ??

HJ 3945

1


HJ 2969

These are not  
"double star"





M 92

A deep-field astronomical image of the globular cluster M 92. The cluster is centered in the frame, appearing as a bright, dense core of stars. The stars are of various colors, including white, yellow, and red. The background is a dark, starry field with many faint, distant stars. The image is framed by a thick black border.

# Discoverer Codes:

BU 1337

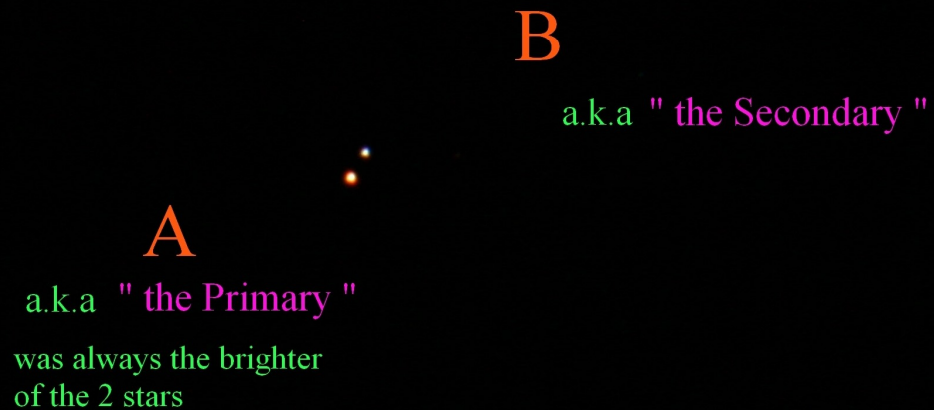
ARG 47

48

<b>BU</b>	<b>S.W. Burnham</b>
<b>ARG</b>	<b>F.W. Arglander</b>
<b>B</b>	<b>W. van den Bos</b>
<b>A</b>	<b>A.G. Aiken</b>
<b>DUN</b>	<b>J. Dunlop</b>
<b>ES</b>	<b>T.E.H. Espin (Rev.)</b>
<b>H I, H VI</b>	<b>William Herschel</b>
<b>HU</b>	<b>W.J. Hussey</b>
<b>J</b>	<b>Robert Jonckheere</b>
<b>HJ</b>	<b>John Herschel</b>
<b>STT</b>	<b>Otto Struve</b>
<b>STF</b>	<b>F.G.W. Struve</b>
<b>STFA</b>	<b>F.G.W. Struve Supplementary Cat.</b>
<b>SHJ</b>	<b>J. South-J. Herschel</b>
<b>WNO</b>	<b>US Naval Observ.</b>

A short list of a much longer one !!

In the beginning when it was only  
" two stars "



