

# The Stars of Namaqualand

Madeleine Scriba, September 2004



## Introduction

The night sky in Namaqualand is very impressive because you can see a lot of stars. In most places there is too much light around us, so that we can only see a few stars. Here are no street lightings, no house lightings and only a few light sources that shine through the sky. Often there is no moon in the first part of the night, so that it's very dark outside and the stars seem very clear to us.

You can see 2500 stars and 5 planets with the naked eye. To see them better, you have to use binoculars or a telescope. Binoculars should be 10 x 15 or better to see something in the sky, which mean that 10 is the number for magnify and 15 is the diameter of the lens.

Here is a **brightness table** of the planets and stars in the southern hemisphere, beginning with the brightest:

Venus

Mars and Jupiter

Mercury

- Sirius
- Canopus

Saturn

- Alpha Centauri
- Arcturus
- Vega
- Capella
- Rigel
- Procyon
- Achernar
- Beta Centauri
- Altair

These are only the 15 brightest objects in the night sky, which can be found more easily than others. How to find them is described below.

A **galaxy** is a group of stars, which all revolve around the same central point. Our galaxy is called the **Milky Way**. All stars, which we can see with naked eyes in the night sky belong to it. They are connected together with proximity and gravity. The astronomers estimate the number of the stars in the Milky Way between 100 and 400 billion, they are not sure because they suspect that there are millions of stars invisible from the earth. But the spiral galaxy Milky Way itself is only a very small part of the cosmos.

When our ancient ancestors looked up into the sky, they saw a faint glowing band of light streaming across the constellations. They didn't know what it is and so they thought for an explanation. The Semiole Indians regarded it as a road that the dead took to a glorious city in the sky. The Vikings likewise saw it as a path to Valhalla. For the Chinese it was a vast river that separated two lovers, represented by the stars Vega and Altair. The ancient Egyptians, whose lives were dominated by the Nile, thought of the Milky Way as a heavenly Nile. It was the ancient Greeks, who called it Milky Way, because they thought it was created by the Goddess Hera spraying the heavens with her milk. Indeed, the word 'galaxy' comes from 'gala', the ancient Greek word for milk.

If you look at the night sky with binoculars or a telescope, you will see **planets** as little balls and stars will appear as light points. The planets orbit the sun on their pathway with different speed. Mercury, Venus and Mars move relatively fast, so that you will see them from month to month at other positions. The other planets move too, but they are too fast away to recognize it.

### **Light year – distances**

When you look at the stars, you see the past of the stars. The light needs so much time to reach the Earth that it's not current what you see. So when you look at any object, you are actually seeing the object as it was at the instant light began to move from that object to your eyes.

To deal with the distances in the sky you have to take a new unit, because kilometers are too small for explanations. The typical unit is the light year. Romans had discovered the speed of light in 1675. The light year is the distance which light travels in a vacuum in one year. The sun is about 8 light minutes away from us, because the light from the sun takes 8 minutes to reach the earth.

### **History of astronomy**

We don't know the first people who looked at the stars and described them. There are rock paintings, which show the planets and stars and they are more than 20 000 years old. The Babylonians wrote a few scripts about the earliest knowledge of astronomy and they gave a few constellations the names, which were passed on by mouth through many generations. **Aristoteles** (384 – 322 B.C.), a Greek mathematician, was the first man who proof scientifically that the earth is round and not flat. He pointed out that you could see stars in Alexandria who are not visible from Athens. And he wrote down that you could see the shadow of the earth on the moon during eclipses. So that this shadow shows that the earth must be round.

Other Grecian scientists found out the distance to the sun (Aristarchus 310 – 230 B.C.) and realized that the earth orbits the sun (Eratosthenes 276 – 196 B.C.). **Ptolemy** wrote the book *Almagest*, which was the summary of the knowledge of Greek scientists and philosophers. In this book he said that the earth is round which many people in that time didn't believe and that the earth is the center of the universe.

A polish priest Niklas Koppernigk (latin: **Copernicus**, 1473 – 1464) was, after studying the sky and a few books, convinced that the earth must revolve the sun. He published a book about it, although it was at that time very dangerous not to agree with the church.

