

D I S T A N T **L I G H T**

Rockland Astronomy Club Journal ~ November 2006

ANTENNA GALAXIES

SAVE THE DATE
MERCURY TRANSIT
NOV 8TH 1:30 PM
TO SUNSET
BEAR MTN, NY

DETAILS ON PAGE 3

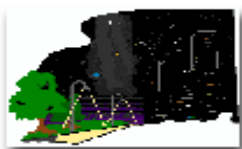


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International Dark Sky Association



2005 Recipient

PLEASE NOTE OUR NEW ADDRESS:
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 225 Route 59, Suffern, NY 10901-5203

[CLICK HERE FOR MONTHLY SKYDATA: P. 7](#)

[CLICK HERE FOR RAC MEETINGS SCHEDULE AND ADVISORY COMMITTEE: P. 8](#)



ON THE COVER

The Antennae Galaxies NGC 4038-4039

This new NASA Hubble Space Telescope image of the Antennae galaxies is the sharpest yet of this merging pair of galaxies. During the course of the collision, billions of stars will be formed. The brightest and most compact of these star birth regions are called super star clusters. The two spiral galaxies started to interact a few hundred million years ago, making the Antennae galaxies one of the nearest and youngest examples of a pair of colliding galaxies. Nearly half of the faint objects in the Antennae image are young clusters containing tens of thousands of stars. The orange blobs to the left and right of image center are the two cores of the original galaxies and consist mainly of old stars criss-crossed by filaments of dust, which appears brown in the image. The two galaxies are dotted with brilliant blue star-forming regions surrounded by glowing hydrogen gas, appearing in the image in pink.

The new image allows astronomers to better distinguish between the stars and super star clusters

created in the collision of two spiral galaxies. By age dating the clusters in the image, astronomers find that only about 10 percent of the newly formed super star clusters in the Antennae will survive beyond the first 10 million years. The vast majority of the super star clusters formed during this interaction will disperse, with the individual stars becoming part of the smooth background of the galaxy. It is however believed that about a hundred of the most massive clusters will survive to form regular globular clusters, similar to the globular clusters found in our own Milky Way galaxy.

The Antennae galaxies take their name from the long antenna-like "arms" extending far out from the nuclei of the two galaxies, best seen by ground-based telescopes. These "tidal tails" were formed during the initial encounter of the galaxies some 200 to 300 million years ago. They give us a preview of what may happen when our Milky Way galaxy will collide with the neighboring Andromeda galaxy in several billion years. ★

Credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA)-ESA/Hubble Collaboration

RAC MEMBERSHIP APPLICATION

Club members receive this journal, enjoy special prices for annual subscriptions to S&T and ASTRONOMY magazines, discounts to club events and much more. Make checks payable to RAC and mail with this form to: Rockland Astronomy Club, Attn: Memberships, 225 Route 59, Suffern, New York 10901-5203.

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High School Student	\$10	\$18	\$25	\$40	+\$18/yr.	_____
Grand Total						_____

RAC SPECIAL EVENT

Mercury Sun Transit November 8th, 2006

Free public observing event sponsored
by The Rockland Astronomy Club

Time: 1:30 - Sunset

Location: Perkins Drive atop Bear Mountain

Take Palisades Interstate Pkwy Exit 18

Call 845.47STARS for weather update

On Wednesday, 2006 Nov 08, Mercury will transit the Sun for the first time since 2003. The transit or passage of a planet across the face of the Sun is a relatively rare occurrence. As seen from Earth, only transits of Mercury and Venus are possible. There are approximately 13 transits of Mercury each century. In comparison, transits of Venus occur in pairs with more than a century separating each pair.

The principal events occurring during a transit are conveniently characterized by contacts, analogous to the contacts of an annular solar eclipse. The transit begins with contact I which is the instant when the planet's disk is externally tangent with the Sun. Shortly after contact I, the planet can be seen as a small notch along the solar limb. The entire disk of the planet is first seen at contact II when the planet is internally tangent with the Sun. During the next several hours, the silhouetted planet slowly traverses the brilliant solar disk. At contact III, the planet reaches the opposite limb and once again is internally tangent with the Sun. Finally, the transit ends at contact IV when the planet's limb is externally tangent to the Sun. Contacts I and II define the phase called ingress while contacts III and IV are known as egress. Position angles for Mercury at each contact are measured counterclockwise from the north point on the Sun's disk.

