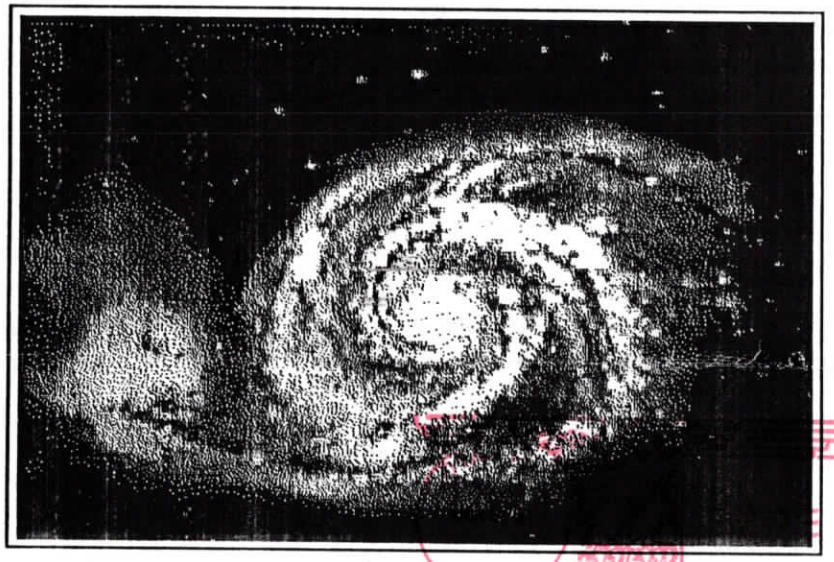
Many people think that all astronomy is about is boring lectures and only a brief glance though a telescope. You can show them the truth by giving them a personalized tour of the moon and other interesting sights. Some people are very curious, but just can't seem to get up enough nerve to ask for a look, so be prepared to offer one directly if someone says "What in the world are you doing with that big funny looking thing?". It's also a bit of an ego boost to you, especially if you built the scope yourself. So try "Moonlighting" sometime. Who knows, there might just be a future amateur down the block just waiting for his or her first wonderful experience in one of the worlds most fascinating hobbies.



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THE Prairie Astronomer

A Planetary Grand Tour

by Carolyn Collins Petersen

OLD ICE AND FIRST LIGHT

(Note: this article was originally presented as a talk at the 1990 Middle Atlantic Planetarium Association membership, May 3, 1990. It has been updated for publication here.)

The 1986 apparition of Comet Halley was probably the most-heralded astronomical event of the last twenty years. Most of us remember the newspaper stories, the sell-out planetarium shows and lectures, the tours to Africa, Australia, and South America, the cruises, the many books published about the comet, the comet pills, the t-shirts, buttons, songs, Mark Twain quotations... a long list of Comet-alia. It's safe to say that a lot of hype accompanied this second coming of Halley in the 20th century. And, it turned out to be, shall we say, less than spectacular to the naked-eye observer.

Behind the scenes, the scientific community quietly went about the business of studying and measuring the comet. A small flotilla of spacecraft intercepted the Halley in March, 1986, returning data that are still being reduced and interpreted today.

The International Halley Watch (IHW) was formed to link observatories around the world together, in an effort to photograph Halley from as many places on Earth as possible. Dedicated amateur and professional astronomers were asked to make as many images as they could of this "once-in-a-lifetime" visitor to the inner solar system.

The International Halley Watch succeeded beyond the hopes of its planners, and archives of photographs have been established at JPL, the University of Colorado and the Goddard Space Flight Center. These photographs are being digitized onto tape and will eventually be released on CD-ROM. For now, however, the most tangible piece of work being done with the Halley pictures is the assembly of the Comet Halley Atlas. A team at the University of

exploration of space, a goal established by President Bush two years ago. Stafford's report contains four long-range scenarios: (1) intensive scientific exploration of Mars, (2) a balanced exploration of Mars and the Moon, (3) establishing a permanent Moon base with Mars to follow later, and (4) a plan to use materials on the lunar and Martian surfaces to fuel space ships traveling even further into the solar system. The report comes at a time when NASA's Freedom space station program is in jeopardy in Congress and the President's space initiatives are having a tough time getting funding.

SOLAR ACTIVITY

The Sun continues to be active, so you shouldn't let up on the aurora watch. The sunspot index is taking a jump, too, with Peter Taylor reporting an average of 165 for the week ending June 7th and Caspar Hossfield reporting 183 for the week ending the 12th.

JUNE 7, 1991

THE SUN GETS HOT!

