REFLECTIONS / REFRACTIONS

University Lowbrow Astronomers

APRIL 2015

VOLUME 39, ISSUE 4

Messier 45

The Seven Sisters and Their Veil

By Brian Ottum

Very likely everyone reading this newsletter has seen the Pleiades, naked eye, with binoculars and through a telescope. But rarely do any of us see even the faintest hint the nebula swirling around the Seven Sisters. "Since I just bought a new Subaru in January, I figured I would shoot M45. Taken over 3 nights in mid-February."
Canon 5D mkIII (modded)
Homemade TEC cooler box
10" f/5 Newtonian w/Baader field flattener
4" APO with Orion SS..

Treasurer's Annual Report:
April 1, 2014-March 31, 2015

By Doug Scobel, *Treasurer*

University Lowbrow Astronomers Balance Sheet 2014-15 (01 April 2014 - 31 March 2015)

Income	
Dues	$2,123.00
Extra for mailed newsletter	$162.00
Magazine subscriptions	$468.95
Donations/Gifts	$180.00
Shirt sales	$1,073.00
Shipping charges	$37.55
RASC publication payments	$916.00
Total Income	**$4,960.50**

Expenses	
Phone (AT&T Messaging)	$190.20
Newsletter printing/mailing	$161.37
Magazine subscriptions	$468.95
Donations	$450.00
Guest speaker expenses	$0.00
Shipping/mailing	$54.11
RASC publications	$851.90
McMath maintenence	$319.13
17.5" Dob project	$1,031.66
Miscellaneous	$1,804.05
Total Expenses	**$5,331.37**

Balance 01 April 2014	**$5,130.65**
Plus Income	**$4,960.50**
Minus Expenses	**$5,331.37**
Balance 31 March 2015	**$4,759.78**

Shirt Inventory	**69**

From a monetary standpoint, our fiscal year 2014-2015 was a pivotal one. For the first time since any member can remember, we Lowbrows increased our dues. Yay! Okay, maybe that's not something that many of you want to cheer about. But financially, it was a good thing. The former dues structure ($12.00/year for seniors age 55 and up, $20.00 for individuals/families) that as far as we know dated back to the inception of the club, combined with the "graying" of the club*, meant that revenues were beginning to fall relative to expenses. We projected that it would not take too many years before we would be hurting financially.

Last August, after months of discussion, the membership voted on and approved a new dues schedule, $20.00/year for seniors, and $30.00 for individuals/families. As a result, our bottom line is much healthier, and should remain that way into the foreseeable future. At least for your treasurer, that's a reason to celebrate!

Now here's something that might be more interesting to you, particularly you members who have joined the Lowbrows very recently. Late last year, the Lowbrows re-replenished our inventory of way-cool T-shirts. They are navy blue with our Lowbrow logo (Lowgo?), designed by our very own Kathy Hillig, printed on the front (pictured at the left). We have a large inventory of adult size small through extra-large, and your price is only $10.00 each. That's quite a bargain! To acquire one all you need to do is contact Yours Truly prior to a meeting or event and I'll bring the shirt(s) to you.Besides T-shirts, we custom-ordered some hooded sweatshirts and long-sleeve Tees, and I ordered a couple extras. I still have one size XL

and one size XXL long-sleeve T, and one size large hoodie. Prices are $15.00 each for the long-sleeve Tees, and $30.00 each for the hoodies. I'll make them available on a first-come first-serve basis, and once they're gone they're gone. Again, just let me know and I'll bring it/them to the next meeting.

One really nice benefit of being a Lowbrow, besides the awesome camaraderie and access to the second-to-none newsletter, is that you are entitled to substantial discounts on Sky & Telescope and Astronomy magazine subscriptions. Through the club you can get one year of Sky & Telescope for $32.95 and two for $62.95. Astronomy is $34.00 for one year and $60.00 for two. If you subscribe to both your savings just might cover your annual dues! If you subscribe to one or both, or wish to, and are not participating in the club discount plans then just let me know and I'll help you get in on the action.

Clear, dark, and green skie$!
Doug Scobel, Treasurer

*Of this fiscal year's new memberships and renewals, 41 were from individuals and families, and 57 were from seniors. Compare those numbers with 45 individual/family and 46 senior the previous year, and 47/42 the year before that.

