



The Warren Astronomical Society Paper

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www.boonhill.net/was

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2003 WAS OFFICERS

// November 2003

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The WASP (*Warren Astronomical Society Paper*) is the official monthly publication of the Society. Each new issue of the WASP is mailed to each member and/or available online www.boonhill.net/was. Requests by other Astronomy clubs to receive the WASP, and all other correspondence should be addressed to the editor, Cliff Jones, email: cliffordj@ameritech.net

Articles for inclusion in the WASP are strongly encouraged and should be submitted to the editor on or before the first of each month. Any format of submission is accepted, however the easiest forms for this editor to use are plain text files. Most popular graphics formats are acceptable. Materials can be submitted either in printed form in person or via US Mail, or preferably, electronically via direct modem connection or email to the editor.

Disclaimer: The articles presented herein represent the opinions of the authors and are not necessarily the opinions of the WAS or the editor. The WASP reserves the right to deny publication of any submission.



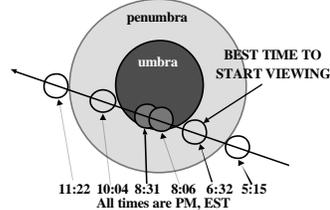
Astro Chatter

by Larry Kalinowski

This month's big event is the eclipse of the Moon, occurring on Saturday, November 8. Partial phases of the eclipse begin about 6:32pm, EST, in the Detroit area, with totality happening ninety-four minutes later at 8:06. The Moon begins to brighten again around 8:31 and the last phase ends at 10:04. Mid totality is around 8:18. The Moon will be just thirteen degrees above the eastern horizon when the partial phases begin. So if you have a lot of trees around your viewing site, you may have to look through some branches to see the beginning of the event. With the Sun nearly below the horizon as the Moon is above, twilight will just about be over, providing an early evening event. Totality only lasts about twenty-five minutes because the Earth's shadow will pass more above the Moon than below. Usually, such a configuration produces a rather bright eclipse, with the bottom portion of the Moon showing a brighter glow. Binoculars will show the color range better than a telescope will because too much magnification dilutes color

intensity. True, the image will be smaller but in this case the gain in color saturation will show a prettier picture. In short, use low magnification for observing, unless you are timing shadow events and want to know exactly when a certain crater starts to fall into the Earth's shadow. This kind of eclipse lends itself to a great photo

TOTAL LUNAR ECLIPSE Saturday, Nov. 8, 2003



opportunity because exposure time is shorter and a greater color range appears on the lunar surface. There will be an exposure guide available at the observatory for those who want to capture the entire sequence of events. You can hand hold your camera at the eyepiece and shoot away because exposure times are quite short during partial phases. Totality is another

story. The darker umbra will mean exposures longer than one second and usually that requires a motor drive and some way of fastening your camera to the telescope to prevent camera movement. Totality is also the best time to look for meteor impacts on the Moon's surface. If you're able, video record the entire series of events, along with the time. One of those SuperCircuits cameras will do the job or use one of those electronic eyepieces offered by Meade and Orion Corp. If you're using a TV set with an enclosed VCR recording device, you can also record sound through the audio input, using either a microphone or a radio, broadcasting time signals at 5, 10 or 15 Mhz.

The club is planning a public star party at Stargate Observatory during the eclipse. So if you can make it out there, with or without a telescope, we'll need all the help you can provide. There's no telling how big the crowd will be and we could be overwhelmed with people. The same thing occurs at the Cranbrook Natural Science Museum. The public will be invited to attend a showing, on the museum's grounds. If you live near Cranbrook, that event may be a better choice for you. You'll be helping amateur astronomy and the public no matter which site you plan to attend.

There were about 150 people waiting at The Eleventh Annual Island Lake Public Star Party when the drawing for door prizes began. Just what the total amount of attendees were, is hard to say because so many people were coming and going at the event. The weather didn't look like it was going to cooperate. Then the clouds broke about 8:30 and a full, clear sky dominated the event. Grand prize at the drawing was an EQ-60, an equatorially mounted 60 mm refractor, donated by Rider's Hobby Shop. Two dozen other prizes were given away, ranging from soap and body lotion, with an astronomical label, to planispheres, a Telrad finder and a half dozen eyepieces of various focal lengths. It was cold but everyone kept smiling. A twenty-four inch Dobsonian dominated the telescope viewing area, the proud possession of one of the sponsoring Ford group's members.

