

Ursa Major

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Ursa Major, often referred to as the Great Bear, is one of the most recognizable and prominent constellations in the northern celestial hemisphere. Its distinctive shape, resembling a large bear with a long tail, has captivated human imagination for millennia. At the heart of Ursa Major lies the Big Dipper, a prominent asterism formed by seven bright stars that serve as a navigational guide and cultural icon across cultures and civilizations.

Keywords: astronomy ; constellation ; IAU ; Big Dipper ; star ; galaxy

1. Introduction

Ursa Major, Latin for "Great Bear," commands attention as one of the most recognizable and illustrious constellations adorning the northern celestial hemisphere. Spanning a vast expanse of the night sky, Ursa Major is distinguished by its prominent asterism, the Big Dipper, composed of seven bright stars arranged in the shape of a ladle or plough. These stars, known as Dubhe, Merak, Phecda, Megrez, Alioth, Mizar, and Alkaid, form the familiar pattern that serves as a celestial guidepost for navigation and cultural symbolism. Beyond the Big Dipper, Ursa Major boasts an array of stars, clusters, and galaxies, enriching the constellation's celestial tapestry.

Ursa Major occupies a significant portion of the northern celestial hemisphere, bordered by the constellations Ursa Minor, Draco, Leo, Lynx, Camelopardalis, and Coma Berenices. Its celestial coordinates range approximately from 8 to 15 hours of right ascension and from 30 to 60 degrees of declination (**Figure 1**). Positioned prominently in the northern sky, Ursa Major is visible year-round from most locations in the Northern Hemisphere. The constellation's strategic location near the north celestial pole enhances its navigational utility, as it provides a reference point for determining celestial north and orienting oneself in the night sky. The stars of Ursa Major have played a crucial role in human history, guiding travelers and sailors across land and sea and serving as a source of inspiration for myths, legends, and cultural traditions.