Editor's Note: The great majority of our expenses are zeroed out. RASC purchases and screen printing are made up by sales to the club. Some are one time, like the $1031 for the 17.5". The actual running expenses (phone, PO Box, printing, shipping, Observatory/McMath maintenance, donations, July meeting munchies) added up to about $1500 last year. It is these expenses our $2100+ in dues have to keep up with. For those wishing to further investigate the club's finances, the Treasurer's Ledger will be published in the Members Only section of the Lowbrow web site.

Lowbrow Calendar

***Saturday, April 11 and Saturday April 18--*Open Houses at Peach Mountain--**Begin at sunset, may be cancelled if cloudy.

***Friday, April 17, 7:30 PM--*Monthly Club Meeting**-Room G115 Angell Hall, University of Michigan, 435 South State Street, Ann Arbor--1) Elections. 2) Michael Meade (University Lowbrow Astronomers): "Northern Exposure: A Total Solar Eclipse Over the Faroe Islands."

***Saturday, April 25--*Astronomy Day--**The Lowbrows will be in downtown Ann Arbor (between Huron and Ashley Streets) showing the public the first quarter moon, Jupiter and some of the brighter deep sky objects. Begins at sunset.

Final Calendar Note: There will be *SIX* public club events this coming September: Open Houses on the 5th and 12th, the Club Meeting on the 18th, Astronomy Day (Fall) at the Leslie Science Center on the 19th and Astronomy At The Beach at Kensington Metro Park on the 25th and 26th. This is more than a full schedule for the club. Noting five of these gatherings require many Lowbrows and their equipment, the Officers realized the need for as much notice to the club as possible. So...take that vacation, clean out that garage and paint that fence in any month this year except September. With five months notice, hopefully all 120+ of you will be able to attend at least one(or more) of these events.

University Lowbrow Astronomers Meeting Minutes

March 20, 2015

President Charlie Nielsen opened the meeting at 7:30 PM. He then introduced Don Fohey, one of the club VPs who gave a talk and slide presentation.

Don's presentation was about how to interface digital encoders mounted on an Alt-Az scope with Sky Safari using wireless communication (Blue Tooth) and an Arduino Uno computer system. The system could easily be applied to a dec-RA scope as well. After fully explaining the steps involved and the issues with hardware and software he had worked through, he offered to club members his help and guidance for anyone wishing to build their own system. Information about suppliers and component costs were provided. Throughout Don's presentation he answered audience questions.

Officers Reports:

V.P. Dave Snyder reported that the exoplanet naming process through IAU continues. The IAU sent out an email, which Dave forwarded to the club earlier in the day. The IAU email listed "the most popular 20 ExoWorlds" which included "15 stars plus 32 planets - total 47 names." If the club wants to we can submit names to the IAU, but the deadline for submitting names is May 31 and there is more to it than just submitting some names. Following the "Minutes" is a copy of the email letter and spreadsheet showing the objects to be named sent to Dave from IAU.(*Posted online with the newsletter.*)

V.P. Don Fohey reported that the Northfield Public Library decided not to do a telescope loan program. Their inventory of scopes was reviewed and organized. The library plans to have a rummage sale to dispose of the scopes.
Treasurer Doug Scobel: We have 122 members and cash of $4900. Doug said we have made Mark Cray a lifetime member for all the donations and work he has done for the club. Charlie suggested that he should also receive a club shirt.
Newsletter Editor, Jim Forrester reported that the Open house, March 21, was "on" and the gate would be open at 7:30PM. He and Jack Brisbin visited the observatory recently and returned the 17.5" scope. The ground around the radio telescope should be fine, but driving down to the observatory should only be attempted with 4 wheel drive vehicles. He requested help to manage the McMath and the 17.5" for the open house. He also made a pitch for Newsletter articles for next month, since the article bin is empty.

Observatory Director, Jack Brisbin showed us a video of the observatory area taken a few days ago, emphasizing the downing of several of the trees to improve our visibility of the sky and that the observatory wall repairs seem to have been successful.

Member Input:

Member, Larry Halbert showed us the demonstration board he made. It is a replacement for the board that is used to show how light interacts with lenses and mirrors. Very nicely done and artistically attractive, including our club logo.

