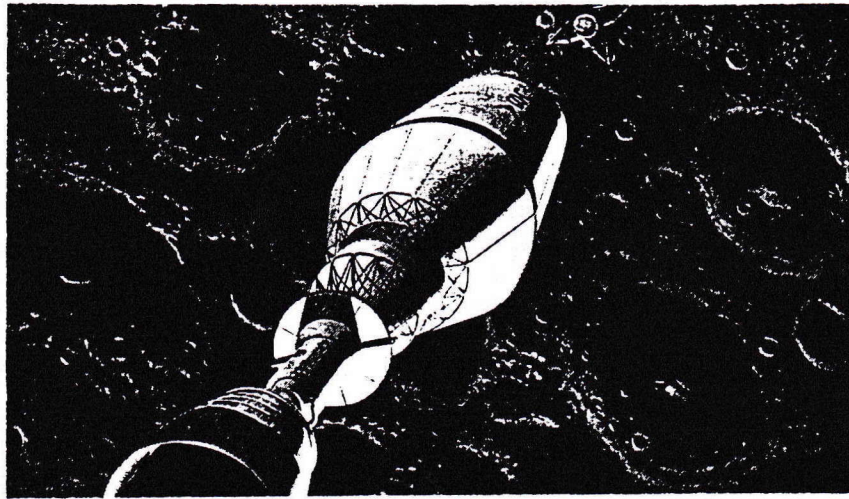


REFLECTIONS



REFLECTIONS

July 1995

A Nuclear Thermal Rocket (NTR) making a lunar transfer.  
 More about NTR inside this issue. Photograph: NASA  
 Lewis Research Center, Advanced Space Analysis Office.

**Chris Sarnecki**  
 Editor

## Of the University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of Astronomy enthusiast which meets on the third Friday of each month in the University of Michigan's Physics and Astronomy building (Dennison Hall, Room 807). Meetings begin at 7:30 pm and are open to the public. Public star parties are held twice a month at the University's Peach Mountain Observatory on North Territorial Road (1.1 miles west of Dexter-Pinkney Road; further directions at the end of the newsletter) on Saturdays before and after the new Moon. The party is canceled if it's cloudy or very cold at sunset. For further information call Bill Razgunas at (313) 995-0934.

### This Month:

**July 1** - Computer Subgroup is taking the Summer off.

**July 21 - Meeting at 807 Dennison.** Caroline Cox will be speaking on recent events in the media. The membership will be deciding how to schedule our August meeting - see ideas under August 18th in the next column.

**June 22 - Public Star Party at Peach Mountain Observatory.** Uranus (mag 5.6) is at opposition. Check out Jupiter, still well placed for viewing.

**July 27 - New Moon** at 11:13 am EDT

**June 29 - Public Star Party at Peach Mountain Observatory.** Saturn is rising just after twilight. Comet d'Arrest is expected to be two degrees southwest of Saturn and shining at mag 7.5.

### Next Month:

**August 18 - Meeting at ?** - Ideas for scheduling the August meeting:

- Cook-out/Star party at Peach mountain.
- Lets all go see Apollo 13 at the local theater.
- Star party on the Diag.
- Your idea here....

**August 19 - Public Star Party at Peach Mountain Observatory.** Comet d'Arrest is approximately six degrees west of Beta Ceti (Cetus), 20 degrees below Saturn, and well placed for viewing just after midnight.. This comet is expected be at mag 6.5 at mid-month.

**August 26 - New Moon** at 12:31 am EDT  
**AND Public Star Party at Peach Mountain Observatory** - The summer's steady atmosphere viewing season is here!

**August 29 - Close conjunction of a young Moon, Spica and Mars** - Early dusk.

# LOX-Augmented Nuclear Thermal Rocket

by Douglas Warshaw

Back in mid-May, I attended the International Space Development Conference (ISDC) in Cleveland. This article will be the first of a series summarizing the lectures that I heard there.

The LOX-Augmented Nuclear Thermal Rocket (LANTR) concept was presented by Dr. Stanley K. Borowski of NASA Lewis Research Center. The idea is an improved version of the Nuclear Engine for Rocket Vehicle Application (NERVA) first proposed in the 1960s. The basic NERVA design employs liquid hydrogen (LH2) flowing around a fission reactor before entering the exhaust nozzle. The heat from the reactor imparts energy to the LH2, giving it a higher exhaust velocity, and, thus, a higher thrust.