The Sun has erupted with most intense series of flares since at least 1989, and as a result all across the U. S. amateurs can expect to see auroral displays in the coming days. Three flares have been recorded at the X12 level, which means they were intense enough to saturate the detectors of the instrument used to p73 monitor them. The most recent one occurred Thursday morning at about 1 hour Universal time. It is well placed on the solar disk, and astronomers expect the Earth to be awash in high-energy particles by tomorrow night. Utility managers across the country have been put on alert for power surges, and Bill Smith of Ukiah, California, called us to report that the shortwave radio band is just a mess of static. NASA space physicist Mario Acuna says this geomagnetic storm is really severe.

We've also already received word of bright auroras spawned by flares earlier this week. Meteorologist Joe Rao says that a score of weather stations from Chicago to the Virginias reported seeing auroras on the morning of June 5th. So if you have clear skies overhead, get outside this weekend for what may be the best sky show in years. By the way, there's also a quite large naked-eye sunspot group near the Sun's northern limb.

SEE AN APOLLO ASTEROID

Here's a footnote about an Apollo asteroid discovered in early May by Eleanor Helin and others in California. The asteroid, designated 1991 JX, has a perihelion just outside the Earth's orbit. It's near that point now, and over the next week the asteroid will be within a few million miles of the Earth. Already Steven Ostro has succeeded in bouncing radar beams off it from Arecibo observatory.

The reason for mentioning all this is that, unlike most Apollos which are hopelessly to faint to observe, you actually have a chance -- maybe -- to see this one. It's well placed in the sky, moving through Corona Borealis, Hercules, and Lyra. And this coming week 1991 JX will be just about 14th magnitude -- that's just about the brightness of Pluto and within the range of an 8- or 10-inch telescope in dark skies. However, the little asteroid is zipping along at about 8 degrees per day -- that's about 20 arc seconds per minute. So, if you're up for the challenge, here are positions for equinox 2000 and 0 hours Universal time:

	R.A.	Dec.
June 8	16h 2.6m	+29d 1'
9	16 28.3	33 18
10	17 0.0	37 36
11	17 38.2	41 34
12	18 22.4	44 43

Eventually, the cometary ices sublimate, and escape the nucleus at a few tenths of a kilometer per second. A fast-moving gas and dust mixture forms a cometary atmosphere. This atmosphere is what is blown away from the comet by the action of the solar wind.

Chemical reactions in this atmosphere alter the nuclear gases, and form a cloud of molecules and ions. These in turn are affected by the solar magnetic field. As the comet plows through the near-Sun environment, a "bow-shock" forms around the nucleus. It's somewhat analogous to the wake of water that forms in front of a speedboat.

The magnetic field embedded in the solar wind interacts with the magnetic field of the comet's plasma tail. In the type of interaction that Dr. Brandt and his colleagues have been studying over the past twenty years, these solar magnetic field lines are somehow "wrapped" around comet. The plasma tail is produced, and is seen when the trapped ionized molecules in the tail fluoresce in the solar illumination.

Polarity changes in the solar wind cause an interesting phenomenon called a "disconnection event". The plasma tail essentially "breaks away" from the nucleus, and floats out behind the comet, eventually dissipating into space. What happens is that the comet passes a "sector boundary" in the solar wind -- a place where the polarity is different. The plasma tail of the old polarity disconnects, and a new one with a new polarity forms in its place.

Dr. Brandt's group has calculated some possible dates, based on solar wind studies, that were good candidates for disconnection events. They put the word out to the observatories, and asked them to take particular care in photographing the comet during those times. The results were pretty good, and there are some really spectacular disconnection event photographs.

THE SYSTEM WE CALL HOME

Immediately after the birth of the Sun, it was surrounded by a slowly- rotating disk of material -- what you might call the 'leftovers' of stellar formation. But what leftovers they were! This disk of material stretched out far beyond the limits of what is now the orbit of pluto. Moving through parts of the disk were rocky and metallic grains of matter. In other regions were tiny particles of water ice and frozen carbon dioxide. Clouds of hydrogen and helium existed throughout the nebula.

Nearest the Sun, where the fires of creation had been hottest, were the metallic and rocky particles. They began to stick together in a process called accretion. After a while, they formed somewhat larger rocky bodies called planetesimals.

Much smaller than a planet, these little worlds grew to 100 kilometers (62 miles) in size over the course of a few million years.

Imagine what a chaotic scene it could have been -- chunks of iron and stone floating through a cloud of dust. Occasionally these rocks would collide, sometimes sticking together, and sometimes breaking apart to send more pieces careening through the nebula.