A German, Johannes **Kepler** (1571 – 1630, ancestor of the mouse researcher Carsten Schradin), proved that the earth and planets orbit the sun and they moved in ellipses. With this knowledge it was possible to forecast the movements of the planets. And you could predict eclipses of the moon, sun, planets and the moons revolving around the planets.

**Galileo Galilei**, who lived from 1564 till 1642, had produced, as one of the firsts, a telescope, which could magnify distant objects by as much as 31 times. He described the planets as little balls and wrote in his books, that the Venus has phases. Galileo Galilei was convinced, because of these phases and the moons from Jupiter, which he saw through his telescope, that the sun must be the center of the solar system. Because of

his opinion that the earth is not the center of the universe, he was criticized by the church and accused as blasphemous. His book was later banned from the church.

The next important discover made **Ole Roemer** (1644 – 1710), who calculated the speed of light. He used Keppler`s laws to observe the eclipses of our moon and of the moons of Jupiter. Roemer wondered that there was a discrepancy between the actual and theoretical time of the occurrence of the eclipses. He concluded from it that light is not instantaneous, but travels at a specific speed.

**Isaac Newton** was a British scientist and he built a new kind of telescope using a mirror instead of a lens. Today all telescope are built to Newton`s design, because the mirror eliminated the false colors, which occurred in lens-telescopes. The important thing Newton developed, were his gravity laws. He didn`t realize the principles of universal gravity and inertia, but he calculated the mathematical formulae pertaining thereto.

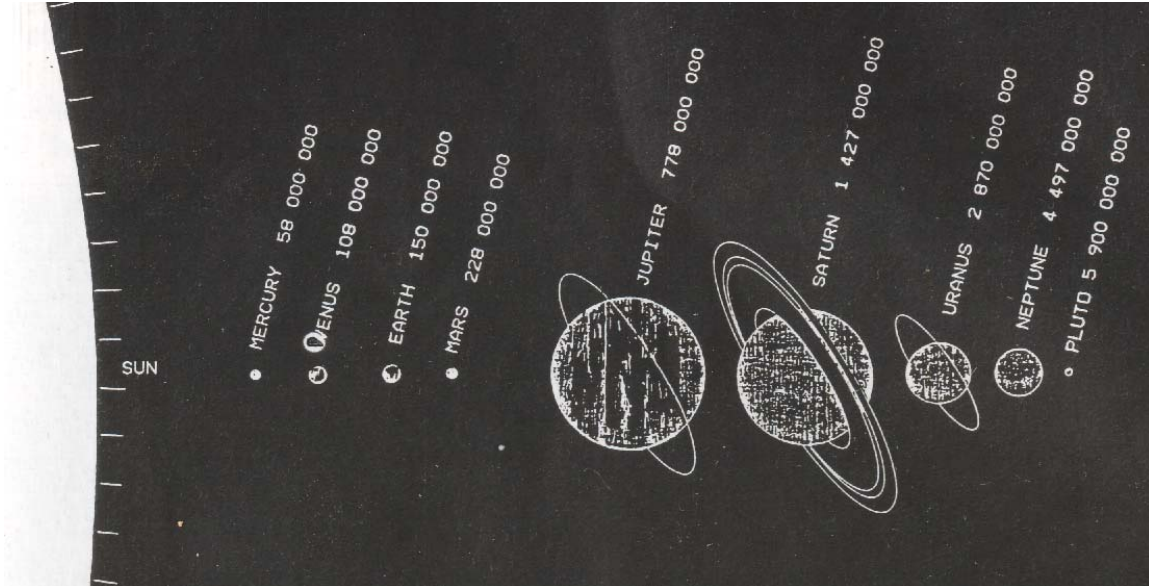
The famous scientist **Albert Einstein** (1879 – 1955) had developed a few theories, which lead to the exploration of space and to the development of nuclear power. In his theory on relativity he says that the speed of light is the speed limit of the universe. Einstein says also that the closer anything approaches the speed of light, the slower it will function. The Americans verified the theory. They put an atomic clock in a deep basement of a building and one atomic clock in a jet fighter. The jet plane was flying at his maximum speed for three weeks. After that time the fast moving clock lost some time to the static one.