Member, Paul Walkowski informed us that the GLAAC organization will be trying to obtain an astronaut speaker this year (a cost of about $3500). Some funding comes from astronomy clubs, but recently corporate sponsors have increased their contributions. He noted that the GLACC committee is down to only 6 members, and that additional members are welcome and needed. Meetings begin this Sunday at 1PM and will continue monthly for several months.

Member, Jim Forester, reminded us that at next month's meeting election of officers will take place. Since 8 current officers were present at tonight's meeting, he requested that they state their desire to continue or resign from their positions for another year. As I recall, Charlie, Jack, Jim, Doug all confirmed their intent to continue. Some other officers were non committal.

Member Charlie Nielsen shared with us the forecast of scheduled speakers for the year and the vacancies needing speakers.
President Charlie Nielsen adjourned the meeting at 9:07PM.
Submitted by V.P. David Jorgensen

Reflections March 2015 Article

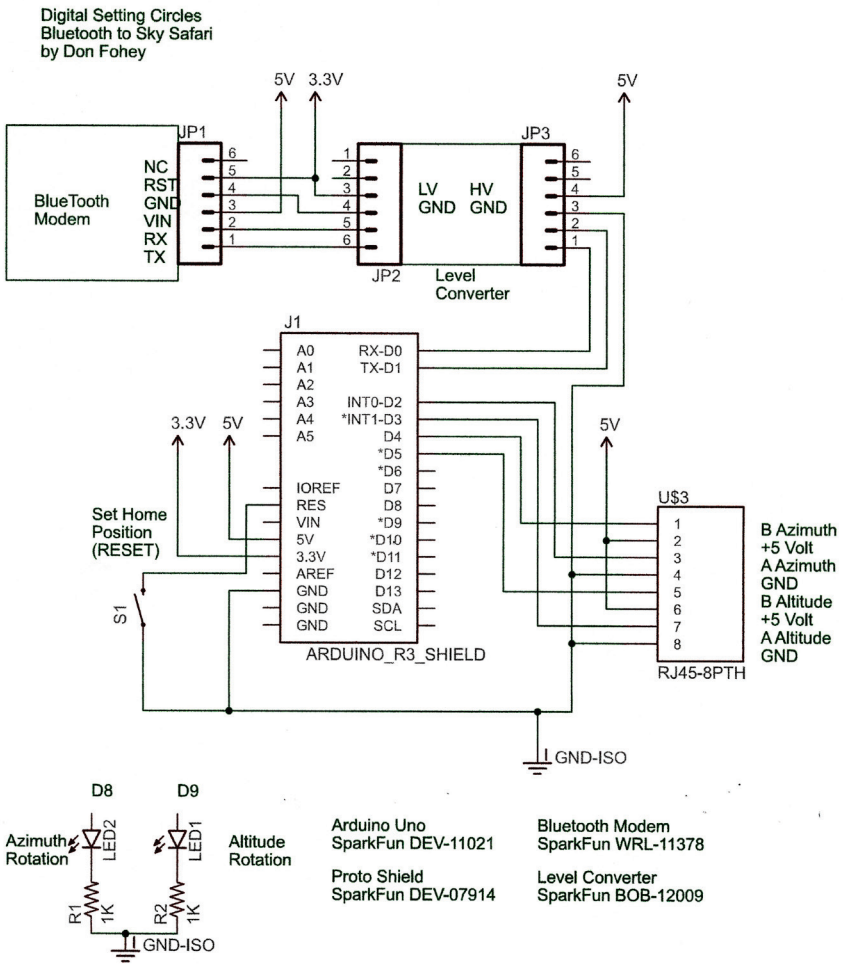
Digital Encoders for Sky Safari with Arduino Uno: Update

By Don Fohey

The Bluetooth Modem use of Serial Port Profile (SPP) required for two way communication with Sky Safari is available on Andriod devices. Neither IPhone nor IPad support SPP.

The 10,000 step encoders available from Astro Systems are 2,500 slot(pulse) encoders and require the quadrature detection algorimith for a Sky Safari 10,000 count.

The serial pass thru communication to the modem and it's dependence on the Software Serial Library must be removed from the program to prevent the Arduino from missing encoder counts at high count rates. The level converter for the modem should be connected to the UART hardware serial pins D0 and D1 instead of pins D10 and D11. There is now a two step process. The modem is first wired to pins D10 and D11 and the code with serial pass thru is used to set the modem parameters . The shield is then unplugged and the modem connections are moved to pins D0 and D1. The Arduino is then loaded with a program where the serial pass thru is removed. The shield is then reinstalled. I will help any Low-brow member who would like to implement the device.



