REFLECTIONS AND REFRACTIONS

OF THE UNIVERSITY LOWBROW ASTRONOMERS

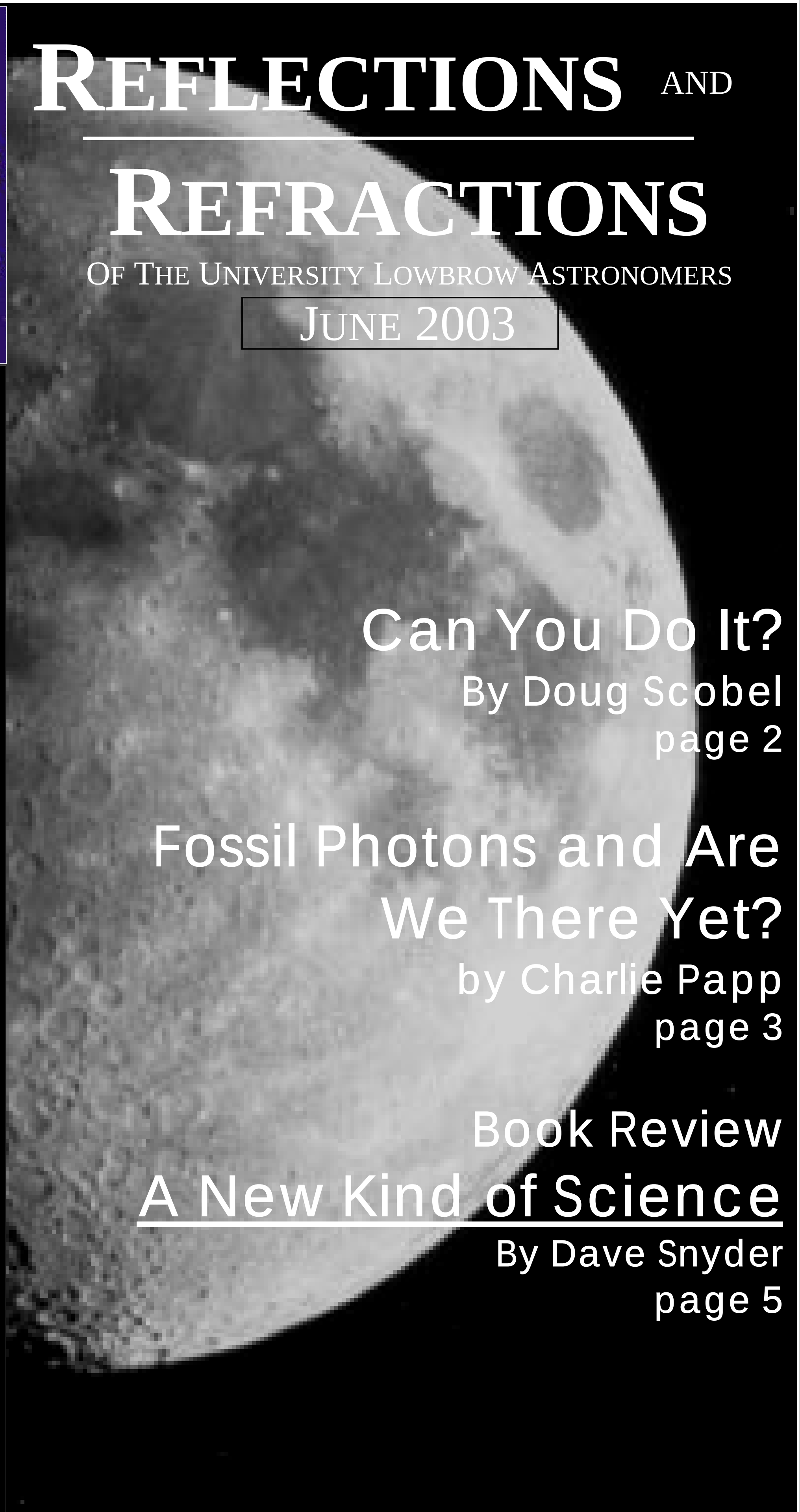
JUNE 2003

University Lowbrow Astronomers
Ann Arbor, Michigan

Upcoming Events

June 2003

- **Friday, June 20 Monthly Meeting (Starting at 7:30) held in either room 130 or 807 in the Dennison Building.**
- **Saturday, June 28 (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather Permitting.**
- **Saturday, July 5 (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather Permitting.**
- **Friday, July 18 (Starting at 7:30) Monthly meeting held in either room 130 or 807 in the Dennison Building.**
- **Saturday, July 26 (Starting at Sunset) Regular Scheduled Open House and Star Party at the Peach Mt. Observatory. Weather Permitting.**