## **Moon**

The **Moon** is very close to the Earth, being only 384400 km away. It has phases and every 29.5 days it goes through a full cycle of phases. It starts with the new Moon, when it`s invisible to us and ends just over two weeks later with the full moon. The phases of the Moon reflect the position of the Moon in its orbit, relative to the position of the sun. The Moon rises in the east and sets in the west. It moves eastwards and we can notice the moving in a single night, because it`s so close to us.

Even with a binocular you can see a lot. The surface is covered in craters in variety size, because seas of basalt flooded the Moon`s surface billion years ago. Except during full and new moon, you can see the peaks of the high mountains.

## Planets



**Fig. 1**  
The constellations and distances of the planets to our sun.

**Mercury** is not easy to locate, because it's the closest planet to the sun. When it is too close, below, behind or in front of the sun, it's not visible for us. Mercury is the fourth most brilliant planet at our sky. It has phases too, like our moon or Venus.

**Venus** is the brightest of all the stars and planets in the night sky. For about 8.5 months you can see Venus in the evening sky, then it disappears behind the sun and after that it will appear in the east for some 8.5 month to be the morning star. The period when Venus has disappeared behind the sun varies from a couple of nights up to two month. It depends on the position of the planet in relation to the sun, as viewed from Earth.

Venus has no moons. It displays different phases like quarter or half moon. When Venus is furthest away from Earth, it is viewable in gibbous phase (nearly full) and when the planet is near the Earth its crescent (half).

You can see Venus shortly after sunset or after the sunrise, when there is still a little bit light in the sky. In daytime it's often very close to the sun, so that you can see the planet not very good.

Even with binoculars you can see Venus' phases. With a telescope it's tricky to see details, because of its sheer brightness. The light will be scattered in the lens, which is why astronomers use filters to see Venus better. But even with filters you can't see the surface, because it's completely obscured by clouds.

**Mars** is relatively close to the Earth and it seems to be red even with the naked eyes. The red color comes from the surface of the planet, which is covered by rocks and sand deserts. There is much iron ore, which has bonded with oxygen to create iron oxide (rust). Mars has two moons, but they are too small, to see them. The planet itself is very small; it's just half over the diameter of the Earth. With a telescope, you can see the surface and

make out the polar caps. Sometimes there are dust storms on Mars, so that the surface is not viewable.

**Jupiter** is very bright and therefore very obvious. It is visible all night long most month in the year because it orbit is outside our own. It has a small ring system which is not viewable with a normal telescope.

Jupiter is named after the most powerful of the Roman gods, because it is the biggest planet. Its volume is 1300 times greater than that of the Earth, but it's only a quarter as dense as our planet. So that it's 300 times more massive. Jupiter has no phases, but it has 39 large moons, which orbits it. You can see some of the moons with binoculars or a telescope as little specks of light near the planet. Galileo Galilei was the first who viewed and described a few of the moons (in 1610).

**Saturn** is the second largest planet after Jupiter and it has 30 moons. You can find Saturn with the naked eyes. It's visible 10 month out of the year. Saturn is very far away from the Earth, so you can't see all of the moons. With a telescope you can see 5 of the moons (Tethys, Dione, Rhea, Titan, Iapetus). Even with binoculars you can see Saturn and its rings around it. The rings consist of rock and ice and they are during some years more visible from Earth as in other years. This is because of the movement of Saturn around the sun, relative to the Earth. Galileo Galilei was the first who saw the rings in the early seventeenth century, but he didn't know what it was.

**Uranus** was discovered in 1781 from an English astronomer (Wilhelm Herschel). The name comes from the Roman mythology. Uranus is the father of Saturn, who turn is the father of Jupiter. The planet has 20 moons and 10 rings around it. Uranus can be seen with a binocular only under ideal conditions.