On Saturday, September 27, we had another close one with an asteroid. This one was the closest yet recorded. It rushed by at just one-fifth the distance to the Moon. That makes it about 27,000 miles. It wasn't seen until the next day and was estimated to be about 18th magnitude. The size was estimated to be about 10 to 20 feet in diameter. Named 2003 SQ222, Brian Marsden calculated the orbit to be quite elliptical, because it stretches from Venus to

Mars and has a period of one year and ten months. It's believed that an asteroid of this size might disintegrate completely if it ever headed toward Earth. I hope they're right.

We now have a new slate of officers for 2004. Those elected were; Ken Bertin, President; Norman Dillard, 1st Vice-president; Riyad Matti, 2nd Vice-president; Bob Watt, Secretary and Nancy Rowe, Treasurer. All you new officers can relax until January, That's when your jobs really begin. There were approximately thirty members voting in the election. Norman did a grand job selling himself as a candidate. I hope he realizes that he becomes acting president when Ken isn't available. Go Norm!

Louis Namee, our longest acting librarian in the club's history, has had to resign from his job. Louie sites a greater pressing role as husband and father because of his growing daughter's requirements for attention in school, sports and other activities. If you're an avid reader and would like to take over his job as librarian, don't hesitate to let one of our officers know. Thanks a million Lou, you've done a marvelous job!

Cliff Jones, our newsletter editor, gave us old-timers a very nostalgic ride when he gave his talk at the October, MCCC meeting. Cliff talked about a Scientific American publication called THE AMATEUR ASTRONOMER. Now out of print, the book is a prized collector's item among the scientific and technically minded. It features all the articles that Scientific American magazine included in its Amateur Astronomer and Amateur Scientist series. Originally started by Ingalls in the mid fifties, the series lasted throughout the sixties and seventies with exceptional drawings showing how to construct telescopes, mounts, solar observing equipment, astronomical measuring devices and lab experiments with the required equipment. It brought back a lot of memories that I had stored away.

The November third meeting at Cranbrook will feature a planetarium presentation. If you haven't seen the new digital projector, recently installed, this is the night to take advantage of Cranbrook. Normally there's a fee charged to attend one of the shows.

The MCCC meeting on the 20th will feature Marty Kunz, our present president and his subject will be the Milky Way galaxy. Marty has a unique way of using an overhead projector to make his presentations. His overhead slides, sometimes devised while he's talking, will give you a true picture of what's happening around us and in outer space.

Occasionally, Rik Hill, the previous AAVSO solar coordinator, sends me some bit of news and/or a joke to make my day a little better. Just last week I asked him about a statement that appeared in one of David Levy's books called OBSERVING VARIABLE STARS. The book will be available from the club's library after I finish reading it and return it. The statement said "I owe Rik Hill \$10.00." David made a bet with Rik concerning when a certain variable would reach maximum. The variable was irregular, so the bet could go either way. Anyway, David lost and a check for ten dollars was presented to Rik on a huge check facsimile, large enough to make cashing a little difficult. Rik mentioned that they both have continued to play games with each other, even up to this day. Another anecdote that Rik mentioned was his continued teasing of David about an accident he had on his way home one evening, in Arizona. It was out in the country and it was pitch dark when David ran into a cow. The cow was a black cow, so it was difficult to avoid. His vehicle disabled, he decided to wait at the side of the road until some help came along. The cow he ran into was still alive, laying on the other side of the road. Dazed, after the accident, David couldn't do anything for the injured cow and the cow certainly couldn't help him, so they licked their wounds together, so to speak. After a while, a car came zooming on the road and ran into the back of David's vehicle, overturning it and moving it until it slammed into the injured cow, killing it. The driver of the second car was intoxicated. It was quite a shock for David because it could have been him that died, not the cow. After hearing about his accident, Rik took advantage of the situation and started mooing into David's telephone whenever he tried to reach him and only the recording machine answered. After awhile, Rik admitted to the mooing but he enjoyed bringing the cow back to life for David.

In case you're wondering who the present man in charge of the AAVSO solar section is, it's our own WAS member, Rick Gossett. He is always willing to lend support to anyone interested in solar astronomy, as well as any other branch of astronomy. You can reach him at rick2d2@sbcglobal.net.