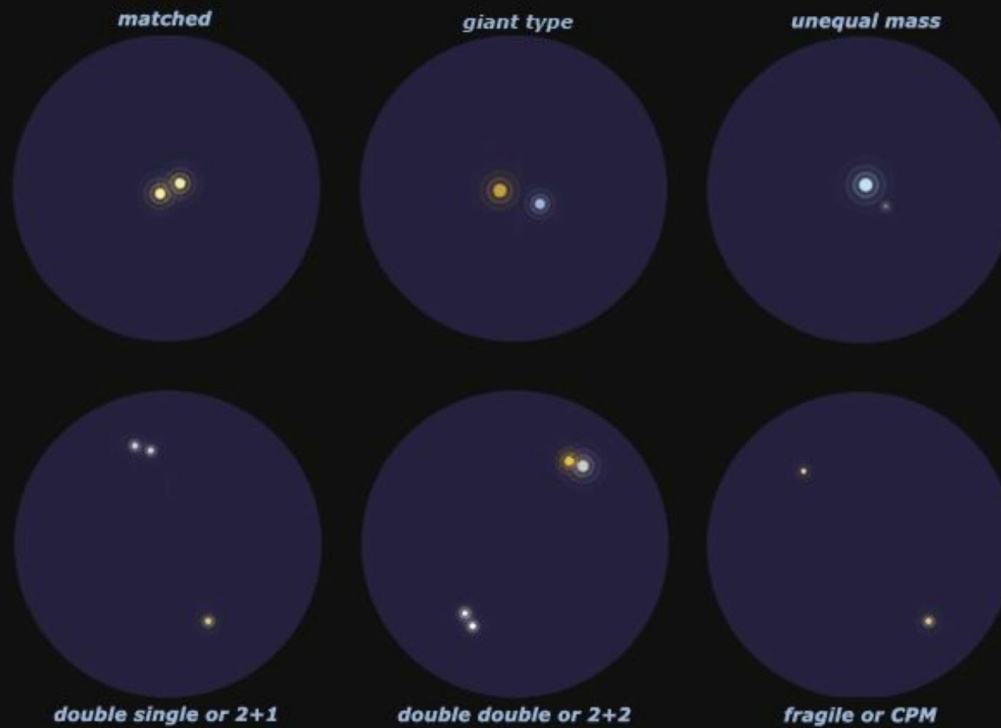
HJ 3945



### Common Visual Patterns

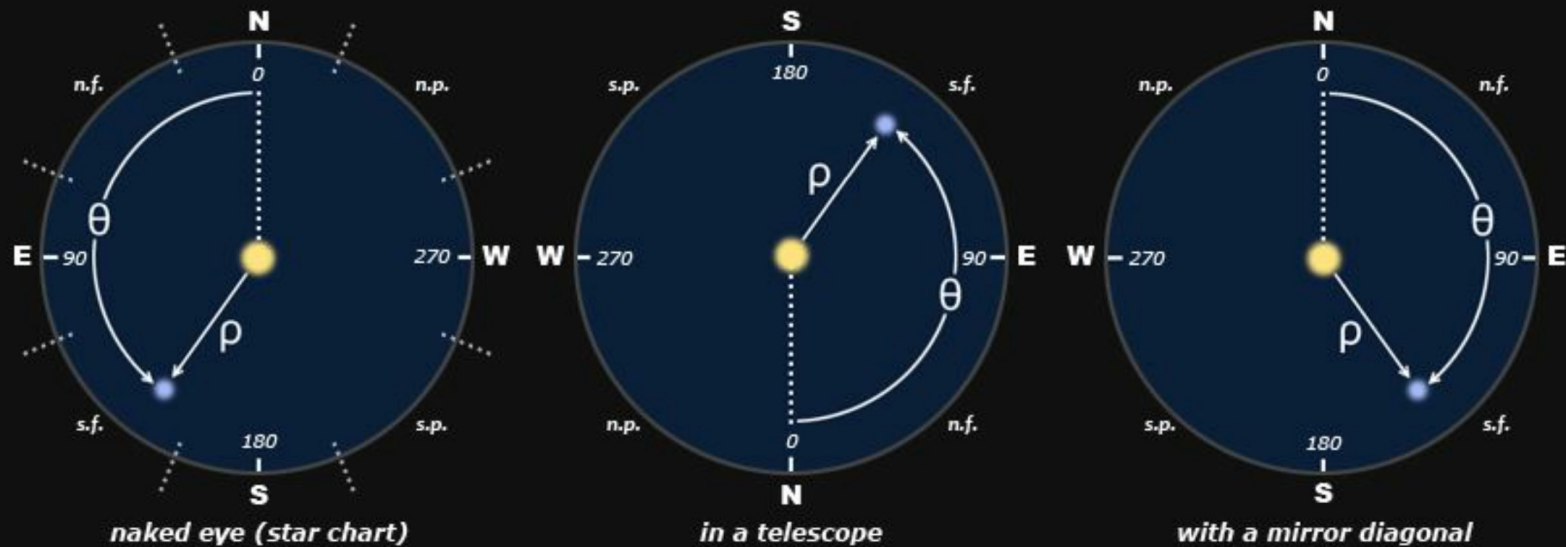
Double stars appear in a wide variety of combinations, but some of these create patterns that are especially striking or memorable due to a unique arrangement, close separation, vivid brightness and/or color contrasts, or the location of the system in a rich field of stars or even inside a star cluster.