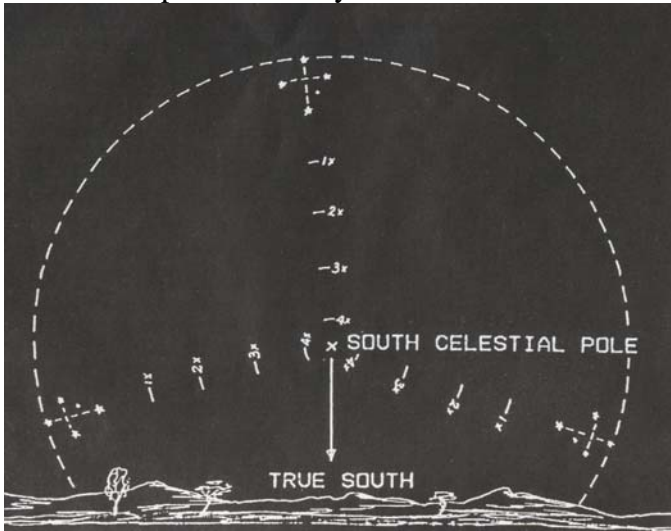
**Neptune** and **Pluto** are too far away to see them even with good telescopes. Neptune was finally observed in 1846 from a German astronomer (Johann Gottfried Galle). It has 11 moons and a ring system.

Pluto was very late discovered, in 1930, from an American amateur astronomer (Clyde Tombaugh). It's a very small planet with a radius of 2250km and it has one moon. Pluto is fairly bright, so that locating it is not easy. Even if you find it, you will only see a point of light.

## **Southern Hemisphere Stars**

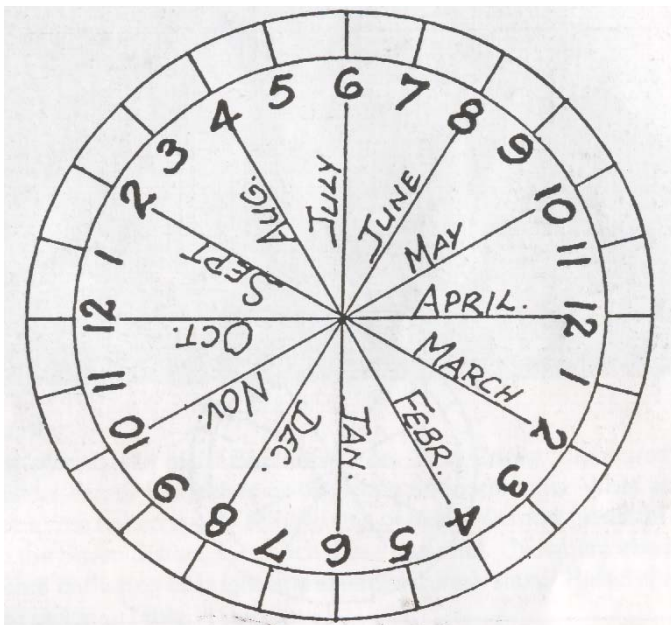
The **Southern Cross** is the most recognizable constellation in the sky. It consists of four bright stars, which are named by using the Greek alphabet (beginning with the brightest star Alpha, then clockwise: Beta, Delta, Gamma). They are visible every night from all over South Africa, but not during all hours. In the north the Southern Cross sometimes disappeared beneath the horizon and from October to November the Southern Cross goes down with the sun and rises again after twelve o'clock. But in winter you can see it in the south-western sky from everywhere in South Africa.

Alpha cruxis is the brightest star of the Southern Cross and it is the star most far away star from the middle of the cross, so it's the long axis of it. This axis always points to the south pole of the sky.