LANTR increases the thrust even further by the addition of liquid oxygen (LOX) in the nozzle section (The LOX is injected at this location in order to prevent the reactor from corroding). The LOX and LH2 chemically react to produce water and heat, thereby increasing the thrust even further.

This improvement carries several beneficial side effects with it. LH2 takes up a great deal of volume, which means that a

NERVA's fuel containment structural mass and size will be large. To get the same thrust amount with LANTR, LOX replaces a good fraction of the LH2. Since LOX is denser than LH2 (in a 16:1 density ratio), less of the vehicle's size and mass must be devoted to the fuel tanks. A smaller vehicle requires a smaller engine, which is easy to build and test.

The NERVA design is also limited to a fixed thrust value (assuming a constant reactor output) (This is not a favorable situation; imagine if the accelerator in your car was locked in one position...). The LOX flow in LANTR can be throttled, allowing for an overall variable thrust.

The primary proposed use for a LANTR vehicle would be as a ferry from Low Earth Orbit (LEO) to Low Lunar Orbit (LLO) and back. Chemical analysis of moon rocks brought back by the Apollo missions indicate that about 42% (by mass) of our next-door neighbor oxygen. If we could extract oxygen from the moon, that much mass would not have to be provided from Earth. Since the moon has only 1/6 the gravity of the Earth and lacks a drag-producing atmosphere, reloading LANTR would be a lot easier and cheaper.

But how well does LANTR perform? Below is a table showing the specific impulse (Isp) levels for different LOX/LH2 mass ratios. Specific impulse describes how efficient an engine is; the value represents the ratio of thrust to weight flow. The units cancel out to "seconds"; thus the greater the number of seconds, the more efficient the engine is.

\*Note: Values are for a 66,700 Newton LANTR with a chamber pressure=13.8 MPa.

		Isp (sec)				
Life (hr)		5	10	30	Tankage	T/W(engine)
T(chamber) (K)		2900	2800	2600	Percentage	ratio
LOX/LH2 = 0.0		941	925	891	14.0	3.0
1.0		772	762	741	7.4	4.8
3.0		647	642	631	4.1	8.2
5.0		576	573	566	3.0	11.0
7.0		514	512	508	2.5	13.1

For comparison's sake, a typical liquid-fuel chemical rocket has an Isp = 260-410 seconds.



As far as cargo capacity is concerned, a rocket equipped with two of the 941-second Isp engines could transport a 9-ton returning lunar lander (or a 34 ton "one-way" cargo version) to the moon using a burn time of just over an hour. This first flight would take 84 hours. The landers could carry the oxygen-processing equipment needed to make LANTR more efficient after its maiden flight. [Note to editor: is that phrase PC? - Response: I have consulted the great PC guru and have obtained special absolution for this one time - Ed.]

Once LANTR has achieved its full potential, it will be capable of taking a 25 ton passenger module on the Earth-Luna (or Luna-Earth) run in only 24 or 36 hours, depending on how much oxygen is aboard. Perhaps we can go back to the moon, this time to stay. I shall discuss another aspect of this possibility in a follow-up article in a future edition of Reflections.

**MIR/Atlantis Sighting** The following is an "on-line" conversation:

July 1st at approximately 10:47 EDT our club was having our bi-monthly star party outside Ann Arbor Michigan. Someone had the local Mir/Atlantis sightings. All decided to stop our celestial observing for a view of this passage. Right on schedule the space craft made their appearance. Beginning low in the WSW and rising to only 16 degrees two of us decided to point our telescope preceding the spacecraft and observe at x100. Independently we "claimed" to see two unresolved blobs skip through the eyepiece. My question is it possible to see what we claimed to see? Please let me know your thoughts. - chrisandi@aol.com.

"Yes, but it's not easy: I watched the same pass from here in Illinois where peak altitude was about 25 degrees. The slant height from here was about 550 miles. From your location, it would be about 700 miles. A 200 foot object at 700 miles distance has an angular diameter of about 10 seconds of arc. That's small, but bigger than Mars right now. I've done a little Mir-chasing myself, and when it passes nearly overhead you can definitely see a resolved shape." - FrankEReed@aol.com.