Moon   Photo by Peter Alway

Can You Do It?
Make your own telescope mirror, that is?

by Doug Scobel

Make your own Newtonian telescope mirror that is? Most people think it is such a daunting task that they never even consider it. But is it really that difficult? When I started out in this hobby back in the late 60's (I'm showing my age here), most everyone made their own mirrors – commercial mirrors were simply too expensive. Nowadays, due to various reasons, the relative cost of commercially made mirrors is much less. So if your main reason for making your own mirror is to save money, then don't do it. You'll end up spending nearly as much money as what a finished mirror would cost, at least one in the smaller sizes. But if you enjoy building things yourself, there is nothing like the personal satisfaction you get when you finally get a good mirror, accurate across the entire surface to within a couple millionths of an inch, that you made yourself, literally with your bare hands. Plus, you will have learned a skill that few others have mastered.

But doesn't it require sophisticated tools and measuring devices? Well, yes, but they are easily made or obtained. The primary (pun intended) tool you need is patience and the ability not to get frustrated. Bad, or I should say unpredictable, things will happen, and you need to be able to objectively analyze what's going on to figure out what to do when things don't go according to plan. This is where the help of someone else or a group with mirror making experience is valuable. All the books and all the web sites simply can't cover it all - there are too many variables.

But doesn't the primary mirror have to be nearly perfect to be useful? Not really. There's perfect then there's perfect. Even a mirror that produces an error at the wavefront of, say, ½ wave will produce a decent image at low to medium power. And a ¼ wave mirror will provide as good an image as atmospheric seeing will normally allow. Besides, if you are working alone, then you have two chances of getting that nearly perfect mirror on your first try - slim and none, and slim just left! Seriously, there is too much to be learned with just one mirror, unless you are willing to have the project go on for years. My personal suggestion is that you try to make an OK first mirror, then go for a better one. It will take much less time than trying to get a "perfect" mirror on your first try. And don't start out with anything larger than an 8 inch – it is generally accepted that the difficulty grows roughly with the cube of the aperture. Stick to moderate focal ratios – say between f/6 and f/8. Faster focal ratios require a very precise figure, while with slower ratios the paraboloid is so close to a sphere that it is next to impossible to figure.

What about grinding the curve – isn't that difficult? Actually, rough grinding the curve is probably the easiest part of the job. Fine grinding without leaving larger pits behind is a little harder. Polishing it out completely is a little harder yet. Figuring is by far the most difficult part of the job, maybe by an order of magnitude. The difficulty here is twofold – mastering the testing methods to analyze the surface, and then mastering the techniques you need to manipulate it. This is where you need to keep a cool head, go slow, and not get frustrated. Once you stop thinking objectively, or over-analyze things, things can easily get out of hand. And by all means ask for help. There are a few Lowbrows that have made mirrors, and there are also on-line forums that are helpful .

I made my first mirror when I was 14, a 6" f/9 (it was supposed to be an f/8, but I had trouble getting the curve deep enough), by myself using Thompson's "Making Your Own Telescope". It probably came out no better than ½ wave - I don't know - I really didn't know how to test well yet. After using it for a while, I re-ground it to f/4.5. This ended up a little better, maybe 1/3 wave. Next I made an 8" f/8, which ended up about ¼ wave. Then I refigured my crappy 1 (yes one!) wave Coulter 13.1" f/4.5 to about ¼ wave. Now I'm finally refiguring my 8" f/8 to be as good as I can get it - I won't settle for less than 1/10 wave. My point is that most people need the experience of easier projects before going on to more difficult ones. There's as much (if not more) art as science when it comes to testing and figuring, which simply takes time to learn. But if you have modest expectations for your first try, then try again for that really good second mirror, your odds of success go way up.

So, can you do it yourself? Only you can answer that question. But if you put your mind to it, and keep at it, you just might surprise yourself.