The diagram (below) illustrates some of the more frequently encountered visual patterns. These by no means exhaust the combinations that an active observer will encounter, nor are the labels standard in the double star literature.



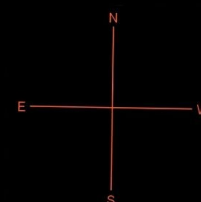
The standard method of positional measurement since Herschel's time is to indicate the separation between the two stars (denoted  $\rho$ ) in arcseconds, and the "clock face" position angle (denoted  $\theta$ ) on the celestial sphere in counterclockwise degrees measured from a line to celestial north.

The diagram (below) shows the effect of telescope optics on the apparent position angle: an "inverting" refracting or reflecting telescope rotates the apparent orientation by  $180^\circ$ , and a mirror diagonal reverts the east/west orientation to produce a mirror image around the telescope's optical axis.









STF 762

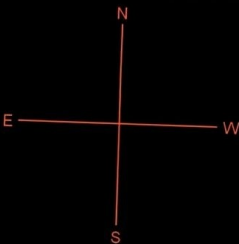
STF 761

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A D  
E,F  
B C

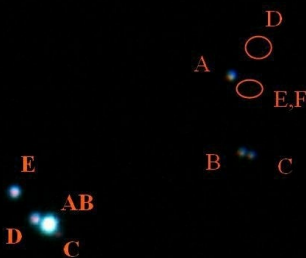
E  
AB  
D C



I

STF 761

STF 762



H

DISCOV#	COMP	FIRST	LAST	OBS	PA	SEP	MAG1	MAG2
NOI 6	Aa,Ab	2006	2013	26	164	0.0	4.07	
BU 1032	AB	1888	2015	174	250	0.3	4.07	5.27
STF 762	AB,C	1831	2016	44	237	11.6	3.76	8.79
STF 762	AB,D	1779	2017	88	84	12.7	3.76	6.56
STF 762	AB,E	1777	2016	79	62	41.5	3.76	6.34
STF3135	AB,F	1823	2016	13	324	208.0	3.76	7.86
TRN 19	AB,G	2001	2008	4	20	3.2	3.76	12.00
SHJ 65	AB,H	1823	2016	7	125	306.9	3.76	8.06
SHJ 65	AB,I	1823	2016	6	60	524.7	3.76	8.44
CAB 26	Ca,Cb	2003	2007	2	12	2.0	9.10	14.50
STF 762	DC	1831	2013	31	252	23.8	6.56	8.79
RAS 22	Ea,Eb	2007	2010	3	303	0.3	6.60	11.30
STF 762	EC	1831	2013	23	241	52.8	6.34	8.79
STF 762	ED	1779	2015	53	232	29.7	6.34	6.56
CAB 26	Ha,Hb	2003	2003	0		0.5	13.34	
BOY 24	Ja,Jb	2004	2007	2	317	0.2	10.60	12.80

DISCOV#	COMP	FIRST	LAST	OBS	PA	SEP	MAG1	MAG2	D_MAG
STF 761	AB	1823	2016	36	202	68.1	7.86	8.39	0.53
STF 761	AC	1891	2016	21	209	72.1	7.86	8.55	0.69
STF 761	AD	1909	2016	11	308	32.7	7.86	11.85	3.99
CAB 11	AE	1998	2005	2	267	10.6	8.20	12.80	4.60
CAB 11	AF	1998	2005	2	269	18.7	8.20	13.00	4.80
STF 761	BC	1819	2015	39	269	8.5	8.39	8.55	0.16

Data from "Stelle Doppie"

