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MIRA NEWSLETTER

The MIRA 36-inch Telescope

(See "On the Cover," p. 2)

Contents

Q&A

This feature is inspired by the questions we have received over the years from interested readers. If you have a question about an astronomical topic, please send it to us.

Cath Tendler-Valencia asks, in a 2 January 2007 e-mail,

Happy New Year! I'm curious now that we've passed the winter solstice just how much daylight we gain each day. How much at sunrise and at sunset? And what is the approximate length of daylight on the winter solstice and on summer solstice at our latitude of 36 degrees? Many thanks.

Dr. Bruce Weaver replies,

Because the earth's orbit is not round and the 3rd of January is the date that the earth is closest to the sun, the shortest day of the year, 21 December in 2006, has neither the latest sunrise nor the earliest sunset.

The latest sunrise falls on 9th or 10th of January and the earliest sunset falls on the 5th or 6th of December. The change of the length of the day is least at the solstices and fastest at the equinoxes. I'm sure you noticed that the length of the days seem to change rapidly in March and September. Near the winter solstice, the change is only about one minute per day. On the winter solstice, the length of the day is 9 hours 41 minutes at this latitude.

Thanks for the question.

Readers interested in checking Dr. Weaver's answer, as well as others interested in the times of the rising and setting of the sun and moon, will find this information on MIRA's web site, www.mira.org. *Click on "The Night Sky," then on "The sun and moon."—Ed.*

Calendar of Events

Sunday, 27 May, 2:30-4:00pm Free tour of the Oliver Observing Station on Chews Ridge.

Sunday, 24 June, 2:30-4:00pm Free tour of the Oliver Observing Station on Chews Ridge.

Tours are free and open to the public. Reservations are required, however. Call 883-1000.

On the Cover

In this classic shot of the MIRA 36-inch telescope, we are looking east, toward the rising sun. We see that low clouds, so often a feature of the central coast at lower elevations, have filled the valleys. At 5000 feet, the Oliver Observing Station is nearly always above the tops of this coastal stratus.

These low clouds provide the benefit of blocking light from the cities below. Moreover, the cloud deck most often forms under conditions of atmospheric stability, the reason behind the excellent seeing for which OOS is known. We can infer from this image, then, that the observer who took the photo has just finished an outstanding night of astronomy.

On the left edge of the photo we see the end of the observatory's roll-off roof. Rather than equip the observatory with the traditional dome and slit, the MIRA astronomers elected to design a roof that completely uncovers the telescope and observing deck. This prevents warm air from collecting near the telescope, which would degrade the high-quality images that were the main reason for siting the observatory on Chews Ridge in the first place.

Public Tours of Oliver Observing Station to begin in May

During the pleasant weather from May until October, MIRA invites its Friends and members of the public to visit our research observatory on Chews Ridge. Tours take place on Sunday afternoons, from 2:30 until 4:00.

If you haven't yet seen the MIRA observatory in person, plan on taking one of these tours this summer. You'll learn about the founding of MIRA and see firsthand some of the interesting design elements of the installation.

The Monterey Institute for Research in Astronomy gratefully acknowledges memberships and gifts for 2006 from individuals, families, corporations, and foundations.

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A Wintry Scene on Chews Ridge

Whither Pluto: A Third Opinion

by Dr. Wm. Bruce Weaver

One of the more interesting points made by Dr. Mark Sykes at the 2006 Chesley Bonestell Lecture (*Whither Pluto*, 13 January 2007) was that one of the divisions among astronomers over the status of Pluto controversy was between the dynamicists and the geophysicists. The dynamicists represent the older school of astronomers who are interested in classifying objects based on their orbital properties. But, as we've learned more about the intrinsic properties of solar system bodies due to the hard work of many astronomers, both from new wavelength regions opened up for earth-bound viewing and space-based exploration, much of the study of these objects has fallen into the regime of geophysicists (sorry, astrophysicists was already taken).

Dr. Sykes' conclusion was to drop the current International Astronomical Union clutter – such as 'must clear its orbit of debris' – and use the simple definition that any object that orbits the sun and is massive enough to compress itself into a sphere is a planet. These criteria seem simple enough and quite compelling. The ramifications are that the large asteroid, Ceres, would be upgraded back to planet status – as it was for a score of years – since it is massive enough to have crushed itself into a sphere. Pluto and its satellite/co-planet, Charon, would both be raised to planetary status. Those, with the uncontested planets, add up to 11 planets.

Grassroots support for Pluto. Image from www.votepluto.com.

Now, however, it becomes a bit sticky. There appear to be many Kuiper Belt objects, orbiting the sun beyond the orbit of Pluto, that are large enough to form themselves into spheres. Since we expect there are tens of thousands of Kuiper Belt objects, one can expect that there are an essentially unlimited number of objects that can also eventually meet Dr. Sykes' criteria.

Being neither a dynamicist nor geophysicist, I have a different point of view. Coming from the field of stellar classification, I have been steeped in the background of morphological classification. This is the classification of some set of things by their form or shape. This is the most natural of human activities – one which we engage in from our earliest days – so it is not surprising that arranging our view of any set of objects by their observable properties is the first step in understanding them. To stray too far from this foundation is to invite hubris-based disaster.