Over a period of 70-80 million years, the inner planets and asteroids formed -- slowly growing large enough to maintain their own gravity and attract more and more chunks of matter to themselves. For several hundred million years after that, leftover planetesimals plunged into the surfaces of the already accreted planets. Others barely missed the planets, and were deflected by the gravity of the planets into different orbits around the Sun. Some were deflected out of the Solar System entirely.

Mercury, Venus, Earth and Mars are the rocky, metallic planets that formed nearest the Sun. These are called the terrestrial (or Earth- like) planets.

Further out in the nebula, where the Sun's heat was not so strong, and temperatures were cooler, icy chunks floated among the rocky grains and gaseous remains of the solar nebula. The planets that formed out in the cooler regions were large worlds, made up mostly of gases and ices, with a very little bit of rocky material.

It is not so clear whether these larger (or Jovian) planets -- Jupiter, Saturn, Uranus and Neptune -- formed totally from accretion, or if they might have coalesced from gases and ices similar to the way the Sun formed.

The formation of planets around a star isn't something that happens every time a star is born. Often, the nebula will coalesce into two stars, leaving very little material to build planets. If the nebula is large enough, a star cluster might form. The chances for a planet in a cluster are pretty slim, indeed.

There is still much we don't know about how planets are formed. But, we can apply what knowledge we DO have in our search for planets elsewhere in the universe. We might find strange worlds in that search -- or even mundane ones -- compared to the planets of our system.

Always, we'll compare them to the planets in our own system, which as we've already found out, are pretty interesting worlds in their own rights.

In 1979, two Voyager spacecraft were launched towards the outer Solar System. Their mission has been to study Jupiter, Saturn, Uranus and Neptune, and the data they have returned have answered many questions about the makeup of those worlds. But, the data returned by Voyager, and its predecessor probes Pioneer 10 and 11, have raised many more questions about just HOW those planets formed.

Other probes have explored the inner planets: NASA's Pioneer and Mariner spacecraft (to name a couple) mapped Mercury and Venus, giving us early up-close looks at two very different-LOOKING, but similar worlds. Mariner and Viking have studied Mars extensively. The Magellan probe is mapping Venus, while Galileo is on its way to Jupiter via the Sun and Mars. Ulysses has been launched to study the Sun, and plans for ambitious human missions to Mars are rippling through the scientific community. And, of course, we study the Earth on a daily basis, through the eyes of hundreds of satellites in orbit around our world.

All of this peering and probing will -- eventually -- fill in the gaps of our knowledge about the planets AS THEY EXIST TODAY. Our exploration of the outer planets will give us clues about the original solar nebula -- and a greater understanding of the creation of the Solar System.

SKY & TELESCOPE NEWS BULLETINS

From the Compuserve Information Service

JUNE 14, 1991

NEW COMET LEVY

There's a new and relatively bright comet in the morning sky this week. David Levy discovered it on June 14th -- after just 2 minutes of searching -- with a 16-inch reflector from Tucson, Arizona. He estimates it to be a surprising bright magnitude 7.8. He also says it is somewhat condensed with a 3-arc- minute coma and no hint of a tail. This is Levy's seventh visual comet discovery, and he has five more found jointly with Eugene and Carolyn Shoemaker during an ongoing photographic survey. OK, so where is it? There haven't been enough observations yet to establish an orbit, but the comet was found on the Pisces-Aries border just a couple degrees southeast of M 74. Levy says the comet is much more obvious than the galaxy. The 1950 coordinates when discovered were right ascension 1 hour 42 minutes, declination +13.5 degrees. From the little motion he could detect, the comet appears to be moving quickly -- at least one degree per day -- to the northeast. We'll provide an update on Monday with better coordinates for you to track it down.

"SYNTHESIS GROUP" REPORTS

Earlier this week a study group led by former astronaut Tom Stafford released its long-awaited report on the future of the U.S. space program. The study was initiated a year ago by Vice President Quayle, in his capacity as the chair of the National Space Council. It was termed the "Synthesis Group" because it actively solicited ideas from all across the U.S. -- not just from the usual NASA and aerospace sources. Quayle says the report sets the path for permanent human

Colorado, together with specialists from Goddard and JPL, has been working on the atlas for the past few years, studying photographs from observatories on nearly every continent. Dr. John C. Brandt is the project leader. (He is also a Principal Investigator on the Hubble Space Telescope's Goddard High-Resolution Spectrograph.)

The Atlas itself covers the time period from roughly mid-October of 1985 to July of 1986. Early photographs show Halley before it had formed a tail. It appears as a fuzzy blob in the early winter starfields.