**NGC 2196**

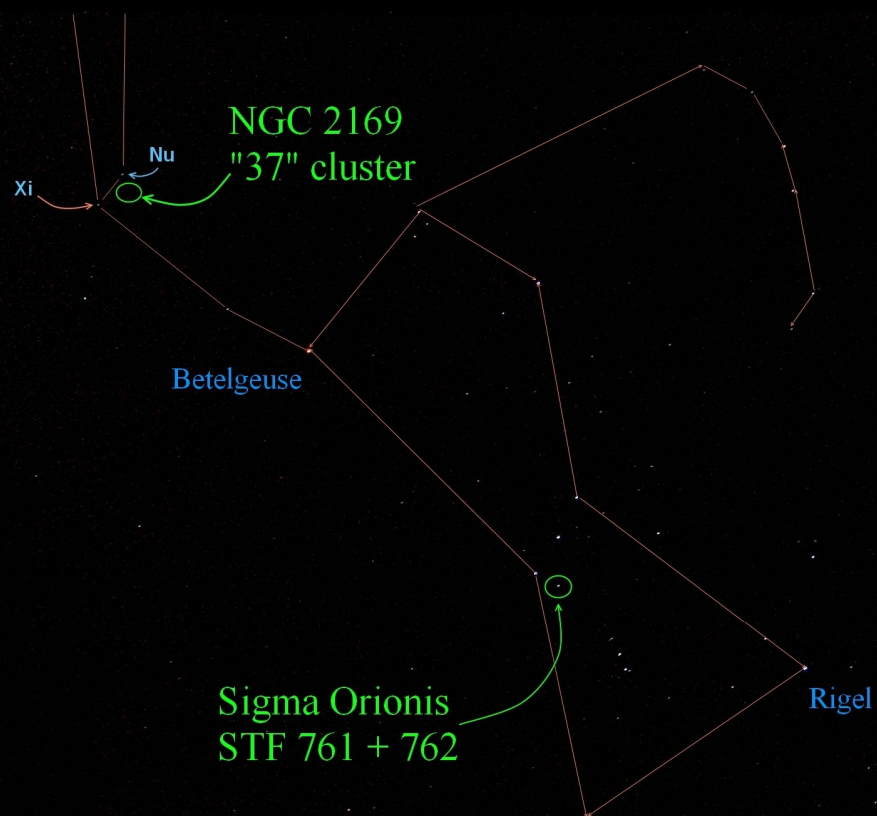




DISCOV#	COMP	FIRST	LAST	OBS	PA	SEP	MAG1	MAG2
STF 848	AB	1825	2016	70	111	2.4	7.28	8.15
STF 848	AC	1844	2001	19	296	16.3	7.28	11.70
STF 848	AD	1830	2016	35	122	28.0	7.28	8.31
STF 848	AE	1830	2016	30	185	43.1	7.28	9.01
ABH 38	AB,F	1906	2001	8	180	64.3	6.88	10.87
ABH 38	AB,G	1906	2001	9	154	61.0	6.88	11.76
ABH 38	AB,H	1982	2011	8	114	82.0	6.88	10.04
ABH 38	AB,I	1906	2011	10	209	100.2	6.88	10.65
ABH 38	AB,J	1906	2011	11	226	126.4	7.28	10.44
STF 848	AB,K	1932	2000	3	214	15.4	6.88	14.90
STF 848	BD	1867	2016	20	123	25.9	8.15	8.31
STF 848	CE	1887	2001	11	167	51.9	11.70	9.01
STF 848	DE	1830	2016	28	223	38.9	8.31	9.01
STF 848	DH	1907	2016	10	110	54.0	8.31	10.04
JRN 23	EF	1906	2016	8	171	21.4	9.01	10.87
JRN 23	EG	1906	2010	7	112	32.2	9.01	11.76
JRN 23	EH	1984	2016	4	83	78.1	9.01	10.04
JRN 23	EN	1906	2011	9	202	109.6	9.01	8.71
JRN 23	IP	1906	2015	7	263	31.4	10.65	13.53
JRN 23	JI	1906	2016	9	90	43.5	10.44	10.65
JRN 23	JP	1984	2015	4	108	13.0	11.10	13.53
JRN 23	JR	1906	2015	7	293	132.2	10.74	11.04
JRN 23	NI	1906	2016	10	356	57.0	8.71	10.65
JRN 23	NJ	1906	2000	7	320	73.6	8.71	10.44
JRN 23	NP	1983	2000	3	327	63.1	8.71	13.53
SLE 838	NV	1907	2000	4	133	36.0	8.71	12.58
SLE 838	NW	1983	2000	3	113	45.9	8.71	15.17
JRN 23	RS	1906	2014	8	42	51.2	11.04	10.65
JRN 23	ST	1906	1998	7	44	102.3	10.65	8.31
JRN 23	SU	1906	2011	10	8	61.7	10.65	10.36