## Ramblings, er - Rumbings

by Christopher Sarnecki

**Apollo 13** - It's not often that a current box office hit gets reviewed in *REFLECTIONS*; but, then it's not often that a movie about a real space mission comes along at your local theater. Rather than review the actor's performance, see your newspapers for that, lets look at the movie for its Space/Astronomy aspects. The space-talk jargon is rated as almost understandable if you take the time to listen. Rocket scientist amongst you would probably be disappointed because it is not technical enough. The close-up lunar shots (why I went) were nice, but too little time was devoted to them in my opinion. Next time put an Armature Astronomer in charge of this portion of the film. The BLAST-OFF and reentry scenes were "out of this world". Much credit goes to the creators for their efforts to make you feel like you were really inside Apollo 13 as an Astronaut. Special effects for these portions of the movie were unique for the subject mater that has been docu-dramatized in PBS's recent MOON SHOT. One scene of the giant booster's ascent is alone worth seeing the movie. You'll know it when you see it. (3.1428 stars out of a possible 3 !)

**From: Mr Astro** - If you read the August issue of *Sky & Telescope* then you probably saw Stuart Goldman's article on "Astronomy on the Internet". As mentioned, he is the host to *American Online's* Astronomy interest area where I posed a question to him relative to Armature Astronomy newsletters - What "additional support" does AOL provide for Armature Astronomy club newsletters? His response: "I don't really understand what you mean about "additional support" for club newsletters on AOL. Basically, if you want to use something from AOL in your newsletter, you need permission from the source, be it text or image. Aren't newsletters supposed to publish articles and images from club members?" Which brings me to my point - Your newsletter Editor needs your articles. Please consider doing your small part to support this publication. Any club member's astronomy article will get top consideration. Thx. - Ed



# The Astronomical League's Double Star Club

by John Wagoner  
Texas Astronomical Society of Dallas

**Introduction** - Welcome to the Astronomical League's new Double Star Club. The purpose of the Double Star Club is to introduce observers to 100 of the finest double and multiple stars in the heavens. You don't need a large, expensive apochromatic refractor to view the objects on this list since a small refractor, Newtonian reflector, or Schmidt-Cassegrain will do just fine. All objects on this list were observed with a three inch refractor using between 75X and 150X. Again, this program is meant to allow you to enjoy a different aspect of our wonderful hobby, and not to test your equipment.

Double star observing can be very forgiving. You don't need the darkest skies, the clearest skies, or even a moonless night to observe many of these objects. Some can be observed from your backyard under moderate light pollution, some can be observed under less than transparent skies, and some can even be observed with the moon up. However, as usual in astronomy, the best results can be obtained under optimum conditions. The point is, always try for the best conditions, but if you don't have them, don't worry about it. You can still enjoy this program.

**Rules and Regulations** - To qualify for the AL's Double Star Certificate and pin, you need only be a member of the Astronomical League, either through an affiliated club or as a Member-at-Large, and observe the 100 selected objects on the included list. Any telescope may be used, but one with an objective 60MM in diameter or larger is recommended. To record your observations, you may use the log sheet provided, or one with similar information. If you use your own log sheets, they should include: object, date, time, power, seeing, instrument, and a drawing of the double or multiple system. Yes, I said a drawing of the double star. Now, before you panic, how hard is it to draw two dots in the box provided, with the size of the dot

indicating magnitude, and the distance between the dots representing separation? I have given you a line for a description, but this is optional and not required. I have included this so that if you are inspired by any one double star, you can write your thoughts or feelings down for later reference. If you need to become a member of the Astronomical League as a Member-at-Large, contact Linda Sensenig, M.A.L. Chairperson, 345 Douglass St., Wyomissing, Pa. 19610, (215) 375-9062.

To receive your Double Star Certificate and pin, simply send your observations along with your name, address, phone number, and club affiliation, either to your club's Awards Coordinator for verification, or to: John Wagoner, A.L. Binocular Coordinator, 1409 Sequoia Dr., Plano, Tx. 75023, (214) 422-1886. Upon verification of your observations, your certificate and pin will be forwarded either to you or your club's Awards Coordinator, whomever you choose.

