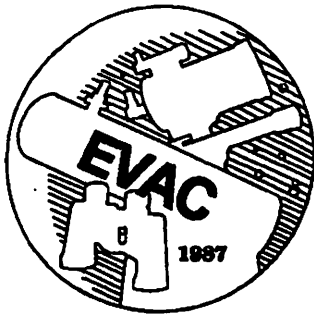


November Meeting is moved to the 18th



East Valley Astronomy Club

September 1998

www.goodnet.com/~rkerwin/evac/evac.html

Scottsdale, Arizona

The Discovery of the Deep Sky objects

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<http://www.seds.org/messier/xtra/history/deepskyd.html>

Since the earliest times, humans could view stars at night whenever it happened not to be cloudy. As in prehistoric times, there was barely no light pollution in most regions of Earth, our ancestors could view stars of very faint light, and thus some of those objects we now summarize as Deep Sky Objects. This way, some of these objects are known as long as anything is known.

The most remarkable such "object" is certainly a galaxy, our own Milky Way; however we will not count this one here. Essentially the same is true for the most remarkable "moving" star cluster, the Ursa Major group, which consists of most of the stars in the famous "Big Dipper" asterism and makes up the more conspicuous part of Ursa Major. These omissions are justified first because most people nowadays don't view them as "Deep Sky Objects", and second because their nature, i.e. that the Milky Way is a galaxy, and that the Ursa Major stars are a physical cluster, did not become apparent before modern times.

Some of the bright star clusters must also have been known very early, even before the time covered by any ancient records; these certainly include the Pleiades (M45) and the Hyades clusters in Taurus, which are conspicuous to the naked eye, and recorded early (i.e., the first certain document on the Pleiades is Hesiod, about 1000 BC). In the Southern Hemisphere, the two Magellanic Clouds (LMC -- the Large Magellanic Cloud, and SMC -- the Small Magellanic Cloud) were certainly known since earliest times, but not much recordings are preserved from the ancient Southerners.

It may be that Aristotle has recorded ancient observations of the open star cluster M41 in Canis

Major around 325 BC; this would make this cluster the faintest object reported in ancient times. According to Burnham, based on the quote by P. Doig in 1925 of a statement made by J.E. Gore, it could be possible that Aristotle also observed M39 in Cygnus about that time, as a "cometary appearing object".

Hipparchos, the famous ancient Greek astronomer, did his observations from Rhodes between 146 and 127 BC. He was the first astronomer who compiled a catalog of stars; this work was perhaps triggered by the observation of a "New Star" (Nova) in the constellation Scorpius in 134 BC. He included two "nebulous objects" in his catalog, the Praesepe star cluster (M44) and the Double Star Cluster in Perseus, now called χ Persei (NGC 869+884, not in Messier's catalog).

Ptolemy, in his *Great Syntaxis* compiled 127--151 AD (better known as the *Almagest*), lists 7 objects, 3 of which are asterisms of little interest and not physical objects, two are those taken from Hipparchos (M44 and the Double Cluster in Perseus), but two are new: "A Nebula behind the Sting of Scorpius" which has now been identified as the conspicuous open cluster M7, which the present author has proposed to name "Ptolemy's Cluster", and the Coma Berenices Star Cluster, now cataloged as Melotte 111 (but not in Messier's catalog).

The first really "nebulous" object to be discovered and documented was the Andromeda Galaxy (M31), observed around 905 AD and documented 964 AD by the Persian astronomer Al Sufi in his *Book of Fixed Stars*. He also mentions a "nebulous star" little more than 2 degrees north of δ Velorum, which is most certainly the open cluster IC 2391. He also includes 6 of Ptolemy's objects, and a new "asterism" in Vulpecula (actually Brocchi's Cluster, Collinder 399, also nicknamed the "Coathanger Cluster"), so a total of 9 entries.

While not a deep sky discovery as the others mentioned here, the occurrence of a supernova on July 4, 1054, was observed and recorded by Chinese and (very probably) by ancient North American astronomers; this

supernova produced the Crab Nebula (M1), one of the most interesting deep sky objects.