Many modern scientists, working in relatively mature fields with established physical phenomenological models, have forgotten the importance and bases of morphological classification. Earlier scientists, closer to the origins to modern science, gave it much respect. Charles Darwin, for example, the author of probably the most important theory in modern science, took the period from 1846 to 1854 away from the development of his cherished theory to clarify the classification of barnacles. In fact, most of his work is based on classifications.

The most basic principle of morphological classification is that it should be based only on directly observed properties – untouched by theory. Thus, as theory changes, and, hence, the inferred physical properties, the classification framework does not.

What does this have to do with the Pluto controversy? With the exception of Pluto and Charon, the spherical nature of distant, very difficult-to-observe, Kuiper Belt objects is determined by a combination of observations and a suite of theories. These are sensible, reasonable theories; in fact, they are applied by MIRA astronomer Dr. Russell Walker in creating the largest catalog of inferred asteroid diameters, which are available on the MIRA web page.[1] But they are theories nonetheless. Changes, hopefully improvements, in our theories will result in different determinations of size and masses.

From the point of view of morphological classification, the spherical nature of these objects remains to be established as a purely observable quantity, so until it can be, I'd say the reasonable Dr. Sykes' criteria admit only the aforementioned 11 objects as planets. A result that makes these criteria more practical.

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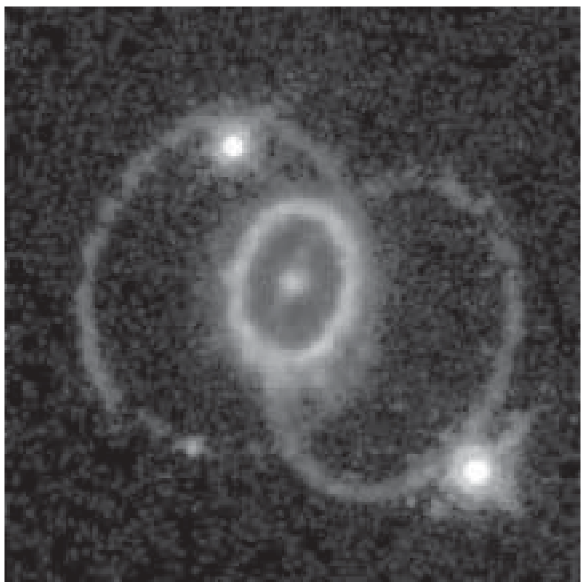
[1] www.mira.org/research/IRASdia.htm

The Spring Sky

by Dr. Whitney Shane, MIRA's Charles Hitchcock Adams Fellow

Fixed Stars

Readers of this *Newsletter* will have long since concluded that there is nothing to be seen in the spring sky except for a large number of galaxies, and we have no desire to disabuse them of this impression. However, these distant galaxies are homes to the same kind of objects that populate the Milky Way, and sometimes they offer us the possibility of studying these objects in ways that are not otherwise possible. Such an object is the supernova. These enormous explosions are so rare that we are normally forced to go far afield in order to study them. The last one known to have occurred in the Milky Way was Kepler's supernova in 1604, and an interval of 400 years or more between supernova explosions in any one galaxy is not exceptional. However, in 1987 we enjoyed the next best thing to a supernova in the Galaxy when one occurred in the Large Magellanic Cloud. The study of this event, relatively close at hand, has provided us with a huge amount of new information on the supernova process, far more than we can fit into as short a piece as this.



The rings of supernova 1987A as imaged by the Hubble Space Telescope. Space Telescope Science Institute image.

Supernova 1987A, as it was named, was a relatively modest event, as these things go, and it was prominent only because of its nearness. Such an object might well have been overlooked if it had occurred in a more distant galaxy. These fainter objects, which we call type II, as well as some of the brighter ones are thought to result when a young and very massive star becomes unstable, because its core no longer produces enough energy to support the outer layers and it collapses under the force of gravity. The core then becomes, after some evolution, a neutron star or a black hole, and the gravitational energy released by the collapse blows off the surrounding material. This is what we see as the supernova explosion. What we do not see is the process leading up to the explosion in which the star accumulates so much mass that it can become unstable. It is, among other things, in studying this process that 1987A has been so valuable.

It is quite possible that during the process of formation a star may accumulate enough mass that it will exceed the stability limit as its central energy sources become exhausted. However, it is now thought that 1987A, and probably many other type II supernovae, acquired their excess mass at a much later stage. We have known for some time that 1987A is surrounded by a very remarkable nebular structure made up of a small but bright central ring and two larger and fainter rings. The planes in which these rings lie are roughly parallel but displaced from one another, with the larger rings lying on either side of the smaller one. The rings are all centered on a single line which is perpendicular to all three planes. This suggests that there is an axis of symmetry, which we might identify with a rotation axis. The size of this structure is such that it cannot have been the result of the supernova explosion but must be much older. This nebula shows a striking resemblance to some other objects, in particular to the Hourglass, which is a planetary nebula and must therefore have a completely different history.