Fossil photons and are we there yet?

by Charlie Papp

Observations in the heavens are not the only observations I take the time and make the effort to "see". I like to reflect upon our human condition, making the eternal observations and asking the eternal questions...where did we come from? How did we develop-why are we here? Where are we going? What is the "meaning" of it all? What is our place in the great scheme of things?

Well, to make attempts to try to answer this for myself, I thought that it would be best to look to the distant past, our past, to perhaps try to put everything into perspective. Best to have seen where we have been, to help try to see where we are going. A point of reference if you will.

And to me it seems that Astronomy has played an important role in our ancient past, from the earliest times, when forms of keeping records were pictographs, right up through to the current "information age".

Really, I guess I've been fascinated with history and archeology. In the course of these studies, one central "thread" has been present in these fields, that thread being astronomy, or perhaps to put it in the proper context, Archaeoastronomy.

This thought often crosses my mind, whenever I use all the modern equipment and technology within my grasp, and turn my gaze up towards the heavens.

Perhaps this ties all the threads together for me, and now that I give some thought to it, is perhaps why I have developed my present interest in observational astronomy. I freely confess that I am a "newbie" in this area. I feel much more comfortable handling a Clovis point, rather then doing anything around a finely polished mirror or intricate dual axis drive mount. That being said, I guess I am nonetheless a fairly "enthusiastic" newbie, due to the equipment roster that I have already amassed; a Televue Genesis (my first real 'scope) followed in quick succession by a 15" Obsession Dob and a Coronado SolarMaxscope 40. And assorted binoculars-the largest being an Oberwerk 20x80 And, of course, numerous and sundry associated tripods, mounts, diagonals and oculars, etc. And books, lots and lots of books!

One thing about the information age is that it is hard to deal with the information overload that sometimes occurs at times as a result. But then again, all our current information does help to make it easier for me to peer into the past. It all seems so ironic. How the hyperprogression that we are now experiencing draws so heavily from the vast amount of knowledge that we have accumulated to help us illuminate our way into the future.

And another irony is that even in "modern" astronomy, we are still using ancient light, the photons from galaxies, star clusters, and far flung solar systems that have perhaps expired or collapsed and long since extinguished, even before we have observed "first light" from them. "Fossil Photons".

All this begs the question about the space/time continuum, just the concept of "time" is but one of the questions we are still grappling with. And as such, it is a subject that is perhaps best left to a more in-depth tome, rather then the humble one that I have now.

I just wanted to briefly touch on some of the things I think about whenever I get outdoors to engage in some observational astronomy.

I also wonder about our arrogance, our shared arrogance that seems to take what we have, what we have accumulated and gained in knowledge and experience over the eons. And feel that it has all only happened in generation or two. To always feel that the current age, whether it be the agricultural age, the industrial age or the information age, to think that whatever age is "new" that we are "at the top" of the heap, seems so.. well...arrogant to me. If we could "transport" an infant child from 5,000 10,000 or even 15,000 years ago into our present age and raise this child in our modern environment. There is every reason to believe that the child would develop "normally" and become fully integrated in the "new age".

The more that I investigate ancient man, the more similarities I notice. It is my belief that even in going back to the earliest epoch of homo-sapiens that our intelligence, our capacity to learn and understand has been central to our development, and has been on a higher level then we realize, or are at least-ready to admit to. We are so busy slapping ourselves on the back that we often take for granted that our ancestors were every bit as "smart" as we are now. And depending on ones point of view, perhaps our ancestors were even "smarter" than we are now, in different aspects of their lives. For instance our ancestors relationship with the environment-with Nature...in all of nature's various forms.

Yeah, we are so smart, we have even created light pollution! We have in our infinite wisdom been able to more or less separate the long held sacred connection that we have enjoyed since ancient times, with the sky! Yes, we have been able to separate large areas of the planet from the night sky. How wonderful and advanced is that!?

The more knowledge and understanding we

gain, the more I realize how lacking it seems we tend to become. Kinda like "the more I learn shows me, that I need to learn more" Not that I have a desire to know everything mind, no one could ever hope to. It's just the same old, same old, search for understanding. Trying to find our "place" in the universe.

Are we there yet?

Will we ever find it?

I've resigned myself to the fact that it is not reaching the destination that matters most - it is all about the journey.