I'm one of the people that volunteered to give some presentations to the public at star parties and other events involving astronomical phenomena. One of those education items involves the package sent to Lee Hartwell by the Astronomical Society Of The Pacific. It has four modules, with each module containing standard

items, such as Styrofoam balls, cardboard tubes, small lights, paper cutouts, marbles, clay, a grating and other assorted items to help display the intricacies of detecting planets around other stars besides the Sun. Each volunteer is supposed to watch a video that comes with it, to get an idea on how to use the items as a teaching aid and report back to the California club, giving any advice as to how to improve the presentation items or any criticism about removing or changing the package. After viewing the tape inclosed, I have to say that I was impressed with how much astronomy could be explained with such simple items. The tape is about thirty-five minutes long and will eventually be shown to the entire club at one of our meetings. If you feel you would like to participate in becoming part of this teaching team, you should contact Lee at 586-979-4827 or e-mailing him at lhartwell@comcast.net. Lee would like to have a meeting with the volunteers in the very near future to get some input about the teaching package. A date, time and place will be announced at one of the club's meetings.

China entered the space age with a manned launch of an Astronaut named Yang Liwei, 38, an army lieutenant colonel. He planned to make 14 orbits around the Earth before making a landing. The space capsule, named Shenzhou, means "Divine Vessel" in English. It's a three seated Russian Soyuz capsule, extensively modified. China has repeatedly announced that its intentions are to put a manned colony on the Moon. If that's so, you can bet there will be another push by the US to establish an American colony.

A home brew super-computer has been assembled from off-the-shelf personal computers, in just one month, at a cost of just slightly more than five million dollars. It'll be ranked as one of the fastest computers in the world. Students, faculty and technicians at Virginia Polytechnic Institute assembled the computer from 1,100 Macintosh frames and 2,200 IBM processors. The usual cost of such high speed computers is 100 to 250 million dollars. The computer runs at 7.41 trillion operations a second, which ranks it in fourth place among super computers. Sirinidhi Varadarajan, the project director, says final testing should show an even greater speed in the future.

Another program has been added to the club's library. This one is a text program written by Mel Bartels, a long time telescope maker and observer. It's based on a formula

written by Roger N. Clark, in his book VISUAL ASTRONOMY OF THE DEEP SKY. When you start the program, it asks you for four variables. A number representing background sky brightness, telescope aperture, object magnitude and object size. The program then calculates your chances of seeing that object, based on the fact that it's at least fifteen percent brighter than the background sky. If it isn't, it says "Not Visible". A range of magnification is also calculated, mainly because small objects and very large extended objects are harder to see. It's a DOS program that can be run in Windows, directly from the A drive, if you wish. You can read all about it in Sky And Telescope's August, 2003 issue on page 62. The article's titled DARK SKIES RULE.



THE SWAPSHOP

This column is for those who are interested in buying, trading or selling items. Call 586-766-9720

(cometman@mybluelight.com) if you want to put an item for sale or trade in this section of the WASP. The ad will run for six months. The month and year, the ad will be removed, is also shown.

WANTED. Lenses for the OMI Olympus camera. Lou Faix, an oldtime member from our club's not too distant past is looking for lenses in the 35 to 40mm focal length range (f2.8 or f4.0) and a 300mm, f6 or faster telephoto lens. If you are willing to sell, contact Lou at lfaix@robsoncom.net. (7-04). FOR SALE. Criterion, 8 in. Schmidt Cassegrain, 9 volt electric drive, PEC (periodic error correction), four speed quartz drive, heavy duty aluminum adjustable tripod, enhanced coatings, and carrying trunk. Best offer over \$695. Mike Best, starmikebest@aol.com. (7-04).

FOR SALE. Classic 6 in. Criterion RV-6 Dynascope., Newtonian reflector, 110v AC electric drive, aluminum pier with three feet, 6x30 two ring finder and rotating tube. Best offer over 395. starmikebest@aol.com (7-04).