No more new deep sky objects were discovered until Magellan, in 1519, reported the sighting of the Large and Small Magellanic Clouds. This brought the number of reported deep sky objects to 11, although Al Sufi's work was not generally known at that time, before Galileo introduced the telescope into astronomy in 1609. At this event, Galileo revealed that Praesepe (M44) was not a nebula but a star cluster.

Nicholas-Claude Fabri de Peiresc (1580-1637) was the first to discover a true gaseous nebula, the Orion Nebula M42, in 1610. This was also the first deep sky discovery with a telescope. Shortly after this, in 1612, Simon Marius (1570-1624) found (independently re-discovered) the Andromeda Galaxy (then Andromeda Nebula, M31). M42 was independently found by the Jesuit astronomer Cysatus (1588-1657) in 1618.

Long forgotten and rediscovered only in the early 1980s (published by Serio, Indorato, and Nastasi in the Journal of the History of Astronomy, No. 45 (February 1985) and No. 50 (August 1986)), Giovanni Batista Hodierna (1597-1660), astronomer at the court of the Duke of Montechiaro, compiled a catalog of some 40 entries, including 19 real nebulous objects, found with a simple Galilean refractor of magnification 20, and printed in Palermo in 1654. Included is an independent rediscovery of the Andromeda Nebula (M31) and one of Brocchi's cluster, a first description of the Alpha Persei

Moving Cluster, and at least 9 (probably 13 and perhaps 15) own true discoveries: M6, M36, M37, M38, M41, M47, NGC 2362, NGC 6231, and NGC 6530 (the cluster associated with the Lagoon Nebula M8), as well as probably M33, M34, NGC 752, and NGC 2451, and perhaps NGC 2169 and NGC 2175.

Johan Hevel or Hevelke (known as Hevelius, 1611-87) from Dantzic compiled a catalogue of 1564 stars, Prodomus Astronomiae, published posthumously together with his star atlas, Uranographia. He included a list of 16 entries, 2 of which are objects (the Andromeda Galaxy M31 and the Praesepe star cluster M44), while the other 14 are asterisms or non-existent. Derham and Messier spent a lot of observing time to find these "nebulae"; among them is a double star in Ursa Major, which Messier believed to have been identified (it is M40) -- we now know that he probably took another double star than Hevelius. Hevelius is also thought to have first seen M22, but the discovery of this first known globular cluster was generally assigned to Abraham Ihle in 1665.

In his star catalog Historia Coelestis Britannica, published in 1712 and revised in 1725, John Flamsteed (1646-1719) refers to several "nebulae" and "nebulous stars". This includes many of the then-known objects (Coma Cluster Mel 111, h+chi Persei, M31, M42) plus three independent discoveries, including re-discoveries of unknown Hodierna objects NGC 6530 (associated with $\bar{m}8$) and $\bar{m}41$ and his own true original discovery of NGC 2244 around the star 12 Monocerotis

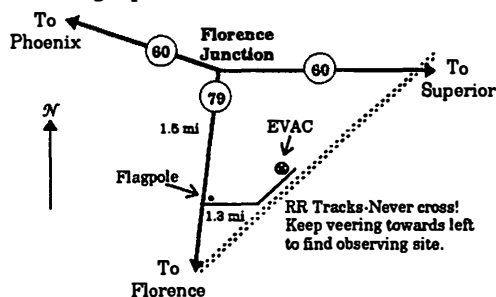
EVAC Star Parties

Local Star Party: Florence Junction Site

General Information: The Florence Junction site is the official site for the East Valley Astronomy Club's Local Star Party, typically held on the Saturday closest to Last Quarter Moon. Florence Junction offers reasonably dark skies within a short drive of most east Valley locations.

Location: N 33° 14' 40" W 111° 20' 16"

How To Get There: Take US 60 east to Florence Junction. At Florence Junction, turn right (south) on SR 79. After 1.5 miles, you will see a tall steel flagpole and a dirt road to the left. Turn left onto the dirt road and continue for another 1.3 miles. Drive with caution as the road is rough in some areas. To the left there will be a large open area.