**The List** - All objects are listed in Right Ascension order so that you can view them as they rise, and so that you can properly plan your observing sessions to make the most of your time. Information provided on each object includes: a check box, object to be observed, Right Ascension, Declination, magnitudes of the component stars, separation, and position angle from the primary star in the double or multiple system. When listing the object to be observed, I have given the proper constellation name rather than use the traditional possessive name to simplify things. I realize that 100 objects out of many thousands in the heavens are only a small representation of what can be seen, and I have probably missed a few of your favorite doubles. If so, let me know which objects you recommend, and if there is enough interest, then just maybe we will have a second double star club. Until then, good luck, clear skies, and good observing.

Plano, Tx. - May 1, 1995

*[An additional column has been added to identify the page number the double star is found in the SkyAtlas 2000 star charts - Ed]*



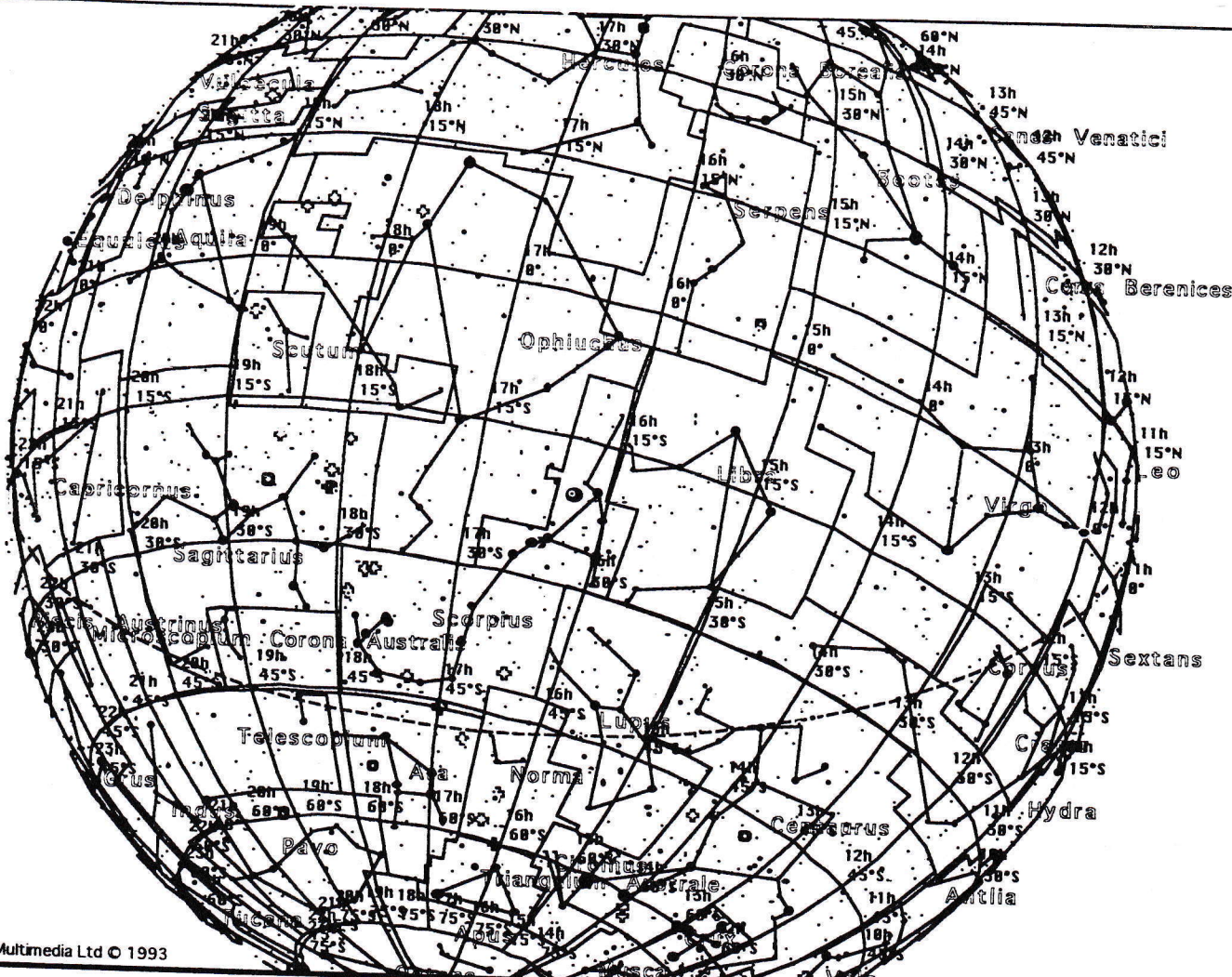
THE ASTRONOMICAL LEAGUE'S DOUBLE STAR LIST (Epoch 2000)