Data from "Stelle Doppie"\*





Xi + Nu Orion

# Why Double Stars ???!



STFA 43 - Albireo



# The Challenge of observing " Double Stars "

#1 Finding them !!

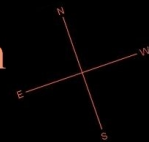
#2 Overcoming the issues of stellar magnitudes

- Very dim ..... very difficult to see !
- Very bright ..... has the potential to "glare" out close companions !

#3 Overcoming the issues of close proximity

- One has to notch up the magnification to get clean separation !

Higher magnifications increase the effects of poor seeing and poor transparency. One very quickly understands the importance of these two conditions. Very often, with dim stars, one experiences intermittent views of the target.



## On the " Plus " side !!

- #1 Virtually no end to the objects available for observing !!
- #2 Will greatly improve your skills as an observer !!
- #3 An incredible variety of shapes, colour and groupings !!
- #4 Observing double stars, but for the very dim, is not effected by moon light !! .... but will challenge your star hopping skills !!
- #5 Double stars with bright components can be observed during twilight hours. A small amount of skylight helps to reduce the glare making close pairs easier to resolve.
- #6 An excellent way to hone your averted vision skills !!

... and finally ...

There is Real Science for  
Amateurs to do !!

Lambda Orionis - STF 738





Epsilon 1 & Epsilon 2 - Lyra Double Double  
E.P. Projection, SW100 ED + 8mm Hyperion  
Exp. 8 sec. @ 800 ISO, Canon 350D

STF 2382

STF 2383

Struve's 2470 & 2474, The Other Double Double in Lyra  
SW100 ED + 8mm Hyperion  
Exp. 8 sec. @ 800 ISO, Canon 350D

STF 2474

STF 2470









## Recommended Online Resources

**Stelle Doppie**      [stelledoppie.goaction.it/index2.php](http://stelledoppie.goaction.it/index2.php)

A website conceived to make navigating the WDS,  
"Washington Double Star Catalogue" .... EASY !!

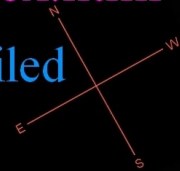
**Star Splitters**      [bestdoubles.wordpress.com/](http://bestdoubles.wordpress.com/)

A blog dedicated to introducing "Double Stars"!  
Highly detailed and written to enlighten and entertain !!

**Astronomical Files from Black Oak Observatory**

[www.handprint.com/ASTRO/index.html](http://www.handprint.com/ASTRO/index.html)

Hugely informative site containing, likely, the most detailed  
information on "double stars" in one location.





## Online Resources cont'd

### Journal of Double Star Observations

[www.jdso.org](http://www.jdso.org)