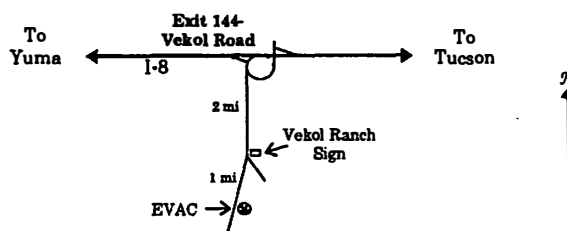


Deep Sky Star Party: Vekol Road Site

General Information: The Vekol Road site is the official site for the East Valley Astronomy Club's Deep Sky Star Party, typically held on the Saturday closest to New Moon. Vekol Road offers dark skies despite prominent skyglow from Phoenix to the north. The site is within 1½ hours drive time from most east Valley locations.

Location: N 32° 47' 55" W 112° 15' 15"

How to Get There: Take I-10 south and exit onto Maricopa Road. Continue through the town of Maricopa to SR 84, about 25 miles from I-10. Turn right on SR 84, after about 5 miles the road merges with I-8. Continue west and exit I-8 at Vekol Road, Exit 144. Turn left and cross the highway overpass. Before looping back onto I-8 take the road to the left. Go south for 2 mi. At the Vekol Ranch sign bear right and continue south for another mile until reaching a large, open area on the left.



(associated with the Rosette Nebula NGC 2237-9, neither the cluster nor the nebula in Messier's catalog).

Gottfried Kirch (1639-1710), who was observing from Berlin, and known for his observations of stars and comets, discovered M11 in 1681 and M5 in 1702.

Edmond Halley (1656-1742) published a list of six "luminous spots or patches" in the Philosophical Transactions of the Royal Society for 1715, including his own discoveries of globular clusters Omega Centauri (on a journey 1677 at St. Helena) and M13 (1714), and the previously known objects M42, M31, M22, and M11.

Jean-Jacques Dortous de Mairan (1678-1771), before 1731, found a nebulosity around a star north of the Great Orion Nebula, which became known as M43 (this was published 1733). Shortly after this, John Bevis (1695-1771) discovered the Crab Nebula M1. He created a star atlas, which he called Uranographia Britannica, which was completed in 1750, but due to the bankruptcy of the publisher, only one or two printings were produced, and the complimentary catalog was never published. Messier must have had access to a copy of this atlas, as he refers to the "English Atlas" several times, e.g. in the descriptions for the objects M1, M11, M13, M22, M31, and M35. Oddly, the discovery of M35 is ascribed to de Cheseaux in 1746 by Kenneth Glyn Jones, although it seems that Bevis might have seen it earlier, as it was in his atlas.

William Derham (1657-1735) published a list of 16 nebulous objects in the Philosophical Transactions of the Royal Society for 1733, 14 of them being from Hevelius' catalog, and the other two from Halley's list. Only two of the objects were real, M31 and M7, all others were nonexistent, or uninteresting asterisms, fooling other observers (including Messier) using this widespread compilation; it was reprinted in the Memoirs of the French Academy of Sciences in 1734, and included in de Maupertius' book Discours sur la Figure des Astres in 1742.

About in 1746, Philippe Loys de Cheseaux (1718-51) observed several clusters and "nebulous stars", and compiled a catalog of their positions. According to Kenneth Glyn Jones and the Webb Society Deep-Sky Observer's Handbook, Vol. 3 (Open and Globular Star Clusters), 8 of them were original discoveries: M16 (No. 4), M25 (No. 5), M35 (No. 12, but see the remark at John Bevis), M71 (No. 13), M4 (No. 19), M17 (No. 20), NGC 6633, and IC 4665. Moreover, he independently re-discovered M6 (No. 1) and M22 (No. 17). De Cheseaux's list was given to Reaumur, who presented it to the French Academy of Sciences on August 6, 1746, but it was not otherwise published. It was investigated by Bigoudan in 1884 and became well known only then.

Besides observing nebulous patches in the sky, de Cheseaux was probably the first to formulate Olbers' paradox.

Jean-Dominique Maraldi (1709-88), also known as Maraldi II, discovered two globular clusters: M15 on September 7, 1746, and M2 on September 11, 1746.

Le Gentil (with his full name Guillaume-Joseph-Hyacinthe-Jean-Baptiste Le Gentil de la Galaziere, 1725-92) discovered M32, the Andromeda Galaxy's companion, on October 29, 1749. He also discovered the gaseous nebula M8, the Lagoon Nebula, in the same year (the cluster had been found previously by Flamsteed, see above). He independently found Hodierna's objects M36 and M38.