CHK OBJECT	RA	DEC	MAGS	SEP	PA	PAGE
[ ] Eta Cassiopeia	00 49.1	+57 49	3.4,7.5	12"	307	1
[ ] 65 Pisces	00 49.9	+27 43	6.3,6.3	4.4	297	4
[ ] Psi 1 Pisces	01 05.6	+21 28	5.6,5.8	30"	159	4
[ ] Zeta Pisces	01 13.7	+07 35	5.6,6.5	23"	63	10
[ ] Gamma Aries	01 53.5	+19 18	4.8,4.8	7.8"	0	4,10
[ ] Lambda Aries	01 57.9	+23 36	4.9,7.7	37"	46	4
[ ] Alpha Pisces	02 02.0	+02 46	4.2,5.1	1.7"	50	10
[ ] Gamma Andromeda	02 03.9	+42 20	2.3,5.5	9.8"	63	4
[ ] Iota Triangulum	02 12.4	+30 18	5.3,6.9	3.9"	71	4
[ ] Alpha Ursa Minor	02 31.8	+89 16	2.0,9.0	18.4"	218	1
[ ] Gamma Cetus	02 43.3	+03 14	3.5,7.3	2.8"	294	10
[ ] Eta Perseus	02 50.7	+55 54	3.8,8.5	28.3"	300	1
[ ] Struve 331	03 00.9	+52 21	5.3,6.7	12.1"	85	1
[ ] 32 Eridanus	03 54.3	-02 57	4.8,6.1	6.8"	347	10
[ ] Chi Taurus	04 22.6	+25 38	5.5,7.6	19.4"	24	5
[ ] 1 Camelopardalis	04 32.0	+53 55	5.7,6.8	10.3"	308	1,5
[ ] 55 Eridanus	04 43.6	-08 48	6.7,6.8	9.2"	317	11
[ ] Beta Orion	05 14.5	-08 12	0.1,6.8	9.5"	20	21
[ ] 118 Taurus	05 29.3	+25 09	5.8,6.6	4.8"	204	5
[ ] Delta Orion	05 32.0	-00 18	2.2,6.3	52.6"	359	11
[ ] Struve 747	05 35.0	-06 00	4.8,5.7	35.7"	223	11
[ ] Lambda Orion	05 35.1	+09 56	3.6,5.5	4.4"	43	11
[ ] Theta 1 Orion	05 35.3	-05 23	6.7,7.9	8.8"	31	11
			" ,5.1	13"	132	
			" ,6.7	21.5"	96	
[ ] Iota Orion	05 35.4	-05 55	2.8,6.9	11.3"	141	11
[ ] Theta 2 Orion	05 35.4	-05 25	5.2,6.5	52"	92	11
[ ] Sigma Orion	05 38.7	-02 36	4.0,7.5	12.9"	84	11
			" ,6.5	43"	61	
[ ] Zeta Orion	05 40.8	-01 57	1.9,4.0	2.4"	162	11
			" ,9.9	58"	10	
[ ] Gamma Lepus	05 44.5	-22 27	3.7,6.3	96"	350	17
[ ] Theta Auriga	05 59.7	+37 13	2.6,7.1	3.6"	313	5
[ ] Epsilon Monoceros	06 23.8	+04 36	4.5,6.5	13.4"	27	11
[ ] Beta Monoceros	06 28.8	-07 02	4.7,5.2	7.3"	132	11
[ ] 12 Lynx	06 46.2	+59 27	5.4,7.3	8.7"	308	1