Is This Really the "Dark Side?"

Uncle Jim Goes Digital

By "Uncle" Jim Forrester

I've enjoyed learning the sky. The process required patience and, for me, star hopping became a form of meditation. All the cares of life fade away when I'm hunting down an object, and even if I wasn't successful, I got lots of practice comparing the star fields I saw at the eyepiece with my charts. I always learned something.

My first toe in the digital waters, was the purchase of Sky Safari loaded onto an iPod Touch. Eliminating almost all my paper atlases and charts, Sky Safari in the field greatly increased the productivity of my observing sessions. I was still star hopping, but on nights with good skies I was bagging 15-25 new objects each night rather than 10-12 (often fewer). I've gone through all the Messiers, many of the Caldwells and all but some of the winter objects in the Hershel 400.

My main scope is a 12.5 inch f/5.6 truss tube Dobsonian. This combination of aperture and excellent optics has allowed me to have good success finding objects with a Telrad and long focal length, wide field eyepieces. But I'm running out of objects I can find star hopping in our county's less than pristine skies.

Most of what I go for now is close to the limits of my scope. Many star fields look enough alike, that I'm often unsure I'm looking at the right one when the object is a low surface brightness mag 13 galaxy. I usually find what I'm looking for, but finding that faint fuzzy can take a long time. And too many nights are too hazy and have too few stars to hop from.

So after 17 years I finally put digital setting circles on my telescope.

The inspirations were Don Fohey's Arduino/Bluetooth setup and Chris Sarnecki's wi-fi/iPad push to arrangement. Mike Radwick built Chris's wi-fi interface last year. Mike was willing to help me out as well, but I could never pull the trigger. Both setups report to tablets running Sky Safari.

Then Don Fohey got the same bug and built himself a wireless interface with an Arduino Uno micro controller and a Bluetooth modem. He lit up the March meeting with his enthusiasm and got so carried away he offered to build a unit for any Lowbrow who would supply him the parts.

Don and I have worked on a couple of things together, so I was delighted when he contacted me saying he had enough parts on hand to build another unit and wondered if I was interested. Don, like me, is retired and has the time to put to projects for friends. It was a no brainer, of course I said yes.

Now digital setting circles for one's telescope is not a cheap project. Don's parts cost about $100. Two optical encoders and the hardware to mount them, along with cables to carry the signals to the modem are another $250+. Then you need a tablet or phone loaded with Sky Safari. Since I already had the tablet (Google Android Nexus 7, 2013) and Sky Safari, my cost was just shy of $400. Well, not quite. I found Don's LIPO battery setup (see last November's *Reflections*) very tempting. Small and light, it easily fits into my scope's rocker box. Charger, battery and protective envelope for the battery: $95.

Centering the altitude encoder

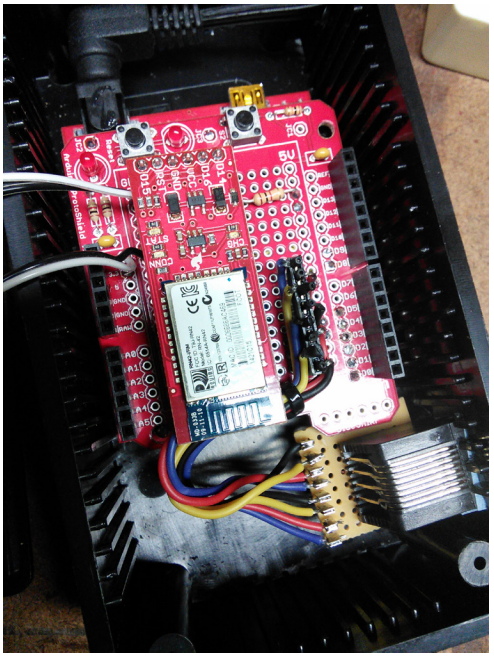
Photos: J. Forrester

Don and I got together in his basement and he finished building the Arduino/Bluetooth unit, soldering wires to the female RJ45 connector and gluing it into place. He then programmed the Arduino (see Don's articles in this and the March issues) and paired it to my tablet. He then made sure my Sky Safari telescope set up was correct: Scope Type--Basic Encoder System; Mount Type--Alt-Az, Push-To; Connect via Bluetooth; with a readout rate of 4 per second.