Table 1 above gives the times of major events during the 2006 transit. Greatest transit is the instant when Mercury passes

TABLE 1:
Geocentric Phases of the 2006 Transit of Mercury

Event	EST Time	Position Angle
Contact I	14:12:04	141°
Contact II	14:13:57	141°
Greatest Transit	16:41:04	205°
Contact III	19:08:16	269°
Contact IV	19:10:08	269°

closest to the Sun's center (i.e. - minimum separation). At this time, the geocentric angular distance between the center's of Mercury and the Sun will be 423 arc-seconds. The position angle is the direction of Mercury with respect to the center of the Sun's disk as measured counterclockwise from the celestial north point on the Sun. Figure 1 shows the path of Mercury across the Sun's disk and the scale gives the Universal Time of Mercury's position at any instant during the transit. The contact times are listed along with the celestial coordinates of the Sun and Mercury at greatest transit. Since the contact times are geocentric they are only correct for an observer stationed at Earth's center. The contact times for any given location may differ from the geocentric times by up to a minute. This is due to the effect of parallax since Mercury's 10 arc-second diameter disk may be shifted up to nearly 13 arc-seconds from its geocentric coordinates depending on the observer's exact geographic position.

The transit will be widely visible from the Americas, the Pacific Ocean, eastern Asia, and Australia. Observers throughout most of the Americas will witness the beginning of the transit but the Sun will set before the event ends. Similarly, Asia and most

of Australia will see the end of the event since the transit will already be in progress as the Sun rises. Regions where the entire transit is visible include western North America, eastern Pacific, New Zealand, southeastern Australia and Antarctica. The transit will not be visible from anywhere within Europe, Africa or western Asia. Table 2 lists predicted contact times and the corresponding altitude of the Sun for over a hundred cities around the world with an emphasis on Canada and the United States.

Observing the Transit

Since Mercury is only 1/194 of the Sun's apparent diameter, a telescope with a magnification of 50x to 100x is recommended to watch this event. The telescope must be suitably equipped with adequate filtration to ensure safe solar viewing. The visual and photographic requirements for transit are identical to those for observing sunspots and partial solar eclipses. Amateurs can make a useful contribution by timing the four contacts at ingress and egress. Observing techniques and equipment are similar to those used for lunar occultations. Since poor seeing often increases the uncertainty in contact timings, an estimate of the possible error associated with each timing should be included.

White light observations of contacts I and IV include a small bias since Mercury is only visible after contact I and before contact IV. However, if Hydrogen-alpha filtration is available, the planet may be visible against either prominences or the chromosphere before and after contacts I and IV, respectively. Observations of contacts II and III also require amplification. They're often mistaken
(Continued on next page)