FOR SALE. Refractor, 3 in., metal tube, 1 1/2 in. two ring finder scope, 2 in. tracking erecting eyepiece telescope, Eastman Kodak Aero-Ektar 7.12 in. (178mm) f.l., 5x5, F2.5 camera #EM6294 (\$150 estimated value), AC heated dew shield for the 2 in. tracking scope, wood, heavy duty, surveyors tripod, two fitted wooden cases, two boxes of machining equipment tools for telescope construction. No mount. Best offer over \$495. starmikebest@aol.com. (7-04).

FOR SALE. Globes of Mars. 12 inches in diameter. One shows the extreme highlands and lowlands, the other shows a more detailed surface. Asking \$50 each. James Oravec, 586-582-0899. Retired, mornings best time to call. (2-04).

FOR SALE. Amateur Telescope Making, books 1, 2 and 3, published by Scientific American, Albert G. Ingals, editor (1972, 1972 and 1961). Famous optical authors like Porter, Clark, Wright, Hale, Hastings, Kirkham, Mayall, Baker, Dall, Paul, Cook, Schmidt and Wilson, all contributing their experience to telescope making for the amateur. They talk about lenses, mirrors, mounts, film and mirror testing. Asking \$50 for the three book set. 810-776-9720. (2-04).

FOR SALE. Meade LX90 telescope with JMI focuser, 2 in. eyepiece, JMI hard case, JMI Moto-Focuser, Dew clip, solar filter, Dew shield, wedge, Skylight/dust filter, Update cable kit, 1.25 and 2 inch diagonal, a 26mm and Meade video eyepiece, AC adapter, and 5 inch color TV. Total value over \$2,850 without shipping and tax, asking \$2,000. 248-236-9983 or jameswynn@charter.net. (1-04).

FOR SALE. Nextstar 8 GPS telescope, one year old. The package includes telescope, tripod and two cases of accessories. The included accessories are; car battery supply adapter, Celestron ISO Pads, Celestron kit (includes 4, 6, 9, 15 and 32 mm Plossl eyepieces. A 2X Barlow, 7piece filter set, 5x12x10 locking, aluminum carry case, 20mm crosshair eyepiece, polarizing filter set #93608, 40mm Plossl, a second aluminum accessory case 6x13x18 with locks and dividers, Night Watch 3rd edition book, The Sky At Night, Nextstar 8 GPS manual and original telescope shipping carton). All items are in excellent condition. Asking price

\$2,000, firm. Location is Port Huron, MI. Please e-mail if interested. mgmfan@aol.com. (1-04).

FOR SALE. Orion XT8 Dobsonian telescope, 8 inch, Orion Plossl 25mm and 9mm eyepieces, Orion Moon filter, Televue Plossl 15mm eyepiece, Vixen LV 5mm eyepiece, Orion 1.25 inch Shorty Barlow, Orion EZ Finder reflex site, Orion collimating eyepiece, medium size accessory case, Orion RedBeam LED flashlight. Cost over \$850, will sacrifice for \$450. Everything is in very good condition. Brian T. Koehler, St. Clair Shores, MI, 588-772-8238. E-mail bkok@wideopenwest.com. (12-03).

FOR SALE. Six inch tube Dobsonian telescope. Includes 6 inch, F8 parabolic primary mirror, 1.25 inch minor axis secondary mirror, 1.25 inch focuser with 0.96 inch adapter, 6X30 finderscope, four vane spider assembly, 8 inch diameter heavy wall Sonotube optical tube (white), Baltic birch solid core plywood construction, stained and clearcoated with polyurethane, Ebony Star with virgin Teflon altitude and azimuth bearings. Reduced to \$290. Call Steve Greene at 586-598-1199 (12-03).

FOR SALE. Two telescope mounting rings. Holds tubes with 12.5 to 13.25 inch outside diameter. Steel, painted black, hinged. Uses 1/4-20 mounting studs which can be removed and replaced with larger studs for heavier telescopes. Asking \$45. 810-776-9720 (1-04).

FOR SALE. Spider (four vane) for a Newtonian secondary. Fits tubes with an inside diameter from 12.5 to 13 inches. Steel, painted black, thin vanes, will accept diagonal holders with 5/16 inch diameter bolt or smaller. Asking \$10. 810-776-9720, (1-04).