Abbe Nicholas Louis de la Caille (Lacaille, 1713-62) observed stars and Deep Sky objects in the Southern sky from South Africa during his 1751-52 journey, invented several southern constellations (many of which are still in use), and compiled a catalog of Southern deep sky objects with 42 entries, 33 of which are real. Among them are 25 original and at least two independent rediscoveries. Lacaille's major original discoveries include the Eta Carinae Nebula NGC 3372, globular cluster 47 Tucanae (NGC 104), the Tarantula Nebula NGC 2070 in the Large Magellanic Cloud, and spiral galaxy M83, the first discovered galaxy beyond the Local Group.

This was the last discovery in the deep sky before Charles Messier (1730-1817) started to compile his catalog, and made his first original discovery of M3 in 1764. For more than a decade, Charles Messier was alone in looking for clusters and nebulous objects. During that time, he discovered 27 objects of which 25 are actually deep sky objects (the other two are the Sagittarius star cloud M24 and the double star M40).

Messier himself originally discovered 15 more nebulous objects (14 deep sky plus the star quartett M73) in the subsequent years until 1781.

In late 1774, Johan Elert Bode (1747-1826) joined those who looked for new nebulous objects with success: He discovered M81 and M82 on the last day of that year (December 31), and 3 more objects are subsequently quoted to him (M53 in 1775, M92 in 1777, and M64 in 1779). Bode compiled a deep sky catalog of 75 entries published 1777 in the Astronomisches Jahrbuch for 1779, and entitled "A Complete Catalogue of hitherto observed Nebulous Stars and Star Clusters". However, according to Kenneth Glyn Jones, this list was inflated by a lot of non-existent objects and asterisms gathered from Hevelius and elsewhere; it contains at most 50 real objects. The second edition, which was extended by his two latest original discoveries of M92 and M64, was published in 1780.

EVAC on the Internet

EVAC Homepage

www.goodnet.com/~rkerwin/evac/evac.html

E-mail Mailing Lists

EVAC-mls is a mailing list for club announcements and quick notification of astronomical events.

EVAC-Board is for EVAC business. All club members are welcome to participate.

AZ-Observing is a fairly general mailing list about observing in Arizona. Included are star party information, who is going, as well as the latest observations and astronomical events.

To join, send E-mail with the Subject: Subscribe to the "-request" mailing address at psiaz.com. For example, you would send the request for AZ-Observing to AZ-Observing-request@psiaz.com.

About five years later, in 1779, when Messier and Bode were still active in compiling their lists, four more astronomers entered the "club" of successful deep sky discoverers: Antoine Darquier de Pellepoix (Darquier, 1718-1802) of Toulouse discovered the Ring Nebula M57 in January, shortly before Messier; both found it when tracing a comet. Johann Gottfried Koehler (or Köhler, 1745-1801), who had independently found M81 and M82 in the time between 1772 and 1778 (so maybe he did it before Bode), had discovered M67 this year or perhaps earlier, and found M59 and M60 on April 11, 1779, when tracing comet Bode 1779. While Messier found, in addition, M58 on that occasion, it was Barnabus Oriani (1752-1832) who first discovered M61. Koehler published a catalog of 20 entries in 1780. Finally, Messier's friend Pierre Mechain (1744-1804) began his astronomical observing career, and made his first original discovery of M63 on June 14, 1779. Subsequently, Mechain discovered originally about 27 objects most of which he contributed to Messier's catalog, as he was observing in close cooperation with Charles Messier. As he surely has communicated all his discoveries to Messier, Helen Sawyer-Hogg, in 1947, decided to add three more of them to the Messier catalog (M105 to M107).

As a major milestone in deep sky discovery, the Messier Catalog was published in its final version of 103 objects in 1781 in the *Connaissance des Temps* for 1784. Together with its more recent additions which brought it to 110 entries, which at least all but one (M102) belong to real objects (though four of them were missed for over a century), it contains the majority of all clusters, nebulae, and galaxies known up to April, 1782 (when M107 was the last Messier object to be discovered, by Pierre Mechain).