Photo: Fred Espanak, 1973

MERCURY TRANSIT

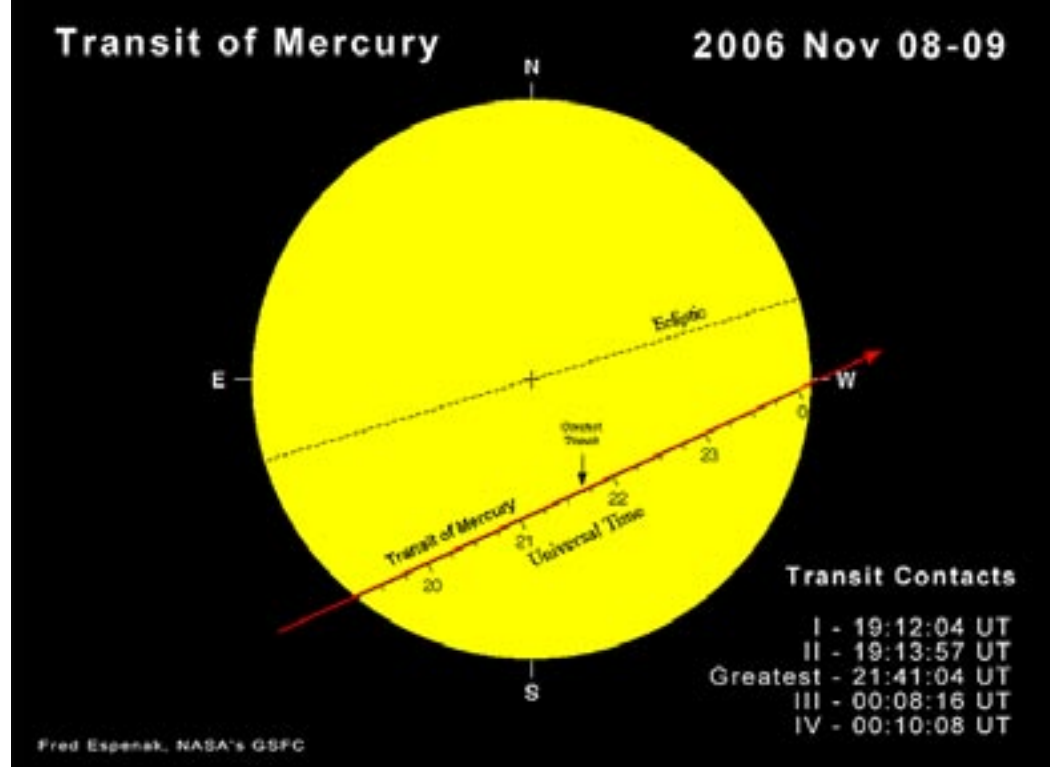
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for the instant when the planet appears internally tangent to the Sun. However, just before contact II, the so-called black drop effect is seen. At that time, the transiting planet seems to be attached to the Sun's limb by a thin column or thread. When the thread breaks and the planet is completely surrounded by sunlight, this marks the true instant of contact II. Contact III occurs in exactly the reverse order. Atmospheric seeing often makes it difficult to measure contact timings with a precision better than several seconds.

Recurrence of Transits

During the present era, transits of Mercury fall within several days of May 8 and November 10. Since Mercury's orbit is inclined seven degrees to Earth's, it intersects the ecliptic at two points or nodes which cross the Sun each year on those dates. If Mercury passes through inferior conjunction at that time, a transit will occur. During November transits, Mercury is near perihelion and exhibits a disk only 10 arc-seconds in diameter. By comparison, the planet is near aphelion during May transits and appears 12 arc-seconds across. However, the probability of a May transit is smaller by a factor of almost two. Mercury's slower orbital motion at aphelion makes it less likely to cross the node during the critical period. November transits recur at intervals of 7, 13, or 33 years while May transits recur only over the latter two intervals.

Edmund Halley first realized that transits could be used to measure the Sun's distance, thereby establishing the absolute scale of the solar system from Kepler's third law. Unfortunately, his method is somewhat impractical since contact timings of the required accuracy are difficult to make. Nevertheless, the 1761 and 1769 expeditions to observe the transits of Venus gave astronomers their first good value for the Sun's distance. Because Venus's orbit is considerably larger than Mercury's orbit, its period is also longer making transits of Venus are much rarer. Indeed, only



seven such events have occurred since the invention of the telescope (1631, 1639, 1761, 1769, 1874, 1882 and 2004). During the current era, transits of Venus are only possible in early December and early June when Venus's orbital nodes pass across the Sun. Venus transits show a clear pattern of recurrence at intervals of 8, 121.5, 8 and 105.5 years.

The 2004 transit of Venus was the first one since 1882. The upcoming 2012 transit will be visible from all of North America and Asia as well as parts of Europe and Africa (Esenak 2002). Since Venus will subtend 58 arc-seconds, it can be seen with the naked eye (using suitable filtration) as a tiny black disk against the Sun. This final transit of Venus during the

21st century is most eagerly anticipated. For more details, see: <http://sunearth.gsfc.nasa.gov/eclipse/transit/venus0412.html>

The next transit of Mercury occurs on 2016 May 09 and is visible from the Americas, Europe, Africa and central Asia.