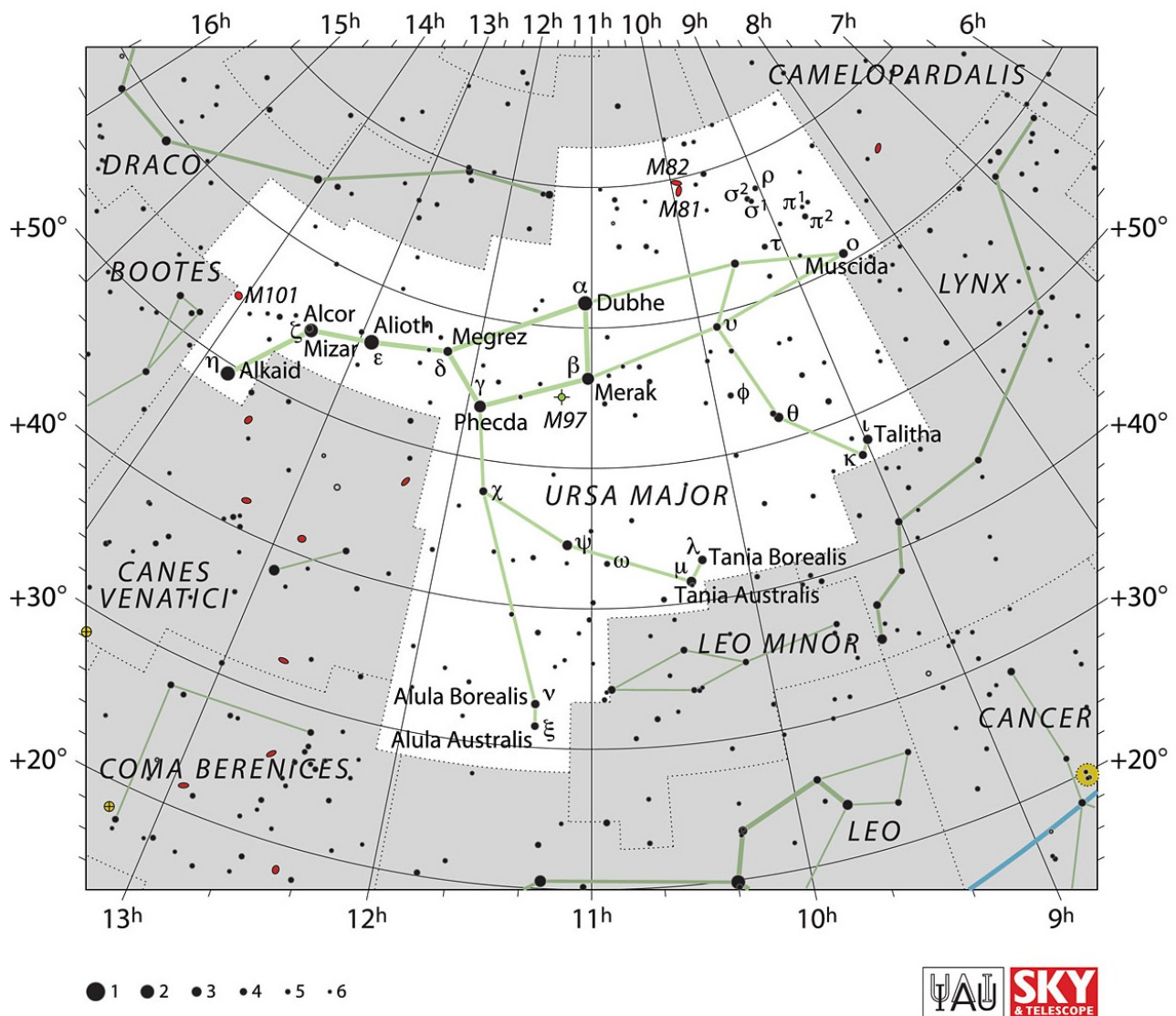


Figure 1. IAU chart of Ursa Major. Source: <https://www.iau.org/static/archives/images/screen/uma.jpg>. Credit: IAU and Sky & Telescope. Reproduced under CC BY 4.0 license.

2. Historical Background and Mythology

Ursa Major, the Great Bear, has been a prominent figure in human culture and mythology for thousands of years, transcending geographical and cultural boundaries to become one of the most recognizable constellations in the night sky. In ancient Mesopotamia, Ursa Major was associated with various celestial myths and rituals, reflecting the region's deep reverence for the stars and their perceived influence on earthly affairs. Babylonian astronomers cataloged the stars of Ursa Major and incorporated them into their astrological and divinatory practices, believing that the movements of the stars held predictive power over human destinies.

In Greek mythology, Ursa Major is often linked to the story of Callisto, a nymph who caught the eye of Zeus, the king of the gods. Zeus transformed himself into a bear to approach Callisto discreetly, but their affair was discovered by Zeus's jealous wife, Hera. As punishment, Hera transformed Callisto into a bear, and she was subsequently placed in the heavens by Zeus, forming the constellation Ursa Major. This mythic narrative underscores themes of divine punishment, transformation, and the enduring bond between mother and son, as Callisto's son, Arcas, was also placed in the heavens as the constellation Ursa Minor.

Across indigenous cultures around the world, Ursa Major holds significance as a celestial guide and cultural symbol. In many Native American traditions, the stars of Ursa Major are revered as spirit guides and markers of the changing seasons. The constellation's appearance in the night sky signaled important celestial events, such as the arrival of spring or the onset of winter, which were marked by ceremonies and rituals to honor the natural world and its rhythms.

Throughout history, Ursa Major has served as a crucial navigational aid for travelers, sailors, and explorers. The Big Dipper, a prominent asterism within Ursa Major, points toward the north celestial pole, making it a reliable marker for determining direction. This navigational utility has been utilized by cultures around the world for millennia, enabling safe

passage across land and sea and facilitating exploration and trade.

3. Notable Stars

3.1. Dubhe (Alpha Ursae Majoris)

Dubhe is one of the two stars that form the outer edge of the Big Dipper's bowl. It is a binary star system located approximately 124 light-years away from Earth. The primary component, Dubhe A, is an orange giant star with a visual magnitude of around 1.79, making it one of the brightest stars in Ursa Major. Its companion, Dubhe B, is a much fainter star that orbits Dubhe A at a distance of about 23 astronomical units.