My electronic and computer programming skills are almost non-existent, so Don's help was crucial. I do have woodworking skills, but they are very slap dash, so I implored Dave Jorgenson for his help mounting the altitude encoder. I had been part of the team that built the club's 17.5" TeleKit, but was absent when the

altitude encoder placement was determined. So Dave and I installed the encoders over a couple of mornings in his Chelsea wood shop.

It was less than two weeks from Don making his offer to my being able to give the system a try. I spent the night of April 4 finding out that what can go wrong, will go wrong. Not with the system, but with my ability to read directions. Don was clear in his article: "*Put the telescope in the home position, horizonal pointing north, and* **touch the Arduino reset button to set the counters to zero**. *In Sky Safari SETTINGS select Telescope Setup, Basic Encoder System. Scope Type-Basic Encoder System. Mount Type-Alt-Az Push-To . Connect via Bluetooth. Readout Rate 4 per second (I have not tried higher rates. Note: Don is now using a 6/second rate. JF). Under Mount Type Select Alt-AZ Push-To and enter the Encoder Steps Per Revolution (+5000,+5000). Do not check the Get Automatically box*." I'll bet you can't guess what I forgot to do all night. (Hint: Try the bold underlined part.)



The heart of the matter

But I lucked out. The next night, Sunday the 5th was also clear. This time I pushed the button. And this time I was able to find all kinds of objects. The system led me to Jupiter, M44, Kolchab, Mizar, M81, M82, M94, Comet Lovejoy, M35, M36, M37, M38, M42 and M45 plus putting several other bright stars in the field.

The comet was particularly interesting. Low in the northwest in Cassiopeia, only points of light showed up in the eyepiece against a very light gray background. But the only stars in the field were mag 6.5-9.5, and their pattern in the eyepiece matched what Sky Safari displayed. A a point of light with the faintest bit of haze around it was exactly where Sky Safari said the comet was supposed to be. I would never have found it without the setting circles.

I started with the 32mm MK80 (56x, 80deg AFOV, 1.4deg true field). At the beginning of the night most objects were in the outer 1/4 of the field, sometimes close to the edge. At one point early on the scope lost its way altogether and I had to realign. The only way I could do that, though, was to disconnect, leave Sky Safari, and turn off the Bluetooth in the tablet.

I put the scope horizontal pointing north, reset the Arduino, turned everything back on and the tablet showed the scope in the home position. I selected Polaris in Sky Safari and lifted the scope until it was centered in the cross hairs. The star was about 1/3 from the edge, almost 1/2 degree off. I centered the star and tapped align. Sky Safari asked me, "Do you want to align on Polaris? I pressed yes. I repeated the process with Mizar. This time Sky Safari gave me three choices: First Star, Second Star and Cancel. I chose first star. I went to another star, repeating the process again, though this time selecting Second Star.

This second alignment was better, most objects noticeably more toward the center, enough so that I switched to a 20mm 100deg Explore (1.1deg true field). The alignment seemed to improve as the night went on. M38, M36 and M37 were the last objects of the session and all fell on the edge of or in the inner 1/2deg of the field.

The response of the image on the tablet to the movement of the scope in a large field was almost immediate. Only when zoomed in to a degree or less was putting the cross hairs on an object difficult. I wasn't able to get closer than 5 minutes on the screen. (Don's new code should improve this.)

I was out a little more than an hour and was very impressed. Many things I would not have found without the setting circles as I was looking directly over a street light.

I found out later Polaris and another star farther away than Mizar were all I needed. But even my lame alignment routine was good enough. Don realized from this report that the Arduino had to be reprogrammed to match the Encoder Steps Per Revolution in Sky Safari to the way my encoders actually work, hence the update on page 5.

By the time most of you see this I'll have had the scope out for another observing run (this time at Peach Mountain), giving the new code a workout. I can't wait.

WIMPZILLA?