NASA's Eclipse Home Page features two catalogs listing dates and details for all transits of Mercury (AD 1600 to AD 2300) and Venus (2000 BC to AD 4000). The transit catalogs were generated using elements published by Meeus (1989). Both catalogs can be accessed from the top transit page at: <http://sunearth.gsfc.nasa.gov/eclipse/transit/transit.html> ★

WINTER CONTELLATION

Lepus the Hare

Edited by Dr. Bernard Sokolowski

Lepus the Hare is a rather faint constellation located just south of the constellation Orion, sandwiched between Canis Major to the east and Eridanus to the west. It is best observed during the mid winter months. Lepus is often overlooked by observers in mid-northern latitudes because it lies only 20 degrees off the southern horizon and of it's proximity to the more grandiose constellations that surround it, which get more attention. The stars that give Lepus its shape resembles a flattened X or the outline of an "open book", making it easy to recognize once you're looking in the right spot. The easiest way to find Lepus is to follow a straight line south 12 degrees from the Great

Nebula. This will put you almost dead center in the constellation.

Lepus is a very ancient constellation. No one knows for sure who discovered it or has been able to ascertain precisely when the constellation was identified as an animal. Some ancient records recognize the Arabs as initially describing this group of stars as "the throne of Orion the hunter".

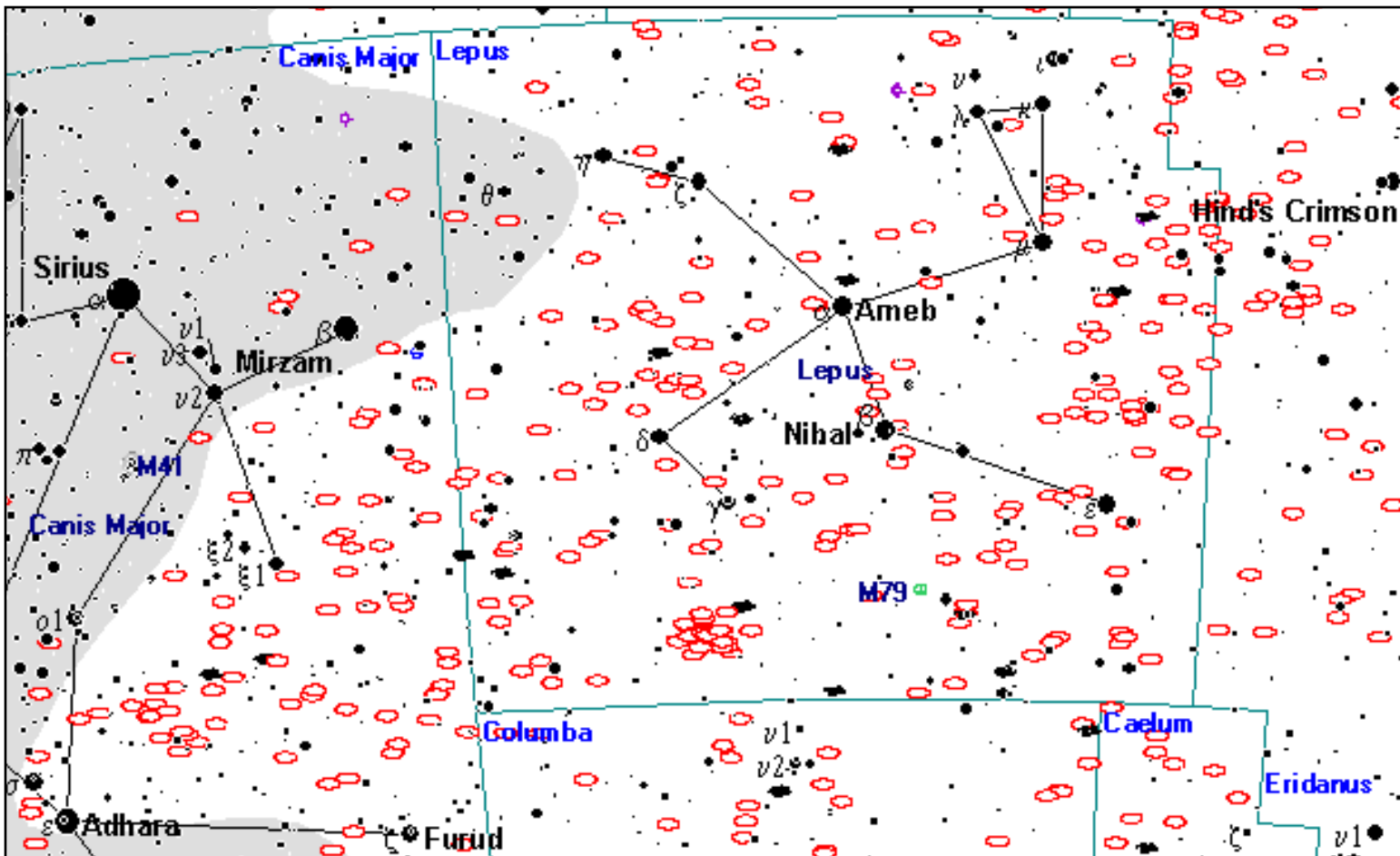
It seems from most historical records that Lepus has always been associated with the constellations Orion the Hunter and Canis Major and Minor, Orion's hunting dogs. One version of mythology describes Lepus the Hare as being a favorite prey of Orion