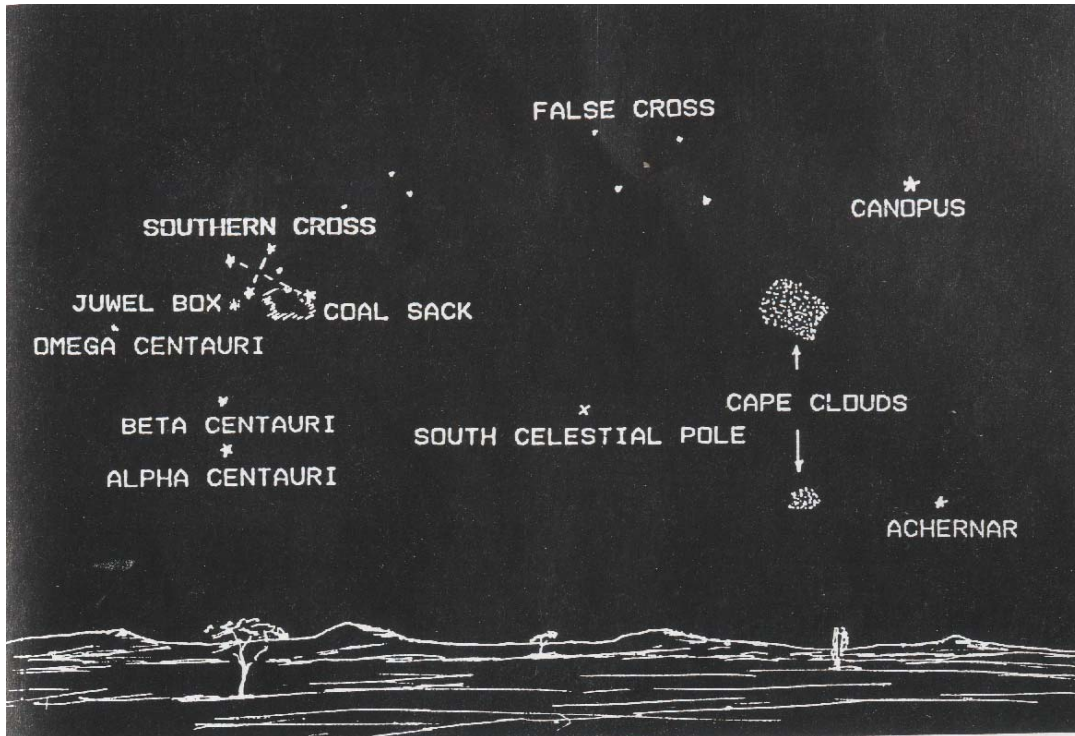
**Fig. 2**

The celestial South Pole is an imaginary point, but all the southern stars appear to rotate around it. In fact it's the earth revolving and not the stars. The South Pole can give you the actual position where you are. You have to determinate the degrees between horizon and the celestial pole then you know at what latitude you are.



**Fig. 3**

When you see the Southern Cross in the sky, you can read the time of the night from it. You have to hold the picture in such a way that the line of the actual month is vertical. Then the long axis of the Southern Cross should point to the center of the disc. Now you can read the time of the night as indicated by the long axis.



**Fig. 4**  
Survey about the constellation of a few important stars and where to find them.

Near Beta Crusis, the star from the Southern Cross, there seems to be a faint star. It's a star cluster, which twinkles very bright and in multi colors. So it's named the **Jewel Box**.

Between Alpha and Beta Crusis there is one spot, where no stars can be seen. It's called the Coal Sack. You can't see the stars there because they are hidden from the **Coal Sack**, which is an enormous, vast cloud of dust and gas.

On a dark clear night you can see the **Cape Clouds** in the sky, when you take a line from the long axis of the Southern Cross through the South Pole to about the same distance beyond. The Clouds were also named after Magellan, because he discovered them in his circumnavigation of the world in 1552. The Magellanic Clouds are two own galaxies, which are about 175000 till 210000 light years away from the earth.

Near the smaller Magellanic Cloud you can see a brilliant blue-white star. Old Arab astronomers called it **Achernar**, which means 'end of the river'. Achernar is 120 light years away from the earth and it appears as the 9<sup>th</sup> brightest star to us.