The Messier catalog did in particular impress the great German-British astronomer Friedrich Wilhelm (William) Herschel (1738-1822), who by that time had become famous especially because of his discovery of planet Uranus in 1781. Herschel received his copy of Messier's catalog from a friend, William Watson, on December 7, 1781. At that time, he was still working as organist at Bath (which he gave up in May, 1782), and a skilled telescope maker. He started an extensive scan of the skies he could observe from England (i.e., the northern sky), with large telescopes of up to a 48-inch aperture, 40-foot focal length giant which he set up himself on August 28, 1789 (on that first day he discovered Saturn's moon Enceladus with this new scope). Published in 3 steps, Herschel cataloged over 2500 discoveries, most of which are real deep sky objects. As he had the best telescope of that time, he was without competition. He was assisted by his sister Caroline Lucretia Herschel (1750-1848) who was an avid observer herself; she discovered a lot of the clusters and nebulae in Herschel's catalog (among them is an independent discovery of M110 = H V.18, which Messier had discovered but not cataloged 10 years earlier, and an independent rediscovery of the missing Messier open cluster M48 = H VI.22), and discovered 8 comets.

William Herschel classified the nebulous objects in eight groups: 1. Bright Nebulae; 2. Faint Nebulae; 3. Very faint Nebulae; 4. Planetary Nebulae; 5. Very large Nebulae; 6. Very compressed and rich star clusters; 7. Compressed clusters of small and large (i.e., faint and bright) stars; 8. Coarsely scattered clusters of stars. As the true nature of the objects was still unknown at that time, this classification is more of historical importance today.

William (and Caroline) Herschel had virtually exhausted the northern skies with object discoveries around 1800. But the southern sky was still waiting to be explored, and it was James Dunlop (1795-1848) who made the first major observations there after Lacaille. He went to New South Wales, Australia, in 1821, accompanying a Sir Thomas Makdougall Brisbane. He was keeper of the Brisbane observatory at Paramatta, 1823-1827, and compiled a star catalog (the Brisbane Catalogue of over 7000 southern stars). His observations of deep sky objects from that time were compiled to "A Catalogue of Nebulae and Clusters of Stars in the Southern Hemisphere observed in New South Wales" of about 600 discovery entries. This catalog was sent to William Herschel's son, John Herschel, who presented it to the Royal Society in 1827. Dunlop was awarded for this work with the Gold Medal of the Royal Astronomical Society, and with the Lalande Medal of the French Academy. However, this did not prevent a lot of his "objects" to be nonexistent, or so badly described that they couldn't be safely

identified later: Hardly half his entries can be related to real objects.

John Frederick William (John) Herschel (1792-1871) had continued his father's work, and added 525 new entries (northern objects) in a catalog published in 1833. But John Herschel also wanted to catalog the southern skies. On November 13, 1833, he and his family went on ship to sail to the Cape of Good Hope, South Africa, where they arrived on March 4, 1834. He intensively studied the southern skies in the subsequent years. His observations of southern nebulous objects were published in 1847 as a catalog with 1713 entries. Evidently, he summarized his and his father's, as well as others' deep sky discoveries in his great General Catalogue of over 5000 entries.

The work of the Herschels finally brought the great "nebula" (and cluster) discovery time to a conclusion. Nevertheless, it took time and new research methods (especially photography and spectroscopy), until the nature of the various deep sky objects was uncovered: The gaseous nature of the "true" nebulae was discovered by the British amateur and pioneer of spectroscopy William Huggins (1824-1910) in the late 19th century, while only in the 1920s the true nature of galaxies as independent "island universes" like our Milky Way became apparent (due to the work of Edwin Hubble (1889-1953)).

EVAC Meeting Highlights

M. Aaron McNeely, Editor
amcneely@primenet.com
August 12, 1998

President Sheri Cahn began the meeting at 7:38 and addressed the following EVAC events:

August 15-Local Star Party
August 22-Deep Sky Star Party
September 9-EVAC Meeting

There were approximately 54 people in attendance including 7 newcomers.

Sheri discussed the following star parties: The Northern Arizona Star Party, hosted by the Prescott Astronomy Club, of September 18-19 and EVAC's All-Arizona Star Party of October 17. Sheri also brought up the idea of hosting a star party for the Scottsdale Community College to be held in the fall when classes reconvene.