and his hunting dogs. While on a hunt, just before Lepus was harvested, the great hunter encountered Taurus the Bull and a battle ensued, sparing the hapless Hare.

Other historical accounts also associate the Moon with this constellation. Some earlier cultures claimed that the rabbit's shadow could be seen on the full moon during the seasons when the constellation was most (Continued on next page)



Photo: M79 Globular Cluster



CONSTELLATION

Continued from previous page

prominent. Even some modern texts have identified a rabbit's shadow on the full moon during the winter months.

Lepus is rather devoid of stars and does not have the abundance of objects seen in other constellations such as Orion or Auriga. It does however have several objects of interest that should not be passed over when observing the more famous neighbors to the North and East.

R Leporis (Hind's Crimson Star) is a long period pulsating variable star of spectral class N, ranging in magnitude between 5.9 and 11.0, and having a period of 432 days. R Leporis was originally discovered by J.R. Hind of London in October 1845. Hind's Crimson Star is a rare type of Red Giant star known as Carbon Stars. Carbon stars are of immense scientific interest because this class of stars contains an abundance of Carbon in their cores and atmospheres. All type N stars exhibit very strong spectral lines indicating significant amounts of carbon compounds in their atmospheres. These stars have very cool surface temperatures, of about 2600 Kelvin. This makes them rather "cold" compared to most stars. Because of the cooler temperatures and the abundance of carbon in their atmospheres, the color of these stars often appear as deep crimson or ruby red in color. R Leporis has often been described as an "illuminated blood drop" when observed. The Crimson Star may just be the reddest star visible in the night sky. Parallax measurements of it have determined the distance to be about 1500 light years.

Gamma Leporis is a magnitude 3.6 double star with a combined spectral class of F6 and an apparent separation of 96 arc-seconds. The actual distance of this double star is 29 light years, calculating out to an actual separation of 900 astronomical units at this distance. The star consists of two visual components with contrasting colors, both easily seen in any size telescope. The pair has been described by most observers as Yellow-Orange or Yellow-Garnet. The



COMET SWAN BRIGHTENS *Explanation: A newly discovered comet has brightened enough to be visible this week with binoculars. The picturesque comet is already becoming a favored target for northern sky imagers. Pictured above just last week, Comet SWAN showed a bright blue-green coma and an impressive tail. Comet C/2006 M4 (SWAN) was discovered in June in public images from the SolarWind Anisotropies (SWAN) instrument of NASA and ESA's Sun-orbiting SOHO spacecraft. Comet SWAN, near magnitude six, was visible with binoculars in the northeastern sky. Passing its closest to the Sun, Comet SWAN and was at its closest to the Earth toward the end of October. Comet SWAN's unusual orbit appears to be hyperbolic, meaning that it will likely go off into interstellar space, never to return. ★*

magnitude and spectral class of each star is 3.6 and F6 for component A, and 6.2 and dK for component B respectively. Observing this star is easy, even in a finder scope. Because of their wide separation, low power frames the pair best. This double is a beautiful site and shouldn't be missed.