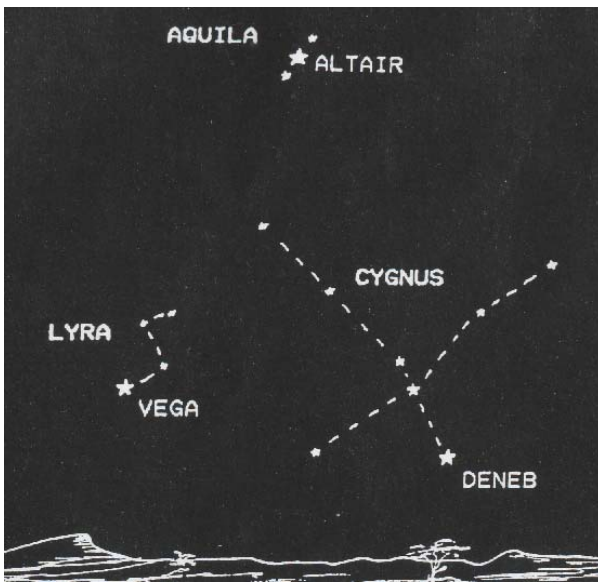
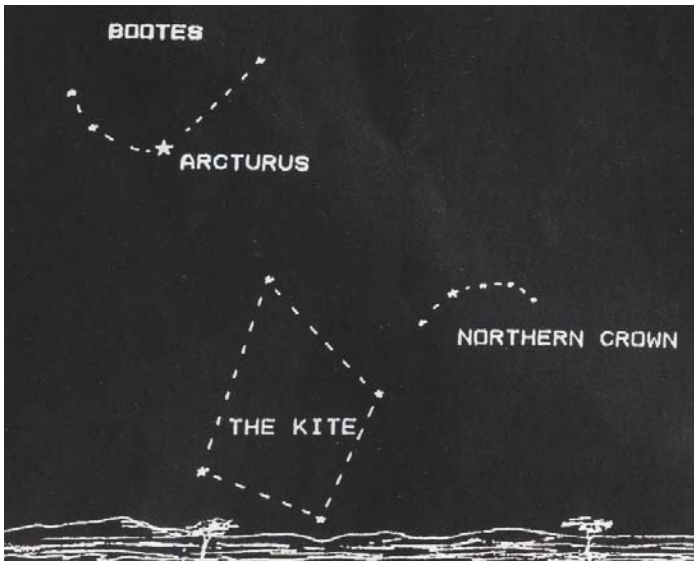
The star **Canopus** can be seen if you imagine a line from the Southern Cross to the celestial southern pole and then build a 90 degrees angle, then you will find it. Canopus is the second brightest star after Sirius, but it would be the brightest, if it would be nearer to the earth. It is 650 light years away and 80000 times as bright as our sun.

**Alpha Centauri** is the name of three stars orbiting each other and they are the closest stars to the earth. They are the third brightest stars in our night sky because it's only 4,3 light years away.

**Beta Centauri** is a star near the Southern Cross and it's the 10<sup>th</sup> brightest star in the sky. The star is 490 light years from earth. Both, Alpha and Beta Centauri are very close to the Southern Cross.



**Arcturus** is only visible from April till August in the northern evening sky. It's the 4<sup>th</sup> brightest star in the sky and you will find it as the brightest star above the northern horizon.

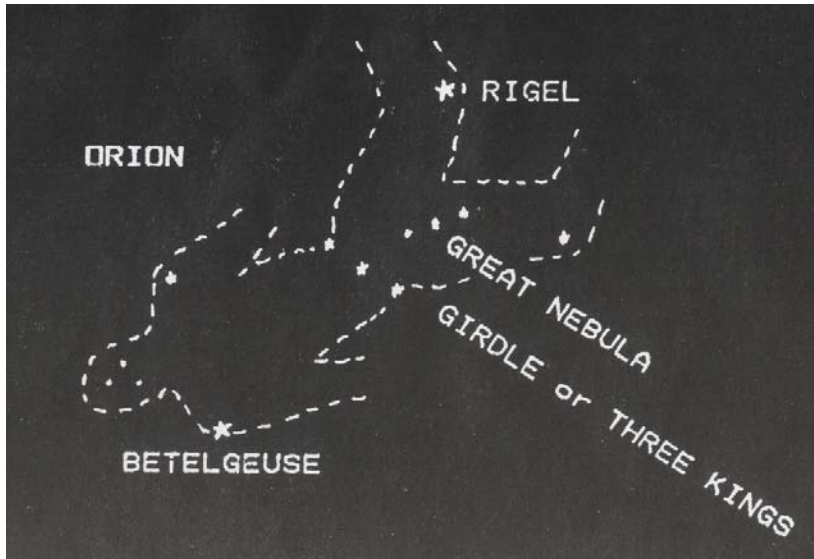


**Fig. 5 a and b**  
Some of the most important stars and forms.

**Altair** has two small stars on either side of it. It's visible from July till October in the evening sky. Altair is relatively close to the earth, it's about 15 light years away.

The star **Vega** is blue-white and 26 light years away from us. Vega is only visible between July till November.