By Jack Brisbin

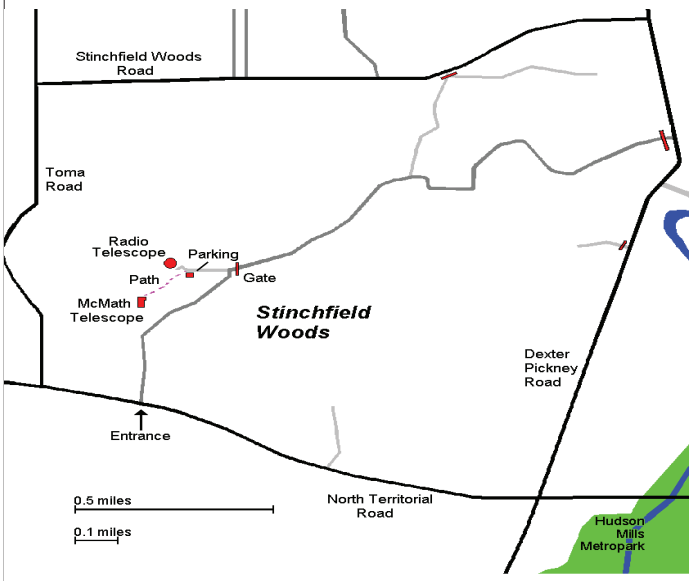
WImpzilla was created by the Big Bang and is part of the ongoing discussion on a component of the Universe called Dark Matter. For the purpose of of this discussion we will say Dark Matter exists and makes up 25% of our universe. Dark Energy is 69% and ordinary atomic matter is 5% of the universe. The rest of the stuff is comprised of Neutrinos, Photons and Black Holes. One of the candidates that can determine the properties of Dark Matter is a particle called WIMP (Weakly Interacting Massive Particle) that is about 100 times the mass of a photon. But that's not the issue we are concerned about; who came up with **"WIMPZILLA?"**

Let's say, after a hard day of creative research, the researchers stopped off at the local restaurant and participated in alcohol particle beverage analysis and had a BAZINGA moment and created Wimpzilla. But, then again, to be fair, they may have spent the day watching Godzilla movies and a BAZILLA moment struck. In theory, these Wimpzilla particles would be 10 billion (plus or minus a few zero's) times the mass of WIMPs. Remember as of this writing Wimpzilla's have not been discovered and not everyone agrees with Wimpzilla. This Lord of the Underworld doesn't.

Places & Times

Monthly meetings of the University Lowbrow Astronomers are held the third Friday of each month at 7:30 PM. The location is usually Angell Hall, ground floor, Room G115. Angell Hall is located on State Street on the University of Michigan Central Campus, between North University and South University Streets. The building entrance nearest Room G115 is the east facing door at the south end of Angell Hall. A club observing session at the Peach Mountain Observatory, weather permitting, often follows the meeting.

Peach Mountain Observatory is the home of the University of Michigan's 25 meter radio telescope as well as the University's McMath 24" telescope, maintained and operated by the Lowbrows. Located northwest of Dexter, MI; the entrance is off North Territorial Road, 1.1 miles west of Dexter-Pinckney Rd. A maize and blue sign marks the gate. Follow the gravel road to the top of the hill to a parking area south of the radio telescope, then walk About 100 yards along the path west of the fence to reach the McMath Observatory.



Public Open House / Star Parties

Public Open Houses / Star Parties are generally held on the Saturdays before and after the New Moon at the Peach Mountain observatory, but are usually cancelled if the sky is cloudy at sunset or the temperature is below 10 degrees F. For the most up to date info on the Open House / Star Party status call: (734)332-9132. Many members bring their telescope to share with the public and visitors are welcome to do the same. Peach Mountain is home to millions of hungry mosquitoes, so apply bug repellent, and it can get rather cold at night, please dress accordingly.

Membership

Membership dues in the University Lowbrow Astronomers are $30 per year for individuals or families, $20 per year for students and seniors (age 55+) and $5 if you live outside of the Lower Peninsula of Michigan.

This entitles you to the access to our monthly Newsletters on-line at our website and use of the 24" McMath telescope (after some training).

A hard copy of the Newsletter can be obtained with an additional $18 annual fee to cover printing and postage. Dues can be paid at the monthly meetings or by check made out to University Lowbrow Astronomers and mailed to:

The University Lowbrow Astronomers

P.O. 131446

Ann Arbor, MI 48113

Membership in the Lowbrows can also get you a discount on these magazine subscriptions:

Sky & Telescope - $32.95 / year $62.95/2 years

Astronomy - $34.00 / year or $60.00 for 2 years

For more information contact the club Treasurer at:

lowbrowdoug@gmail.com

Newsletter Contributions

Members and (non-members) are encouraged to write about any astronomy related topic of interest.