FOR SALE. Compact video camera for astrophotography or surveillance. SuperCircuits PC23C with C-mount adapter for 1 1/4 inch eyepiece holder. Includes 25 feet of video cable, 12 volt power supply (must use 110v AC input) and instructions. Video chip is 1/3 inch, black and white CCD with 510x490 pixel arrangement. Good for solar, lunar and bright planet photography. This video chip is not suitable for stellar photography beyond fifth or sixth magnitude. 0.04 lux light sensitivity. Weight is 6.87 ounces. It does not include a lens. Just slide it into your eyepiece holder and focus

the image on the TV screen. Asking \$45. 810-776-9720 (1-04).

FOR SALE. Micronta FET, analog, volt-ohm meter. Model 22-206. Six inch meter face with mirrored DC-ohms scale. Separate ohms and zero adjust. Measures ohms, DC and AC to 1,000 volts. DC amps to 300ma. Test leads included. Asking \$20. 810-776-9720 (2-04).

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UPCOMING WAS EVENTS

Nov 3 Mon Cranbrook Meeting (7:30 pm)
 Nov 8 Sat Lunar Eclipse/Open House-StarGate
 Nov 20 Thurs Macomb Meeting (7:30 pm)
Dec 1 Mon Cranbrook Meeting (7:30 pm)
 Dec 18 Thurs 2003 Christmas Awards Banquet

Scheduled Speaker 2003/4 By Ken Bertin

DATE	DAY	PRESENTER	SUBJECT
11/3/2003	MON	PLANETARIUM	SKY TONIGHT
11/20/2003	THU	MARTY KUNZ	MILKY WAY GALAXY
12/1/2003	MON	KEN BERTIN	OTHER ASTRONOMERS
12/18/2003	THU	NASA SCIENTIST	SOLAR ASTRONOMY
1/5/2004	MON	KEN MULLIN	PLANETS
1/15/2004	THU	GUY MAXIM	THE BEGINNING,END,& EVERYTHING..
2/2/2004	MON	NORM DILLARD	10 BRIGHTEST STARS
2/19/2004	THU	NANCY ROWE	AURORAE/RADIO PROPAGATION
3/1/2004	MON	PLANETARIUM	
3/18/2004	THU	DAVE D'ONOFRIO	PROCESSING CD IMAGES
4/5/2004	MON	STEVE UITI	TBA
4/15/2004	THU	LARRY KALINOWSKI	TBA
5/3/2004	MON	MIKE BEST	S.E.T.I.
5/20/2004	THU		
6/7/2004	MON	JIM SHEDLOWSKY	IRIDIUM FLARES
6/17/2004	THU		
7/5/2004	MON	ALAN ROTHENBERG	TBA
7/15/2004	THU		
8/2/2004	MON	RIYAD MATTI	TBA
8/19/2004	THU		
9/13/2004	MON	PHIL MARTIN	TBA

Take It With a Grain of Salt

By Guy Maxim

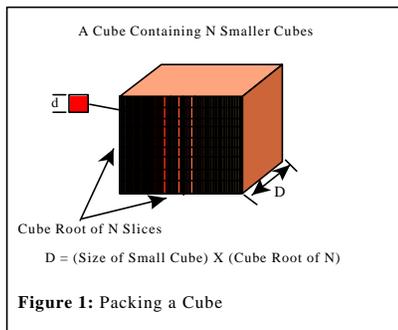
Introduction

At a recent star party the question was asked whether or not there were more stars in the sky than grains of sand on Earth. This is an old idea dating back to the ancient Greeks. After dashing off a quick answer I became curious. Pondering the question further revealed that some interesting observations could be made by reducing the problem to human dimensions. Not having any sand handy, table salt proved a convenient substitute and therein lies the beginning of the tale.

Counting the Stars

Measuring some garden variety table salt with a micrometer shows that the maximum grain size is twenty thousandths of an inch (0.02"). The grains vary in size so it seems reasonable to take ten thousandths of an inch (0.01") as the size of a representative grain.

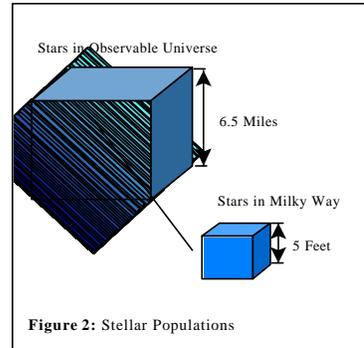
The question is this: if we have N salt grains, what is the size of the cube we can pack them into? First assume that the grains are perfect cubes and second that they are packed with no space between them. Figure one illustrates the answer.