Which brings me back around to the reason why I felt the urge to explore observational astronomy, to allow my eyes to absorb the fossil photons and to let my mind drift back to the dimly lit epoch of human pre-history, to try to provide myself with illumination the same way-our ancestors did.

And realize that we are not "there" yet, and we probably never will be. Or perhaps realize that we have already arrived, eons ago, so long ago that we have forgotten the event.?

I mentioned before, in the litany of my equipment accumulation, about the new books that are also being added to my library. And one of the books that I am reading now is entitled <u>Hamlet's Mill</u> by Giorgio De Santillana & Hertha Von Dechend, First published in 1969. From the back cover; "Ever since the Greeks coined the language we commonly use for scientific description, mythology and science have developed separately. But what came before the Greeks? What if we could prove that all the myths have one common origin in a celestial cosmology? What if the Gods, the places they lived, and what they did are all but ciphers for celestial activity, a language for the perpetuation of complex astronomical data? Drawing on scientific data, historical and literary sources, the authors argue that our myths are the remains of a preliterate astronomy, an exacting science whose power and accuracy were suppressed and then forgotten by an emergent Greco-Roman world view. This fascinating book throws into doubt the self-congratulatory assumptions of Western science about the unfolding development and transmission of knowledge. This is a truly seminal and original thesis, a book that should be read by anyone interested in science, myth, and the interactions between the two."

So...

How many other Lowbrows, wonder about these things? Well at least now that I have brought this up, if any of you perchance meet me at Peach Mtn."up on the hill" or "down on the farm" at Clay's place (nice dark skies there by the way) or at any other locale, around these here parts or beyond, and you wonder upon meeting me what I might be thinking about? Well, all I can offer to say is, all of the above and more!

Past-Present-and Future. All simultaneously spinning around in my noggin. But I guess out of all these, the Past is what gives me the "warm fuzzies" The Present, allows me to see the "faint fuzzies" and the Future? Well...that remains just plain ole' "fuzzy" And truth be told...I wouldn't want it any other way.

A Review of A New Kind of Science

B O O K

A Review of "A New Kind of Science"

by Dave Snyder

Last summer I read the book *A New Kind of Science*, by Stephen Wolfram (Stephen Wolfram. 2002. *A New Kind of Science.* Champaign Il: Wolfram Media, Inc). It is a long book, if you exclude the preface and index there are 1197 pages. (However it isn't quite as bad as it seems, the main text is only 846 pages and there are many black and white diagrams).

In this article I will attempt to explain the basic ideas, but I can only give a rough overview of the book.

The book is primarily about models used in fields such as Biology, Physics and Astronomy and new way of producing models that Wolfram discovered. To understand the book, you need to understand what is a model is, and that is best done with examples. Scientific models first appeared centuries ago in the form of mechanical devices and mathematical equations used to predict the motion of the planets. Early models were not very accurate; but they improved over time. Astronomers now use models based on Isaac Newton's equations. Turning these equations into a prediction is not straightforward. Getting an exact solution is possible, but only under highly artificial conditions. For example, you can solve the equations if for a universe with exactly two objects. No one knows how to get an exact solution for any reasonable set of conditions.

An obvious question is: if this is so, how do we know that Mars will be in opposition in August 1993 or

About the University Lowbrow Astronomers

The University Lowbrow Astronomers is a club of Astronomy enthusiasts which meets on the third Friday of each month in the University of Michigan's Physics and Astronomy building (Dennison Hall, Room 130 or 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-Pinckney Road; further directions at the end of the newsletter) on Saturdays before and after the new Moon. The party may be canceled if it's cloudy or very cold at sunset. For further information call (734) 480-4514.

REVIEW

Venus will transit the sun in 1994? The answer resolves around the word ***exact***. While we can't get exact solutions, we can get approximate solutions (using so called perturbation methods), and these approximation solutions are very close. The difference is extremely small over short time frames (say a few years), but there is a slight error that gets larger over time. After a few billion years this error is very large; it is not possible to use this type of model to make predictions over such long time spans.

If we want to model an entire galaxy, typically we don't use perturbation methods. It is very difficult to follow the trajectory of each star in a large galaxy. Instead astronomers often use a statistical approach; they determine the average velocity of stars. There is a set of equations (the Jeans equations) that computes the average velocity if you know the average density. This relationship can be used in reverse to predict the mass within a galaxy.