Call or Email the Newsletter Editor: **Jim Forrester (734) 663-1638 or** jim_forrester@hotmail.com to discuss length and format. Announcements, articles and images are due by the 1st day of the month as publication is the 7th.

Telephone Numbers

President:	Charlie Nielsen	(734) 747-6585
Vice Presidents:	Dave Snyder	(734) 747-6537
	Dave Jorgenson	
	Don Fohey	
	Ken Ruble	
Treasurer:	Doug Scobel	(734)277-7908
Observatory Director:	Jack Brisbin	
Newsletter Editor:	Jim Forrester	(734) 663-1638
Key-holders:	Jim Forrester	(734) 663-1638
	Fred Schebor	(734) 426-2363
	Charlie Nielsen	(734) 747-6585
Webmaster	Krishna Rao	

Lowbrow's Home Page

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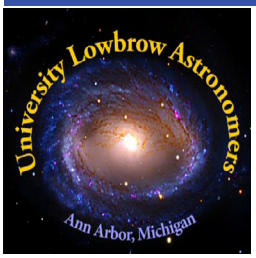
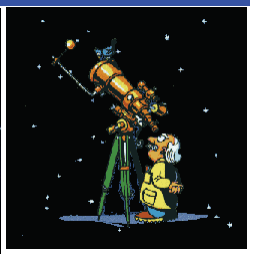
Reflections & Refractions





Website
www.umich.edu/~lowbrows/

THIS SPACE IS

EMPTY

But it doesn't have to be. You've all got astronomical tales to tell or photos to share, maybe both!

Your editor, though, is not seeing them and therefore the rest of the members aren't seeing them in their newsletter.

You can remedy this by sending your articles, drawings and photos (including the ubiquitous dog and scope snap shot) to:

jim_forrester@hotmail.com

University Lowbrow Astronomers
P.O. Box 131446
Ann Arbor, MI 48113

EXOWORLDS NAMING INFORMATION

This should be all the information needed to participate in the Name ExoWorlds Contest.

Date: Fri, 20 Mar 2015 20:55:59 +0900
From: IAU Directory of World Astronomy <info@directory.iau.org>
To: undisclosed-recipients:;
Subject: [IAU Directory] Updates about the Name ExoWorlds contest

Dear all,

Thanks for your registration at the IAU Directory of World Astronomy website again. This is an update about the Name-ExoWorlds contest organized by the IAU and the Zooiverse.

In case you don't know what is the Name ExoWorlds Contest, please refer to:

http://www.iau.org/news/pressreleases/detail/iau1404/

Thanks for all of your votes, I'm happy to inform you that the most popular 20 ExoWorlds are listed below, and there will be 15 stars plus 32 planets - total 47 names - to be named.

Please be reminded that you can select one and only one system for the
naming proposal, no matter it is single or multiple planetary system.

Example: If you want to name 55 Cancri system, you will be able to sumbit the names for the host star (55 Cancri) plus its planets (55 Cancri b, 55 Cancri c, 55 Cancri d, 55 Cancri e, 55 Cancri f), a total of 6 names. If you want to name 51 Pegasi system, then you can only submit 2 names - the host star and the exoplanet.

The Name ExoWorlds website is yet staging for this round of naming proposal submission. We will inform you once again it is opened. ***The deadline of submission is May 31, 2015.***

Thank you very much of your interest in the contest.