The constellation **Orion**, also called **The Hunter**, is visible from November to May in the evening sky from all over the world. Between June and August Orion is invisible to us, because it travels with the sun.



**Fig. 6**  
Orion the hunter.

The star **Rigel**, which belongs to Orion, is blue-white because of its high temperature and 57000 times brighter than our sun. In spite of the distant of 540 light years from the Earth, it shines as the seventh brightest star in our night sky. The astronomers believe, that Rigel is the most luminous star in our Milky Way galaxy.

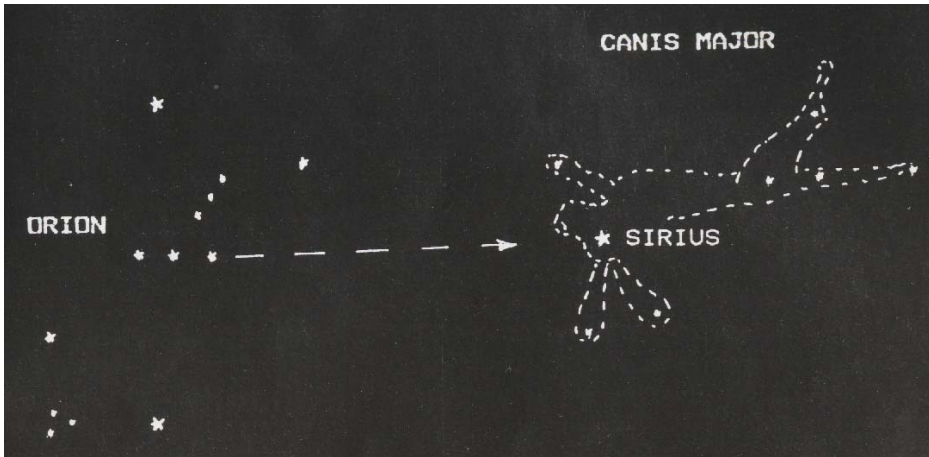
The **Three Kings** are a part of Orion. They were used for navigation, because they are situated on the celestial equator, right above the earth's surface equator.

The **Great Nebula of Orion** represents the middle star in the 'sword' of the hunter. With the naked eye you only view a faint star, but with a telescope you can perceive a small cloud with many bright stars. The Great Nebula consists of gas, mainly hydrogen, and it is 2000 light years away from us.

**Betelgeuse** is the 12<sup>th</sup> brightest star in our sky, although it is 520 light years away from us. It is colder than our sun and because of this quality, it is classified as a red star. The name meant 'the armpit of the giant' and was given from the Old Arabs.

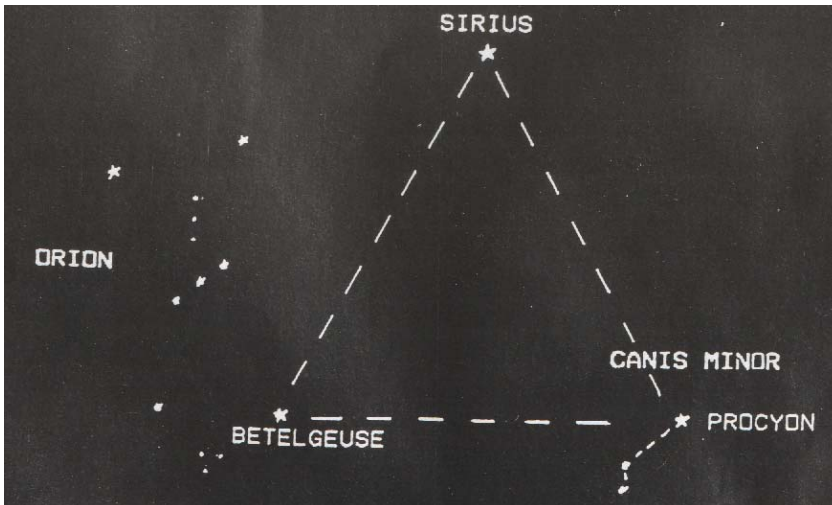
The big dog, **Canis Major**, is visible only from November to May in the evening sky. To find the constellation you have to follow the Three Kings eastwards till you see the most brilliant star in the sky.