In late November, the plasma tail "turned on", indicating that the comet had passed a crucial boundary -- a place where the sun's heat had begun to melt the surface of the comet, and the solar wind was strong enough to blow particles of dust, and ions away from the coma.

Throughout December the tail lengthened, and the comet took on a familiar p73 appearance. In January, we caught a last good look at Halley as it headed toward perihelion (and essentially invisibility from Earth).

The first good post-perihelion photographs document Halley's appearance around late February. In early March, the tail was showing a good bit of dust structure in addition to its plasma structure.

Then, in April, we shifted perspective on the comet as it dipped below the plane of the solar system. It appeared to stand almost on its head, with its tail pointing nearly due north. The plasma structure in the tail of this fast-moving comet was due entirely to the action of the solar wind.

It should probably come as no surprise that a comet tail -- and the plasma tail in particular -- is a good case study of plasma physics. A comet is essentially a ball of ice and dust. Throughout much of its travel in the solar system, a comet encounters a weak solar magnetic field. The heat of sun in the far reaches of the solar system isn't enough to melt very much of the surface of the comet. As it draws closer to the sun, though, a comet's appearance changes pretty radically. In essence, a comet is an obstacle plowing its way through the solar wind, which is moving out from the Sun at about 400 kilometers per second. The closer the comet gets to the sun, the more it is heated.

The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc., and is free to all club members. Membership status and expiration date are listed on the mailing label. Membership dues are: Junior Members and Newsletter Only Subscribers...$10/yr; Regular Members...$26/yr; Family Memberships...$29/yr; Address all new memberships, renewals, or questions to THE PRAIRIE ASTRONOMY CLUB, INC., P.O BOX 80553, LINCOLN, NE 68501. For other club information contact one of the following officers: Dave Knisely (Pres)223-3968, Eric Hubl (V.Pres)423-6267, Ron Veys (Sec)486-1449, Lee Thomas(Tres)483-5639, Jack Dunn (2nd V. Pres)475-3013. All newsletter comments and articles should be sent to Newsletter Editor JOHN LORTZ, 12023 PARKER PLZ #105, OMAHA, NE 68154 no later than 10 days before monthly club meetings. Club meetings are held the last Tuesday of each month at Hyde Observatory in Lincoln, NE.

Observing Chairman's Report

by Dave Knisely

}THE NEXT STAR PARTIES WILL BE JULY 5TH AND 12TH AT THE ATLAS SITE. The following article is a requested revised reprinting from July, 1983.

HEY, ALL YOU SO-CALLED "STAR GAZERS". That's right, all you people who claim to be avid amateur astronomers. many of you moan and groan about the moon drowning out all those fuzzy faint spots of light you call Deep-Sky wonders, wile outside in a clear moonlit sky, nature is putting on a show that puts all those summer reruns to shame. Come on now! Get that scope out into the yard and forget that you still have 50 Messier objects to locate, because we're out to have some serious fun!

Now don't give me that "there's nothing to see when the moon is up" baloney. There are still plenty of sights to feast the eyes and the telescope on. For starters, there's the moon. Have you ever tried looking at the full moon at very high power? It's remarkable to see the tiny grooves that line the bowl-like sides of small craters, or to look for the subtle color variations on the lunar maria, as well as the white splattering of the lunar rays over the dusty plains. And if the moon isn't quite full, there's a wealth of detail visible near both poles.

Aside from the old devil moon, there are lots and lots of double and variable stars within the reach of even modest scopes. You want color? You can't find much better than Delta Cephei, a beautiful gold and blue pair which rivals its near twin in Cygnus, Alberio. You want more stars? Try the "Double-Double" star Epsilon Lyra or its southern twin, Nu Scorpii. Both are striking in a three or four inch aperture. You want even more stars? Try Xi Scorpii, a beautiful quintuplet system that shows color in modest apertures. What looks like another "double-double", at low power becomes a nice fivesome at high, making me wonder why Xi isn't better known among most amateurs.

Want to see a real red star? No, I don't mean Gorbachev, I mean a class N variable star like Mu Cephei, V Aquilae, or Y Canum Venaticorum. These stars seem especially red in small telescopes or when observed near minimum light. They also show variations in light output over several months, and this may lead you into the fascinating world of variable star watching.

So much for the observational aspects of moonlight viewing. What about the benefits to you and the hobby? Standing in your yard or in a public place observing with y our modest instrument can help publicize amateur astronomy in the same way as we do at the observatory, only on more of a one-to-one basis.