When astronomers first used this approach to calculate the mass of galaxies, they obtained a mass that didn't agree with the mass obtained by counting stars. This leads to the "missing mass" problem. This missing mass has persisted even as astronomers have improved their techniques. Astronomers generally assume there is some mass that we can't detect (so called "dark matter") which accounts for this difference.

(A set of equations Albert Einstein developed give more accurate results particularly in large gravitational fields. These equations are much harder to use, which is why Newton's equations are normally used).

While models like these have been very successful, they are not perfect. Many scientific models require approximation techniques; statistical methods often are based on assumptions that may or may not be correct. Can we build models that don't use approximation or statistics? Yes we can. To understand how, we need to look at something called a cellular automata (abbreviated as CA).

What is a CA? Some of you may have heard of the "Game of Life," a computer program that produced interesting patterns. It was incorporated into computer programs beginning in the late 1970's. A few years later it found its way into screen savers. You can understand how it works by considering a chessboard. Begin by placing chess pieces in a random pattern. Then look at each square one by one. Count the number of pieces on the 8 squares adjacent to a particular square. If this count is zero, 1, 4, 5, 6, 7 or 8 call it "0". If this count is 2 and the central square is empty call it "0." Otherwise call it "1." Collect these zeros and ones for all 64 squares, produce a new pattern, repeat the process. This is tedious if you try it by hand, but it is easy to program a computer to do it.

Wolfram wasn't that interested in the Game of Life, but he looked at collection of 256 other CAs, which he named rule 0, rule 1 and so on up to rule 255. Rule 0 always forms a uniform sheet of black pixels. Rule 4 usually forms a series of black lines (the exact location of the lines will vary). Rule 22 usually produces complex patterns, but in certain cases it produces a highly symmetrical pattern (a fractal called the Sierpinski Gasket). Rule 30 always produces very complex patterns; these patterns include many triangles of varying sizes, but otherwise the output looks totally random. This randomness is quite unexpected.

Wolfram examined a number of other systems. While these other systems are not CAs by a strict definition, they were similar. Wolfram lumped CAs and these similar systems under the label "simple programs." Those of you who more mathematically included should realize that this term covers a range of possibilities, but excludes anything based on a differential equation or any other type of continuous equation.

Even after examining many simple programs over a period of many years, Wolfram found they all belong to one of four categories. Some like rule 0 produced a regular pattern. Some like 4 produced lines. Some like rule 22 produced fractals and some like rule 30 produce what appears to be randomness.

You might be thinking, what does this have to do with scientific models? These systems make patterns, but you can also think of them as performing a computation. They take a set of input (also called initial conditions), apply a set of rules and produce a set of output. If the output helps us understand a scientific phenomenon, it can be considered a model. Wolfram found simple programs that produced complex patterns, like rule 30, could be used to construct models.

Wolfram produced a number of models based on simple programs in various areas of Biology, Economics and Physics and other areas. Wolfram argues that conventional approaches do not handle complexity very well; that's when models based on simple programs offer an alternative. He claims that it is difficult to verify the results of the standard approach when applied to a complex phenomena. In such cases it can be difficult or impossible to prove that the results of the model actually agree with what the original equation suggests. However this is not an issue with models based on one of Wolfram's simple programs. (Wolfram devotes many pages to complexity, but a complete discussion is beyond the scope of this article).

So what's the verdict? Is the technique Wolfram proposes worthwhile?

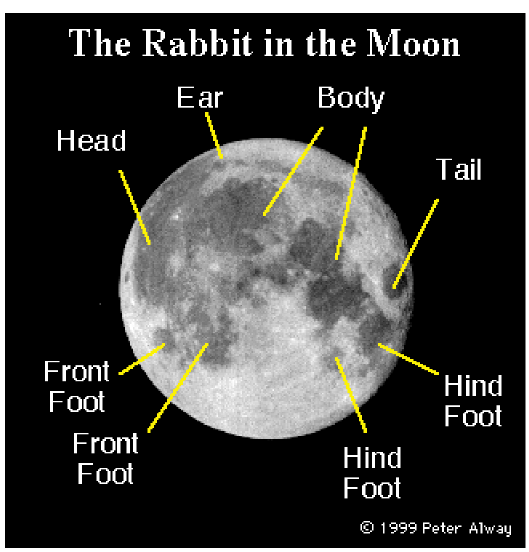
Wolfram described a wide range of phenomena including fluid flow, the shape of mollusc shells and development of snowflakes using simple programs. Most of the models seemed reasonable. His attempt to apply network systems (a type of simple program) to quantum mechanics was less convincing. (Wolfram admitted as much in an interview he gave to ABC News reporter Robert Krulwich).