This star, **Sirius**, is the head of the hunter's big dog. The name Sirius means the 'shiny' or the 'sparkling one'. It's the brightest star in our night sky, even two times brighter than the second brightest star Canopus. Sirius is a blue-white star and it's very close to the Earth, only 8,5 light years away. There is a small star near Sirius, which it orbits. This star is very small, but has very much mass, so that it can influence Sirius. Such kind of star is called a white dwarf.

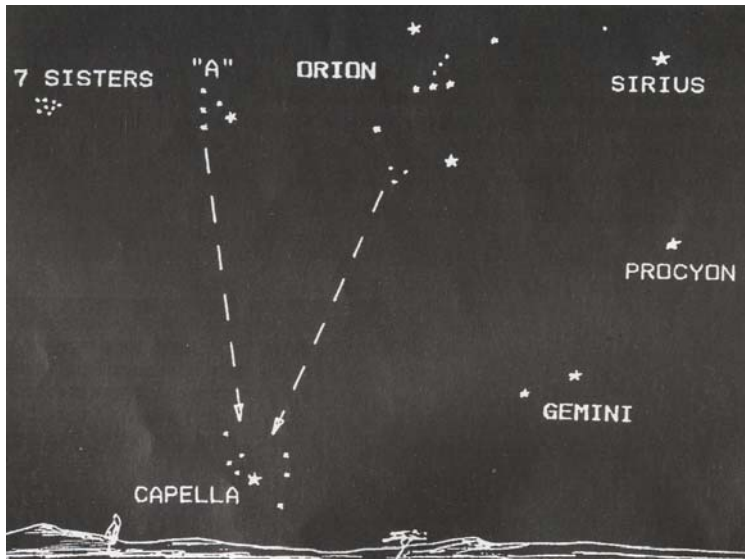


**Canis Minor** consists of three stars, which are visible from November to May in the evening sky. To find the little dog you can build a triangle with Betelgeuse and Sirius and with Procyon, the brightest star of Canis Minor. Within this triangle there are no other bright stars.

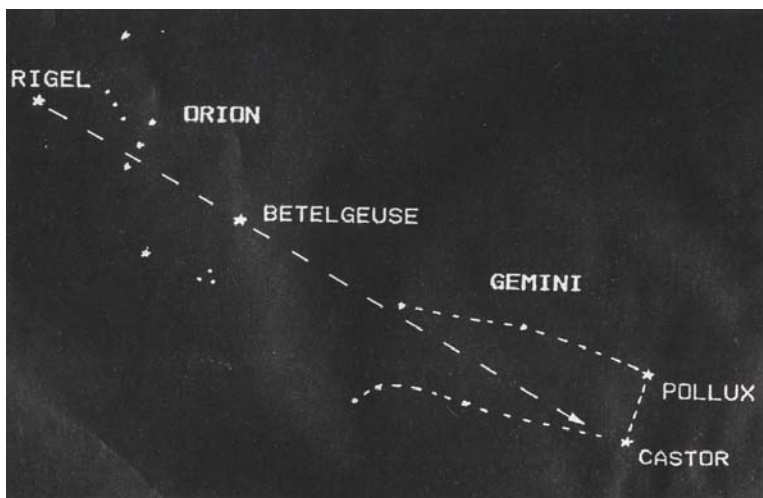
**Procyon** is the 8<sup>th</sup> brightest star in the night sky and it has a small white dwarf as a companion, too. This star you can't even see with a good telescope, because it's so small.



**Capella** is a northern star and only visible from December to March in the evening sky. To find Capella, you have to look slightly to the left and diagonally below Orion. It's the 6<sup>th</sup> brightest star and 47 light years away from the Earth. Actual it is a double star, but they are so close to each other that they look like one even with very good telescopes.



**Gemini** consists of two bright stars, **Pollux** and **Castor**, which are visible from November to May. If you take a line from Rigel through Betelgeuse and lengthen it one and a half times, then you will find Gemini. The yellow star Pollux is the 17<sup>th</sup> brightest star in the sky and it's 32 light years away from the earth. Castor is 43 light years from us and it's the 23<sup>th</sup> brightest star in the sky.



### Literature

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- Scalzi, John (2003): The Rough Guide to the Universe. Rough Guides Ltd. London