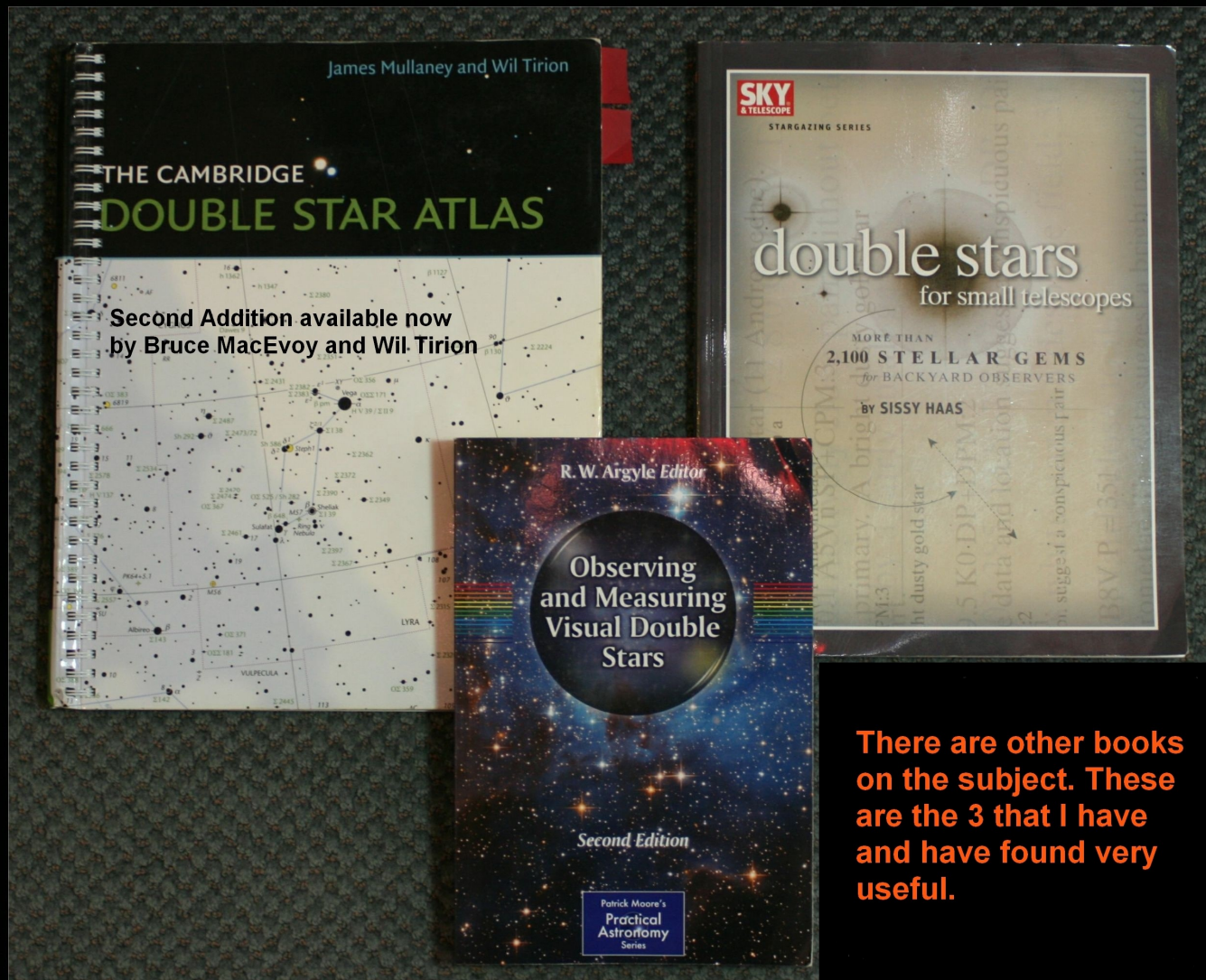
Dedicated to publishing "articles on any and all aspects of astronomy involving double and binary stars."

### Cloudy Nights - Double Star Forum

[www.cloudynights.com/forum/86-double-star-observing/](http://www.cloudynights.com/forum/86-double-star-observing/)

A discussion group dedicated to an informal discussion on everything "double stars" !!

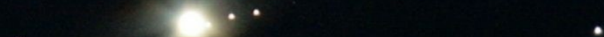
**HDS 1348 + AG 1654**



My Favourite Double Star !



Oops ... it's Jupiter !!!



Thank - you !!