To really answer the question we must evaluate some CA models. How do you evaluate a model? You need to ask several questions. 1) Does it make predictions that agree with reality? 2) Does it predict previously unknown phenomena? 3) Is it easier to use than competing models?

We don't have enough models to answer these questions. Wolfram supplied a number of models, but if the technique is useful, more will appear. I suspect this will happen. In five or ten years if a number of models based on Wolfram's simple programs have been produced, we will be a better position to judge how they work in general.

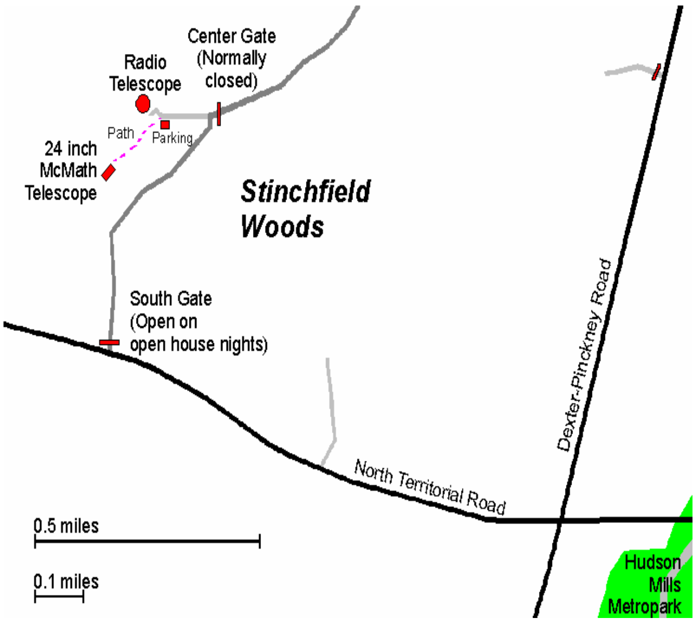
However I don't think CAs will ever completely displace more conventional approaches that have worked well in many areas. There is no reason to discard approaches that work.

In conclusion, Wolfram's book is full of worthy ideas. However they could have been expressed in much shorter book. The main text is easy to read even if you have a limited scientific background, but it gets a little tedious at times. Some of the notes assume specialized knowledge, however it is not necessary to read the notes. Only time will tell whether Wolfram's ideas will become part of mainstream science.



Places and Times

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 130. Monthly meetings of the Lowbrows are held on the 3rd Friday of each month at 7:30 PM. During the summer months, and when weather permits, a club observing session at Peach Mountain will follow 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 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 Dexter-Pinckney 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.

Public Star Parties

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 mosquitoes - bring insect repellent, and it does get cold at night so dress warmly !

Amateur Telescope Making Group meets monthly, with the location rotating among member's houses. See the calendar on the front cover page for the time and location of next meeting.

Membership

Membership dues in the University Lowbrow Astronomers are $20 per year for individuals or families, and $12 per year for students and seniors (age 55/+). 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 Charlie Nielsen at the monthly meeting or by mail at this address:

6655 Jackson Road #415
Ann Arbor, MI 48103

Magazines

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

Sky and Telescope: $29.95 / year
Astronomy: $29.00 / 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. Make the check payable to "University Lowbrow Astronomers".

Newsletter Contributions

Members and (non-members) are encouraged to write about any astronomy related topic of interest. Call or Email to Newsletter Editor at: John Ryan (734) 662-4188 john_edward_ryan@hotmail.com to discuss length and format. Announcements and articles are due by the first Friday of each month.

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Lowbrow's Home Page

This is a multiple exposure of the partial lunar eclipse of March 23, 1997. Taken by Doug Scobel on Kodak Ektachrome ISO 400 film with a Nikon N8008s mounted on a tripod, with a 300 mm lens at f/5.6 No motor drive was used.

Photo by Doug Scobel

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Lowbrow's WWW Home Page:
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Check your membership expiration date on the mailing label.