In a very recent paper a model is presented which appears to explain the structure of the nebulosity and to account for the accretion of mass which led to the instability. The story begins about 20000 years ago with a double star with two massive components, the more massive one a red supergiant whose core was largely depleted of fuel, and the other still a main sequence star. The supergiant expanded and mass was transferred to the other star. This process became unstable, and a massive envelope of gas was formed. Angular momentum was transferred to the envelope as the stars approached one another, so that the envelope evolved to a flattened disk, the inner edge of which became the smaller ring. Eventually the two stars merged to form a blue supergiant which was identified, rather to everyone's surprise at the time, as the precursor of the supernova. The supergiant began losing mass in the form of a powerful stellar wind. This wind was unable to penetrate the surrounding disk, but it was diverted to either side where it provided the material for the two larger rings. With a core unable to produce sufficient energy, the star collapsed and became a supernova.

Although still presumably far from the last word on type II supernovae, this model certainly gives us new insights into the processes which take place before the explosion. The time has been too short for us to follow developments after the explosion. From observations in the Galaxy we know how a supernova looks hundreds of years after the explosion. It remains for us and our successors to follow the development of 1987A and fill in the gaps in our knowledge of the natural history of supernovae.

Planets

Mercury is still just visible in the morning sky in early April, but it soon disappears into superior conjunction. It becomes visible again in the morning sky after the middle of May, when it is quite bright, but it soon fades, reaching maximum elongation on June 2 and inferior conjunction on June 28.

Venus remains very well placed for observation in the evening sky, reaching maximum elongation on June 9.

Mars remains low in the eastern morning sky, its visibility improving only very slowly as the quarter progresses. It will be in Aquarius and later Pisces during most of the quarter. A lunar occultation on April 14 will be visible only from the Indian Ocean and surroundings.

Vesta is in opposition on May 30 and visible to the skilled unaided eye from a good location during May and June.

Jupiter, which remains in Ophiuchus, is stationary on April 6 and reaches opposition on June 5. It is more than twenty degrees south of the equator and thus poorly located for northern observers.

Saturn remains in Leo, as it will for the whole year. Having passed opposition, it will become an evening object during the quarter. It will be stationary on April 20. Its northern declination makes it well accessible for observation. Lunar occultations continue and will take place on April 25, May 22 and June 19, but although the northern hemisphere is favored, none of these will be visible from our area.

The last two of a series of lunar occultations of Uranus will take place on April 14 and May 12, but Uranus is not yet well placed for observation and neither one will be visible from our area.

Placing our membership in the International Astronomical Union at risk, we note here that Pluto is in opposition on June 19. It will then be located in Sagittarius, where it will be particularly difficult to find due to the high density of background stars.

Meteor Showers

The best meteor shower of the quarter, the eta Aquarids, reaches maximum on May 5, just three days after full Moon, so no useful observations of these can be expected. There are, however, several less prominent showers which might be worth observing.

The Lyrids are a rather unpredictable lot, and therefore more interesting to observe than the average. The duration is rather short, often only a day or so, and quite variable, as are the intensity and the timing. The maximum is predicted on April 22 in the late afternoon (our time), so that the timing is unfavorable. The Moon, which will be approaching first quarter, will also make evening observations difficult. Observers in the eastern hemisphere will have a better opportunity.

The pi Puppids, which should peak on April 24 are best observed from the southern hemisphere. This is a relatively new shower, associated with Comet 26P/Grigg-Skjellerup. The comet will reach perihelion again in 2008, so that observations in that year might be more rewarding.

The June Lyrids, which are extremely scarce, should peak, if at all, on June 16, when there will be no moonlight. The potentially more exciting and very unpredictable June Boötids, on the other hand, will be spoiled on June 27 by the nearly full Moon.

Comets

Comet C/2006 P1 (McNaught), which somehow was omitted from our previous list, put on a dramatic show in the southern sky in the middle of January. It was also visible low on the southern horizon from our area. It is now fading and will not be seen again from the northern hemisphere.

Periodic comet 96P/Machholz is expected to pass perihelion in early April, but as of this writing it has not yet been recovered. It should become visible after the middle of April, when it will already have faded to eighth magnitude. It will then be in Pegasus, in the northeast morning sky. Thereafter it will continue to fade rapidly.

Periodic comet 2P/Encke will be seventh magnitude in April, but it will be in Aries, very low on the eastern horizon in the morning. Its visibility will decrease further as it fades and moves into the southern sky.

Comet C/2006 L2 (McNaught) is now quite faint, thirteenth magnitude, and fading slowly, but it is well observable in Camelopardalis, where it is almost stationary.

The only new comet on our list is C/2006 VZ13 (LINEAR) which was discovered last November. It is still quite faint, but it is expected to peak at magnitude 10 in July. It will be in Pegasus in April and then move into Cepheus later on.

Eclipses

There will be no more eclipses until August.

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Monterey Institute for Research in Astronomy
200 Eighth Street
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