To get a total of N grains, the number of smaller cubes along each edge must be equal to the cube root of N . It is true that rounding is needed to get integral values, but the effect is negligible for large N . The edge of the big cube is then $D = (d) \times (\text{cube root of } N)$.

Recent estimates for the number of stars in the Milky Way is 200 billion (2×10^{11}) and for the number of stars in the observable universe is 70 sextillion (7×10^{22}).

Assuming in each case that one grain of salt is equated to one star then figure 2 shows the representation of the stellar populations.

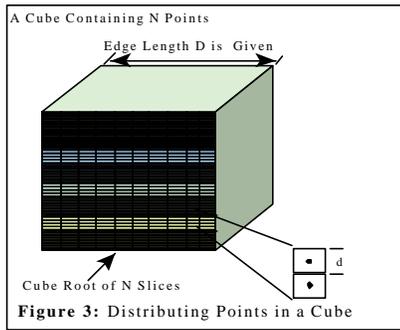


We can tell the Greeks that they will only need about 275 cubic miles of sand to count the stars, not all of the sand on Earth. This should be a great relief. It is interesting to note that the 5 foot cube of salt grains is also representative of the number of galaxies in the observable universe, a number also estimated to be about 200 billion.

Cutting the Universe Down to Size

Taking these ideas just a little further produces a non-obvious insight into the nature of the universe. The question is: what is the average distance between the stars? To answer this the stars will have to be distributed evenly in some fashion. The problem of distributing

points over an arbitrary volume or surface is quite difficult. There is a simple method however, and this is to distribute them in a cube. Figure 3 illustrates the concept.



In this case the points are put at the centers of the small cubes. The distance between the points is then the same as the edge length of the small cube and this is given by $d = D / (\text{cube root of } N)$. To use this idea two distance scales are defined. First the **stellar scale** is defined by setting the size of a salt grain equal to one solar diameter.

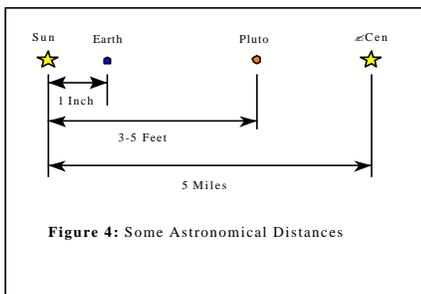
$$0.01'' = 800,000 \text{ Miles}$$

In this scale we also have,

$$1 \text{ Light Year} = 1.16 \text{ Miles}$$

To get a feel for this scale figure 4 shows some well known astronomical distances.

In this scale light travels at about 0.002

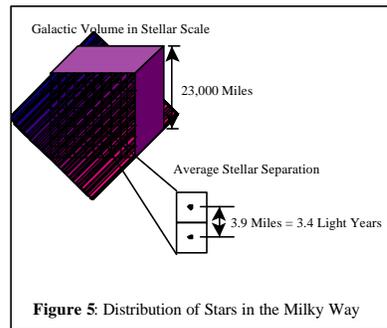


inches per second and a human being is about the size of a single atom. It is believed that the milky way is a disk that is 100,000 light years in diameter and 1000 light years thick. A **galactic scale** can be defined by setting the size of a salt grain to this dimension, i.e.

$$0.01'' = 100,000 \text{ Light Years.}$$

The Stars in the Milky Way

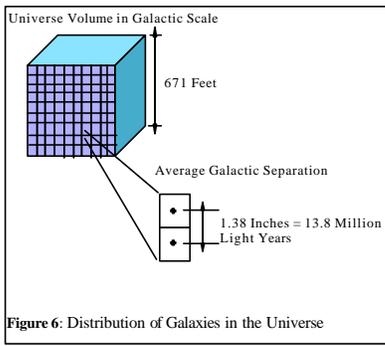
Now the question of the average distance between the stars in the milky way can be answered. If the volume of the galactic disk is converted to a cubical volume using the stellar scale, figure 5 shows the result.