CHK OBJECT	RA	DEC	MAGS	SEP	PA	PAGE
[ ] Epsilon Canis Maj	06 58.6	-28 58	1.5,7.4	7.5"	161	19
[ ] Delta Gemini	07 20.1	+21 59	3.5,8.2	6.8"	211	5
[ ] 19 Lynx	07 22.9	+55 17	5.6,6.5	14.8"	315	1
[ ] Alpha Gemini	07 34.6	+31 53	1.9,2.9	2.2"	171	5
[ ] Kappa Puppis	7 38.8	-26 48	4.5,4.7	9.9"	318	19
[ ] Zeta Cancer	08 12.2	+17 39	5.6,6.0	5.9"	89	6
[ ] Iota Cancer	08 46.7	+28 46	4.2,6.6	30"	307	6
[ ] 38 Lynx	09 18.8	+36 48	3.9,6.6	2.7"	229	6
[ ] Alpha Leo	10 08.4	+11 58	1.4,7.7	177"	307	13
[ ] Gamma Leo	10 20.0	+19 51	2.2,3.5	4.4"	122	6
[ ] 54 Leo	10 55.6	+24 45	4.5,6.3	6.5"	110	6
[ ] N Hydra	11 32.3	-29 16	5.8,5.9	9.2"	210	20
[ ] Delta Corvus	12 29.9	-16 31	3.0,9.2	24.2"	214	13
[ ] 24 Coma Berenices	12 35.1	+18 23	5.2,6.7	20.3"	271	7
[ ] Gamma Virgo	12 41.7	-01 27	3.5,3.5	3.6"	293	13
[ ] 32 Camelopardalis	12 49.2	+83 25	5.3,5.8	21.6"	326	2
[ ] Alpha Canes Ven	12 56.0	+38 19	2.9,5.5	19.4"	229	7
[ ] Zeta Ursa Major	13 23.9	+54 56	2.3,4.0	14.4"	152	2
			" ,4.0	709"	71	
[ ] Kappa Bootes	14 13.5	+51 47	4.6,6.6	13.4"	236	2
[ ] Iota Bootes	14 16.2	+51 22	4.9,7.5	38"	33	2
[ ] Pi Bootes	14 40.7	+16 25	4.9,5.8	5.6"	108	14
[ ] Epsilon Bootes	14 45.0	+27 04	2.5,4.9	2.8"	339	7
[ ] Alpha Libra	14 50.9	-16 02	2.8,5.2	231"	314	7
[ ] Xi Bootes	14 51.4	+19 06	4.7,7.0	6.9"	332	7
[ ] Delta Bootes	15 15.5	+33 19	3.5,8.7	105"	79	7
[ ] Mu Bootes	15 24.5	+37 23	4.3,7.0	108"	171	7
[ ] Delta Serpens	15 34.8	+10 32	4.2,5.2	3.9"	178	14
[ ] Zeta Corona Bor	15 39.4	+36 38	5.1,6.0	6.3"	305	7
[ ] Zi Scorpius	16 04.4	-11 22	4.8,7.3	7.6"	51	15
[ ] Struve 1999	16 04.4	-11 27	7.4,8.1	11.6"	99	15
[ ] Beta Scorpius	16 05.4	-19 48	2.6,4.9	13.6"	21	15
[ ] Kappa Hercules	16 08.1	+17 03	5.3,6.5	28"	12	15,8
[ ] Nu Scorpius	16 12.0	-19 28	4.3,6.4	41"	337	15
[ ] Sigma Corona Bor	16 14.7	+33 52	5.6,6.6	6.2"	233	8
[ ] 16/17 Draco	16 36.2	+52 55	5.4,6.4	3.4"	108	3
			" ,5.5	90"	194	
[ ] Mu Draco	17 05.3	+54 28	5.7,5.7	2.0"	42	3