M79 (NGC 1904) is a magnitude 8.4 Globular Cluster with an apparent diameter of 7.5 arc-minutes and a combined stellar spectral class of F3. The cluster is located just a couple degrees north of the southern most border of Lepus. M79 was discovered in October 1780 by Mechain and was re-discovered and cataloged by Charles Messier in December that same year. It has been determined by measurement that this globular cluster has about 90,000 stars, has an actual distance of 50,000 Light Years and an actual diameter of approximately 110 Light Years. Only 5 variable stars have been identified in M79.

Since most Globular Clusters have many variable stars as residents, this is very unusual for a globular cluster. As an example, M3 has over 200 variable stars in comparison. This globular cluster is

rather dim compared to others in the Messier catalog, but it shows detail when observed with medium to large telescopes. An 8-10" lens will show resolution of the outer edges of the cluster, breaking it into a multitude of magnitude 14 stars. Larger telescopes (14 inches and over) will begin to show detail in the core. As interesting as this object is, only larger amateur telescopes can truly show M79 in its entire splendor.

NGC 1964 is a magnitude 10.8 Sb II edge on spiral galaxy with an apparent diameter of 6.2 x 2.5 arc-minutes. Located just 3 degrees east by south east of Beta Leporis the actual distance of the galaxy is 65 million light years, giving it an actual diameter of 115,000 light years.

Dark, transparent skies are an absolute must with this object. The galaxies nearly edge on position makes the spiral arms difficult to observe. Even though 1964 can be seen definitively in a 4 inch glass, detail can not be glimpsed until the aperture reaches 8 to 10 inches or more. Although the hub and core is visible in a 10 inch, additional detail within can only be revealed in 14 inch or larger telescopes. ★



NOVEMBER SKYDATA

Full Nov 5 Last Qtr Nov 13 New Nov 20 First Qtr Nov 28

Highlights

- Nov 4 Taurid meteors
- Nov 8 Mercury Transit
- Nov 12 Saturn 1.6° south of Moon
- Nov 16 Leonid meteors
- Nov 17 Spica 0.6° north of Moon
- Nov 19 Mercury 6° north of Moon
- Nov 21 Jupiter in conjunction with Sun
- Nov 25 Mercury at greatest western elongation (20°)

Leonids: A Favorable Showing for 2006?

The East Coast is strongly favored for this years Leonid shower. Observers should start watching just before midnight on Saturday evening, November 18, and continue watching through the morning hours of November 19.

Some years ago, when the teams of David Asher and Robert McNaught were making their groundbreaking predictions of Leonid storms and outbursts for the years 1999-2002, they also noted a possible outburst for 2006. This November, we'll find out whether that prediction comes true. On November 19, the Earth is due to pass through a trail of debris left by the Leonids' parent comet on one of its previous returns. A sharp peak of perhaps 100 Leonids/hour is expected, although there is a bit of uncertainty. If it occurs very near the predicted time of 4:45 UT, Europe and Western Africa will see the display during the favored morning hours. The East Coast of North

America will see a bit of the display (maybe up to 25 per hour) as earthgrazing Leonids starting when the radiant rises at around 11pm. Depending on just how short and sharp this peak is, most of North America may be out of luck.

The Leonids are very fast meteors. Most of the meteors seen during this outburst are expected to be faint, so dark skies will be very helpful. Even if you miss the November 19 outburst, the shower is active at a low "background" level for about a week from November 14-21. Expect about 10 meteors per hour on the mornings of November 17 and 18 due to this activity (best during the couple of hours just before the beginning of local morning twilight). A roughly equal number of sporadic meteors should be visible, along with a few late Taurids. The story of the Leonids is a varied one. It officially begins at the beginning of the 10th century when the first accounts appeared indicating that "stars fell like rain." Similar brief accounts would appear for the next several centuries, at roughly 33-years intervals, in the written records of the Asian, European, and Muslim cultures. The very last years of the 18th century showed some signs of an increased curiosity in meteors. First, Heinrich W. Brandes and Johann F. Benzenberg (University of Göttingen) carried out an experiment to observe meteors at two different locations. The result was that they discovered meteors became visible at an average height of 97 kilometers.