The average separation is roughly the same as the distance between Earth and a Cen. The key observation is that *the average separation is about 25 million times the size of a star.*

Galaxies in the Observable Universe

The radius of the observable universe is generally given to be about 50 billion (5×10^{10}) light years. If we switch to the galactic distance scale, the observable universe becomes a sphere 833 feet in diameter which corresponds to a cube that is 671 feet on a side. Figure 6 shows



the result of distributing 200 billion galaxies in this volume. The average distance between galaxies is only about 138 times the size of a galaxy. Thus we conclude that **on average the universe is packed far more densely with galaxies than a galaxy is packed with stars**, a conclusion not immediately apparent, at least not to me.

The Ultimate Comparison

Finally, we can ask, how does the human body compare to the universe? In stellar scale a human is the size of an atom, and the volume of the observable universe is equal to the volume of a cube that measures 93 billion miles on a side. If nothing else, it is clear that there is plenty of room to go around.

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Editor's note: Guy Maxim, from the Oakland Astronomy Club will be the presenter at the WAS Thursday, January 15th meeting. His topic will be:

COSMOLOGY

The Beginning, The End, and Everything In Between.



WARREN ASTRONOMICAL SOCIETY

TREASURER'S REPORT

9/1/03 THRU 10/1/03

Beginning Balance:	\$ <u>270.28</u>
Income Total=	\$ <u>1,053.90</u>
Expense total:	\$ <u>-441.30</u>
Ending Balance:	\$ <u>882.88</u>

Bill Bears – Treasurer

November Calendar

- 1st - 1:00 am: The Moon passes 5° south of Neptune
- 2nd - 10:00am: The Moon passes 5° south of Uranus
- 3rd - 4:00 am: The Moon passes 3° south of Mars
- 8th - 8:06 pm: Full Moon & total lunar eclipse
- 10th - 2:00 am: Venus passes 4° north of Antares
7:04 am: The Moon is in apogee (252,464 miles from the Earth.)
- 13th - 2:00 pm: The Moon passes 5° north of Saturn
- 16th - 9:00 pm: Comet 2P/Encke passes closest to the Earth (24.2 million miles away)
11:15 pm: Last Quarter Moon
- 18th - 2:00 am: Leonid meteor shower
11:00 am: The Moon passes 4° north of Jupiter
- 23rd - 5:59 pm: New Moon & total solar eclipse
6:16 pm: The Moon is at perigee (221,712 miles from the Earth)
- 24th - 10:00 pm: The Moon passes 0.3° south of Mercury
- 25th - 1:00 pm: The Moon passes 2° south of Venus
- 28th - 9:00 am: The Moon passes 5° south of Neptune
- 29th - 7:00 am: Asteroid Amphitrite is at opposition
5:00 pm: The Moon passes 5° south of Uranus
- 30th - 12:16 pm: First Quarter Moon

Calendar courtesy of Jim Mills – Check out his web site at: www.njnightsky.com

If you would like to renew your membership and have not already done so, or if you would like to become a member of the Warren Astronomical Society, please complete the following and submit with the appropriate US funds by Check or Money Order.

Membership	Definition	Dues (US Funds)
Student	One person under 18 years of age enrolled in grades 1-12	\$17.00
College	One person attending a College or University	\$22.00
Sr. Citizen	One person 65 years of age or older	\$22.00
Family	More than one person living at the same address	\$37.00
Individual	One person not fitting a category above	\$30.00

Fill in the WAS application and send it to our current Treasurer:

- ? **Bill Beers**
- ? **c/o Warren Astronomical Society**
- ? **P.O. Box 1505**
- ? **Warren, Michigan 48090-1505**

--tear here--

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Warren Astronomical Society Membership Application

About You:

Name(s): _____

Address: _____

Telephone: _____

E-Mail: _____

Membership Type:

Individual \$30.00 _____

Family \$37.00 _____

College Student \$22.00 _____

Student \$17.00 _____

Sr. Citizen \$22.00 _____

WARREN ASTRONOMICAL SOCIETY
P.O. BOX 1505
WARREN MICHIGAN 48090- 1505



TO:

The society holds meetings on the first Monday and the third Thursday of each month, starting at 7:30 pm.

First Monday meeting:

Cranbrook Institute of Science
1221 North Woodward Avenue
Bloomfield Hills, Michigan

Third Thursday meeting:

Macomb Community College
South Campus, Bldg B, Room 209
14500 Twelve Mile Rd
Warren, Michigan