CHK	OBJECT	RA	DEC	MAGS	SEP	PA	PAGE
[ ]	Alpha Hercules	17 14.6	+14 23	3.5,5.4	4.7"	107	15
[ ]	Delta Hercules	17 15.0	+24 50	3.1,8.2	8.9"	236	8
[ ]	36 Ophiuchus	17 15.3	-26 36	5.1,5.1	4.4"	154	22
[ ]	Sigma Ophiuchus	17 18.0	-24 17	5.4,6.9	10.3"	355	22
[ ]	Rho Hercules	17 23.7	+37 09	4.6,5.6	4.1"	316	8
[ ]	Nu Draco	17 32.2	+55 11	4.9,4.9	62"	312	3
[ ]	Psi Draco	17 41.9	+72 09	4.9,6.1	30.3"	15	3
[ ]	40/41 Draco	18 00.2	+80 00	5.7,6.1	19.3"	232	3
[ ]	95 Hercules	18 01.5	+21 36	5.0,5.1	6.3"	258	8
[ ]	70 Ophiuchus	18 05.5	+02 30	4.2,6.0	2.8"	72	15
[ ]	Epsilon Lyra	18 44.3	+39 40	5.0,6.1	208"	357	8
				" ,5.2	2.6"	173	
				" ,5.5	2.3"	94	
[ ]	Zeta Lyra	18 44.8	+37 36	4.3,5.9	44"	150	8
[ ]	Beta Lyra	18 50.1	+33 22	3.4,8.6	46"	149	8
[ ]	Struve 2404	18 50.8	+10 59	6.9,8.1	3.6"	183	15
[ ]	Otto Struve 525	18 54.9	+33 58	6.0,7.7	45"	350	8
[ ]	Theta Serpens	18 56.2	+04 12	4.5,5.4	22.3"	104	15
[ ]	Beta Cygnus	19 30.7	+27 58	3.1,5.1	34.4"	54	8
[ ]	57 Aquila	19 54.6	-08 14	5.8,6.5	36"	170	16
[ ]	31 Cygnus	20 13.6	+46 44	3.8,6.7	107"	173	9,8
				" ,4.8	337"	323	
[ ]	Alpha Capricornus	20 18.1	-12 33	3.6,4.2	378"	291	16
[ ]	Beta Capricornus	20 21.0	-14 47	3.4,6.2	206"	267	16
[ ]	Gamma Delphinus	20 46.7	+16 07	4.5,5.5	9.6"	268	9
[ ]	61 Cygnus	21 06.9	+38 45	5.2,6.0	28"	146	9
[ ]	Beta Cepheus	21 28.7	+70 34	3.2,7.9	13.3"	249	3
[ ]	Struve 2816	21 39.0	+57 29	5.6,7.7	11.7"	121	3
				" ,7.8	20"	339	
[ ]	Epsilon Pegasus	21 44.2	+09 52	2.4,8.4	142"	320	16
[ ]	Xi Cepheus	22 03.8	+64 38	4.4,6.5	7.7"	277	3
[ ]	Zeta Aquarius	22 28.8	-00 01	4.3,4.5	1.8"	266	17
[ ]	Delta Cepheus	22 29.2	+58 25	3.9,6.3	41"	192	3
[ ]	8 Lacerta	22 35.9	+39 38	5.7,6.5	22.4"	186	9
[ ]	94 Aquarius	23 19.1	-13 28	5.3,7.3	12.7"	350	17
[ ]	Sigma Cassiopeia	23 59.0	+55 45	5.0,7.1	3"	326	3



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<b>Projection:</b>	Local Horizon	
<b>Time:</b>	Local	Jul 21, 1995AD, 11:00pm (Twilight)
	Universal	Jul 22, 1995AD, 3:00am
	Siderial	17:21.8
<b>Epoch:</b>	Universal	Jul 22, 1995AD, 3:00am
	Julian date	2449920.6250
<b>Location:</b>	Earth	
	Lat: 42° 24' 00" N	
	Lon: -83° -56' 00" W	
	Altitude	0.0000 km
	Time zone	-4.00
<b>Zoom Factor:</b>	0.4000	
	<b>Centered on:</b>	Jupiter
		RA: 16h 15m 50s
		Dec: -20° 37' 07"
		Azm: 197° 05' 27"
		Alt: 25° 09' 48"
	<b>Field of View:</b>	180° 00' * 119° 22'



### Places:

**Dennison Hall**, also known as The University of Michigan's Physics and Astronomy building, is the site of the monthly meeting of the University Lowbrow Astronomers. It is found in Ann Arbor on Church Street about one block north of south University avenue. The meeting is held in room 807.

**Peach Mountain Observatory** is the home of The University of Michigan's 25 meter radio telescope as well as the University's McMath 24 inch telescope which is maintained by the Lowbrows. The observatory is located northwest of Dexter. The entrance is on North Territorial Road, 1.1 miles west of of Dexter-Pickney Road. A small maize-and-blue sign marks the gate. Follow the gravel road one mile to a parking area near the radio telescopes. Walk along the path between the two fenced in areas (about 300 feet) to reach the McMath telescope building.