3.2. Merak (Beta Ursae Majoris)

Merak is the other star that forms the outer edge of the Big Dipper's bowl. It is located approximately 79 light-years away from Earth and shines with a visual magnitude of around 2.37. Merak is a blue-white main-sequence star, similar in spectral type to the Sun but hotter and more luminous. Along with Dubhe, Merak serves as a navigational marker, pointing toward the North Star, Polaris, and aiding travelers in finding their way in the night sky.

3.3. Alioth (Epsilon Ursae Majoris)

Alioth is the brightest star in the constellation Ursa Major and the third-brightest star in the Big Dipper asterism. It is a blue-white main-sequence star located approximately 81 light-years away from Earth. Alioth has a visual magnitude of around 1.77 and is notable for its rapid rotation, which causes it to be slightly oblate in shape. Its distinctive appearance makes it a popular target for amateur astronomers and astrophotographers.

3.4. Mizar (Zeta Ursae Majoris)

Mizar is a famous double star located at the bend of the handle of the Big Dipper. It consists of two components, Mizar A and Mizar B, which are separated by about 14.4 arcseconds and have a visual magnitude of approximately 2.04 and 3.95, respectively. Mizar is also a visual binary, meaning that its two components can be resolved with the naked eye under good viewing conditions. In addition to Mizar A and B, Mizar is accompanied by a fainter star, Alcor, which forms a separate binary system with Mizar.

3.5. Alkaid (Eta Ursae Majoris)

Alkaid is the star that marks the tip of the Big Dipper's handle. It is a blue-white main-sequence star located approximately 101 light-years away from Earth. Alkaid has a visual magnitude of around 1.85 and is the third-brightest star in Ursa Major. Its name is derived from the Arabic word "al-qā'id," meaning "the leader," reflecting its position at the end of the handle of the Big Dipper.

The above stars, together with Megrez and Phecda, form the asterism known as the *Big Dipper* (**Figure 2**).



Figure 2. Ursa Major and Polaris with names of bright stars in the Big Dipper. Image source: https://commons.wikimedia.org/wiki/File:Ursa_Major_and_Polaris.svg. Sanu N, CC BY-SA 4.0, via Wikimedia Commons.

4. Deep-Sky Objects

4.1. Messier 81 (M81, NGC 3031)

Messier 81, also known as Bode's Galaxy, is a spiral galaxy located approximately 11.8 million light-years away from Earth. It is one of the brightest galaxies in the Messier catalog and is notable for its well-defined spiral arms and active galactic nucleus. M81 is home to numerous young, hot stars, as well as regions of intense star formation and nebular activity.

4.2. Messier 82 (M82, NGC 3034)

Messier 82, also known as the Cigar Galaxy, is a nearby irregular galaxy located approximately 12 million light-years away from Earth. It is characterized by its elongated shape and intense starburst activity, which is believed to be the result of gravitational interactions with its neighboring galaxy, Messier 81. M82 is undergoing a period of rapid star formation, producing massive clusters of young, blue stars and vast clouds of gas and dust.

4.3. The Owl Nebula (M97, NGC 3587)

The Owl Nebula is a planetary nebula located approximately 2,030 light-years away from Earth. It derives its name from its resemblance to the eyes of an owl when viewed through a telescope, with two prominent dark patches resembling a pair of eyes. The Owl Nebula is formed from the outer layers of a dying star that have been expelled into space, creating a glowing shell of ionized gas.

4.4. Messier 101 (M101, NGC 5457)

Messier 101, also known as the Pinwheel Galaxy, is a spiral galaxy located approximately 21 million light-years away from Earth. It is renowned for its spiral arms, which are adorned with bright knots of star formation and intricate dust lanes. M101 is one of the largest and most massive galaxies in the Local Group, containing billions of stars and numerous star clusters and nebulae.

4.5. The Hamburger Galaxy (NGC 3628)

The Hamburger Galaxy is an edge-on spiral galaxy located approximately 35 million light-years away from Earth. It is characterized by its flattened disk of stars, gas, and dust, which appears as a thin line when viewed from Earth. NGC 3628 is part of the Leo Triplet, a group of galaxies that also includes Messier 65 and Messier 66.

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