Best wishes,
Sze-leung Cheung
International Outreach Coordinator
International Astronomical Union

Host Star (catalogue)	# Planet (designation)	Planet Mass (Jupiter mass)	Planet Mass (Earth mass)	Orbital Period (day)	Semi Major Axis (au)	Discovery (year)	Constellation (English)	Visibility	V magnitude
1 exoplanet (5 systems)									
Ain (epsilon Tauri)	epsilon Tauri b	7.6	2415.5	594.9	1.93	2007	the Bull	Visible to the naked eye	3.5
Edasich (iota Draconis)	iota Draconis b	8.82	2803.3	510.7	1.275	2002	the Dragon	Visible to the naked eye	3.3
Errai (gamma Cephei)	gamma Cephei b	1.85	588	903.3	2.05	2003	the King	Visible to the naked eye	3.2
Fomalhaut (alpha Piscis Austrini)	Fomalhaut b	3	953.5	320000	115	2008	the Southern Fish	Visible to the naked eye	1.2
Pollux (beta Geminorum)	beta Geminorum b	2.9	921.7	589.64	1.69	2006	the Twins	Visible to the naked eye	1.2
1 star + 1 exoplanet (10 systems)									
14 Andromedae	14 Andromedae b	5.33	1694	185.84	0.83	2008	the Chained Maiden	Visible to the naked eye	5.2
18 Delphinis	18 Delphinis b	10.3	3273.6	993.3	2.6	2008	the Dolphin	Faint to the naked eye	5.5
42 Draconis	42 Draconis b	3.88	1233.2	479.1	1.19	2008	the Dragon	Visible to the naked eye	4.8
51 Pegasi	51 Pegasi b	0.47	148.7	4.23	0.052	1995	the Winged Horse	Visible to the naked eye	5.5
epsilon Eridani	epsilon Eridani b	1.55	492.6	2502	3.39	2000	the River	Visible to the naked eye	3.7
HD 104985	HD 104985 b	6.3	2002.3	198.2	0.78	2003	the Giraffe	Faint to the naked eye	5.8
HD 149026	HD 149026 b	0.36	113.1	2.88	0.04288	2005	the Hercules	Visible through binocular	8.2

HD 81688	HD 81688 b	2.7	858.1	184.02	0.81	2008	the Great Bear	Visible to the naked eye	5.4
ksi Aquilae	ksi Aquilae b	2.8	889.9	136.75	0.68	2008	the Eagle	Visible to the naked eye	4.7
tau Bootis	tau Bootis b	5.9	1875.2	3.31	0.046	1996	the Herdsman	Visible to the naked eye	4.5
1 star + 2 exoplanets (1 system)									
47 Ursae Majoris	47 Ursae Majoris b	2.53	804.1	1078	2.1	1996	the Great Bear	Visible to the naked eye	5.1
	47 Ursae Majoris c	0.54	171.6	2391	3.6	2001	the Great Bear	Visible to the naked eye	5.1
1 star + 3 exoplanets (2 systems)									
PSR 1257 12	PSR 1257 12 b	7.00E-05	0.022	25.26	0.19	1992	the Maiden		
	PSR 1257 12 c	0.01	4.1	66.54	0.36	1992	the Maiden		
	PSR 1257 12 d	0.01	3.8	98.21	0.46	1992	the Maiden		
upsilon Andromedae	upsilon Andromedae b	0.62	197.1	4.62	0.059	1996	the Chained Maiden	Visible to the naked eye	4.1
	upsilon Andromedae c	1.8	572.1	237.7	0.861	1999	the Chained Maiden	Visible to the naked eye	4.1
	upsilon Andromedae d	10.19	3238.7	1302.61	2.55	1999	the Chained Maiden	Visible to the naked eye	4.1
1 star + 4 exoplanets (1 system)									
mu Arae	mu Arae b	1.68	532.7	643.25	1.5	2000	the Altar	Visible to the naked eye	5.2
	mu Arae c	0.03	10.6	9.64	0.09094	2004	the Altar	Visible to the naked eye	5.2
	mu Arae d	0.52	165.9	310.55	0.921	2004	the Altar	Visible to the naked eye	5.2

	mu Arae e	1.81	576.5	4205.8	5.235	2006	the Altar	Visible to the naked eye	5.2
1 star + 5 exoplanets (1 system)									
	55 Cancri b	0.8	254.3	14.65	0.1134	1996	the Crab	Faint to the naked eye	6
	55 Cancri c	0.17	53.7	44.34	0.2403	2002	the Crab	Faint to the naked eye	6
	55 Cancri d	3.84	1218.9	5218	5.76	2002	the Crab	Faint to the naked eye	6
	55 Cancri e	0.03	8.3	0.74	0.0156	2004	the Crab	Faint to the naked eye	6
55 Cancri	55 Cancri f	0.14	45.8	260.7	0.781	2007	the Crab	Faint to the naked eye	6