### Times:

**Monthly meetings** of the Lowbrows are held on the 3rd Friday of each month at 7:30 PM in 807 Dennison Hall. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow the meeting.

**Computer subgroup meetings** are held on the first of each month, rotating among member's houses. See the calendar on the cover page for the location of next meeting.

**Public Open House/Star Parties** are held on the Saturday before and after each new Moon at the Peach Mountain Observatory. Star Parties are canceled if the sky is cloudy at sunset or the temperature is below 10 degrees F. Call 480-4514 for a recorded message on the afternoon of a scheduled Star Party to check on the status. Many members bring their telescopes and visitors are welcome to do likewise. Peach Mountain is home to millions of hungry mosquitos - bring insect repellent, and it does get cold at night so dress warmly!

### Dues:

Membership dues in the University Lowbrow Astronomers are \$20 per year for individuals or families, and \$12 per year for students. This entitles you to the monthly REFLECTIONS newsletter and the use of the 24" McMath telescope (after some training). Dues can be

paid to the club treasurer Doug Scobel either at the monthly meeting or by mail at:

Doug Scobel  
1426 Wedgewood Drive  
Saline, MI 48176

### Magazines:

Members of the University Lowbrow Astronomers can get a discount on these magazine subscriptions:

*Sky and Telescope*: \$24 / year

*Astronomy*: \$18 / year

*Odyssey*: \$16.95 / year

For more information contact the club Treasurer. Members renewing subscriptions are reminded to send your renewal notice along with your check when applying through the club Treasurer.

### Monthly Sky Map:

The sky map in this issue of *REFLECTIONS* was produced on a Macintosh version of REDSHIFT, astronomy software by Maris. The sky has been plotted for Peach Mountain.

### Newsletter Contributions:

Members and (non-members) are encouraged to write about any astronomy related topic of interest. Call the Newsletter Editor Chris Sarnecki at 426-5772 or e-mail to [chrisandi@aol.com](mailto:chrisandi@aol.com) to discuss length and format. Announcements and articles are due by the first Friday of each month. Articles should be mailed to:

Christopher Sarnecki  
4835 Holly Way  
Ann Arbor, MI 48103

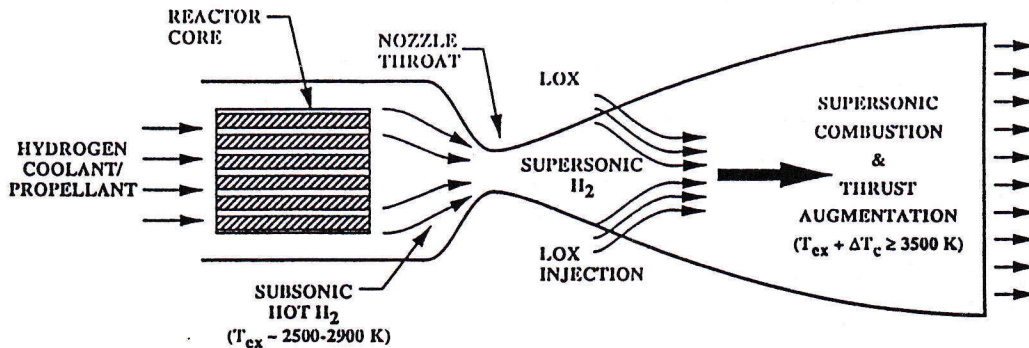
### Telephone Numbers

President:	Bill Razgunas	995-0934
Vice Pres:	Mark Cray	283-6311
	DC Moons	254-9439
	Tom Pettit	
	Tom Ryan	662-4188
	Randy Stevenson	429-5099
Treasurer:	Doug Scobel	429-4954
Observatory		
Director:	Bernard Friberg	761-1875
Newsletter:	Chris Sarnecki	426-5772
Peach Mtn		
Keyholder:	Fred Schebor	426-2363

## MONTHLY MEETING:

### Caroline Cox - Recent Events in the Media

July 21, 1995 at 7:30 pm  
in Dennison Hall  
(Physics & Astronomy)  
Room 807



A schematic view of a LOX-Augmented Nuclear Thermal Rocket engine - NASA Lewis Research Center, Advanced Space Analysis Office

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University Lowbrow Astronomers  
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Check your membership expiration date on the mailing label !