The August meeting consisted of a swap meet and member show and tell. The following EVAC members made presentations:

Tom Polakis: Tom spoke of his visual observations of 17th magnitude Gyulbudagian's Nebula, a variable nebula located in Cepheus.

Bernie Sanden: Bernie concluded, after processing Brian Skiff's post-1977 data concerning cloud cover in northern Arizona, that weekends seemed to have clearer weather.

Chris Schur: Chris displayed his latest astrophotos, these images were created by the use of an 8-inch Schmidt camera yielding a 6° field. Chris concentrated on the Sagittarius and Scorpius regions for some glorious Milky Way exposures. Chris also provided a guided tour of his photos by noting many bright and faint objects that were apparent.

Joe Ormond: Joe presented his latest astrophotos, these were taken with a 35 mm camera attached to an equatorial mount. Joe concentrated on wide field shots of constellations, in particular Sagittarius, Scorpius, and Cygnus.

Laurice Dee: Ms. Dee, a 1998 Ambassador for NASA's Galileo project, began a slide presentation on the highlights of the Galileo mission. She detailed the intricate paths taken by the spacecraft and its images of Earth, the moon, Venus, and asteroids Gaspra and Ida. Laurice will present Part 2 of her history of the Galileo mission at the September EVAC meeting.

The meeting ended with some vigorous buying and selling along with the complimentary snacks.

September EVAC Meeting

Our guest speaker for September is Paul Scowen, Assistant Research Scientist at ASU. His topic will be "The Eagle and the Tarantula—Climbing the ladder to understand distant star formation."

"Star Winds"—*H.P. Lovecraft*

★

It is a certain hour of twilight glooms,
Mostly in autumn, when the star-wind pours
Down hilltop streets, deserted out-of-doors
But showing early lamplight from snug rooms.
The dead leaves rush in strange, fantastic twists,
And chimney-smoke whirls round with alien grace
Heeding geometries of outer space,
While Fomalhaut peers in through southward mists.

This is the hour when moonstruck poets know
What fungi sprout in Yuggoth, and what scents
And tints of flowers fill Nithon's continents,
Such as in no poor earthly garden blow.
Yet for each dream these winds to us convey
A dozen more or ours they sweep away!

- Star Winds
 - EVAC Show & Tell
 - The Discovery of the Deep Sky
- Contents:**

Valued member since 3/16/97
 Next EVAC Meeting — Sept. 9th 7:30 pm



East Valley Astronomy Club
 M. Aaron McNeely, Editor
 4402 North 36th Street, #22
 Phoenix, AZ 85018



East Valley Astronomy Club—1998

Scottsdale, Arizona

EVAC Homepage—<http://www.goodnet.com/~rkerwin/evac/evac.html>

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MEMBERSHIP & SUBSCRIPTIONS: \$20 per year, renewed in December. Reduced rates to *Sky & Telescope* and *Astronomy* available. Contact Kathy Woodford, P.O. Box 213, Apache Junction, AZ 85217, 602/857-3438. Email—ariz.kat@juno.com

CLUB MEETINGS: Second Wednesday of every month at the Scottsdale Community College, 7:30 pm. Normally Room PS 170 or 172 in the Physical Sciences Building. See map below.

NEWSLETTER: Mailed out the week before the monthly Club meeting. Send contributions to M. Aaron McNeely, 4402 North 36th Street, #22, Phoenix, AZ 85018, 602/954-3971. Email—amcneely@primerenet.com
 Contributions may be edited for length or clarity.

ADDRESS CHANGES: Contact Bill Smith, 1663 South Sycamore, Mesa, AZ 85202, 602/831-1520. Email—bsmithaz@aol.com

EVAC LIBRARY: The library contains a good assortment of books, downloaded imagery, and helpful guides. Contact Enrico Alvarez for complete details, 602/837-0486.

BOOK DISCOUNTS: Great savings through Kalmbach and Sky Publishing. Contact Don Wrigley, 423 West 5th Avenue, Apache Junction, AZ, 602/982-2428. Email—donwrig@juno.com

EVAC PARTY LINE: Let other members know in advance if you plan to attend a scheduled observing session. Contact Robert Kerwin, 602/837-3971. Email—p24493@email.mot.com