It is commonly accepted that the Leonids brought about the birth of meteor astronomy. Up to this time it was believed meteors originated within Earth's atmosphere, but the Brandes-Benzenberg experiment revealed meteors traveled at several kilometers per second which indicated an origin outside Earth's atmosphere. The second significant event that happened at the end of the 18th century was on November 12 of 1799, when the Leonids appeared and, for the first time, were actually observed by scientists who provided detailed accounts. Unfortunately, the enthusiasm was short-lived. Although less than a handful of astronomers began to systematically observe meteors during the 1820s, little came out of these observations other than the fact that more meteors fell on some nights of the year than on others. This all changed on the night of November 12/13, 1833. It is true that people were awoken from their sleep by the screams of people believing the world was coming to an end, but astronomers rushed to make as detailed observations as possible. By the time morning twilight began washing out the display in the United States, one very important fact was apparent. This meteor display appeared to radiate from one spot in the sky. Within the next few years it was realized that when enhanced displays of meteors occurred they radiated from one area of the sky. This led to the determination that meteors moved around the sun in elliptical orbits and then came the realization that comets produced meteor showers. ★

Prime Observing Window

Wednesday Nov 15 through Friday Nov 24

Sun & Moon Rise & Set Times

Date	Sunrise	Set	Moonrise	Set	Phase
Nov 5	16:36	06:42	16:36	06:42	Full
Nov 13	06:41	16:40	Prev Day	13:30	Last Qtr
Nov 20	06:50	16:34	06:42	16:03	New
Nov 28	06:59	16:30	12:51	Next Day	First Qtr

Planetary

Visible Planets in the Night Sky

November 1

	Rise	Transit	Set	Mag
Mercury	07:53	12:37	17:21	1.6
Venus	06:33	11:45	16:58	-3.9
Mars	06:13	11:28	16:44	1.8
Jupiter	07:49	12:44	17:40	-2.3
Saturn	00:06	07:00	13:55	0.4

November 15

	Rise	Transit	Set	Mag
Mercury	05:34	10:49	16:05	4.6
Venus	07:09	12:01	16:53	-3.9
Mars	06:07	11:10	16:14	1.8
Jupiter	07:09	12:02	16:55	-2.2
Saturn	23:11	18:06	13:02	0.4

November 30

	Rise	Transit	Set	Mag
Mercury	05:22	10:28	15:35	1.6
Venus	07:45	12:21	16:58	-3.9
Mars	06:02	10:54	15:46	1.8
Jupiter	06:27	11:16	16:06	-2.3
Saturn	22:14	17:09	12:04	0.3

All data calculated for Suffern, New York, Eastern Time:
Latitude: 41:06:48 N; Longitude: 74:08:38 W



The RAC Essentials

MONTHLY CALENDAR

**201-768-2238
or 845-47STARS**

Prime Observing

Fri, November 3, 8pm

**Wed, Nov 8,
1:30pm – Sunset**

Sat, Nov 11, 3pm

Thur, Nov 16

Tues, Nov 14, 8pm

Fri/Sat, Nov 17 & 18

Sat, Nov 18

Message Hotline: The latest information or last minute changes to club events.

November 4 thru 23

Lecture at Suny RCC Suffern, NY, 'The Kuiper Belt', Lecture by Keith Murdock

Mercury Transit of Sun Observing Perkins Drive atop Bear Mtn, NY

Getting Started Telescope Workshop

Part I: 'Buying Your First Telescope'

Presented by Dr. Sokoloski of RAC

LHV Challenger Center, Airmont, NY

Leonid Meteor Shower

Advisory Board Committee Meeting

LHVCC, Airmont, N.Y.

Observing at Wawayanda

(members night)*

Up all night Observing at Taghkanic

State Park (members night)*

LOCATIONS

North Rockland

High School Planetarium

Hammond Road, Thiells, NY

Rockland Community College

College Road, Suffern, NY

Lower Hudson Valley

Challenger Center

Rt. 59, Suffern, NY

Anthony Wayne

Recreation Area*

Exit 17, P.I.P., NY

Silvermine Ski Area*

Exit 18, P.I.P., NY

Wawayanda State Park*

973-853-4462,

Highland Lakes, NJ

Taghkanic State Park*

Taconic State Parkway,

Ancram, NY

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*Special permits required to observe at these locations. Contact Frank Bifulco for permit info.

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