June 2010:
Science Fair Winners
Joe Morris

An ongoing activity of National Capital Astronomers is the judging of astronomy-related projects in area science fairs, and our June meetings are traditionally the time when we invite the winners to present their projects to the NCA membership.

This year the June pre-meeting dinner, to which the winners and their parents are invited, will be held at Three Brothers Pizza in Beltsville, MD. The address is 10961 Baltimore Avenue (aka Route 1), just south of Powder Mill Road. We've reserved the back room; everyone is welcome (no additional reservations are required) so please plan to arrive before about 5:30.

The winning students who accepted our invitation are:

David Zhang: "Automatic Feature Detection and Information Retrieval from the Large Scale Database Obtained by SOHO"

Shubham Chattopadhyay: "Is it Possible to Measure Skyglow with a Digital Camera?"

Ben Wing: "Supernova Project"

Megan Trippllett: "Asteroid Mining: Payload Launcher"

Amateur Telescope Making:
Fun with Chemistry (Part 2)
By Guy Brandenburg

In the May Star Dust Guy gave an overview of his options for stripping the gold coatings off of a batch of secondary mirrors he purchased.

My decisions

However, I decided that I was NOT going to do the following, because they sounded too caustic (i.e., dangerous).

(1) No concentrated or heated chemicals in any form. Room temperature all the way.
(2) No cyanide in any form.
(3) No melting off the gold.
(4) No alkalis. (I have seen the damage they can cause to mirrors.)
(5) No naval jelly.

Continued on Page 2
several of the telescopes will also be set up for viewing.

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Thank you!

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**Reminder**

After the meeting, everyone is invited to join us at Plato’s Diner in College Park. Plato’s is at 7150 Baltimore Ave. (US Rt. 1 at Calvert Rd.), just south of the university’s campus. What if it's clear and you want to stick around and observe? No problem -- just come over when you're through. This is very informal, and we fully expect people to wander in and out.

Continued from Page 1

And I decided that I would try the following methods on individual flats:

1. Acetone to see if the gold is over-coated with something
2. Ferric Chloride (yes, you CAN buy it at Radio Shack – but you need to call ahead to see if the store you want to go to actually has it in stock)
3. Hardware-store-strength hydrochloric acid (aka muriatic acid)
4. Green River (a mixture of the muriatic acid and blue copper II sulfate crystals, exact proportions not important) – it’s a mixture that I normally use to remove aluminum coating.
5. Liquid mercury, which was generously provided, in small quantities, by several local NCA and/or NOVAC members who were trying to get rid of it and finally had an excuse. [I will refrain from naming them, lest somebody give them a hard time.]
6. Some of these methods, followed by others.

So, I got some large plastic cups and put the various liquids into each one, and then I put a mirror into each one. Or vice-versa, I don’t recall.

**Results:**

1. I hadn’t realized that the acetone would dissolve the plastic cup and make a mess all over everything. But it did. That method not only caused havoc, but when put into a glass container, did nothing at all to the gold coating that I could tell. I concluded that there is no overcoating on top of the gold.
2. Ferric chloride etchant mostly worked, but rather slowly (hours). Flakes of gold came off in patches, and either floated to the surface or went to the bottom. The nickel never came off completely, but the small patches that were left were nearly transparent. The sides of the blanks did not lose their gold.
3. For some reason, I forgot to try straight muriatic acid.
4. Green River worked a little faster than the ferric chloride, but again, not completely. However, the gold that was on the sides of the blank did disappear.
5. The mirrors floated on TOP of the mercury, and had to be pushed down. The liquid mercury worked extremely slowly. After a couple of hours, it had produced a handful of silvery holes in the gold coating; the mercury seemed to be forming an amalgam with some of the nickel underneath. I couldn’t find any gold flakes. But the coating mostly seemed intact. [To my surprise, week or so later, after having taken the mirror out of the mercury and having put this mirror to one side, I went to show it to someone, and I discovered that there was no gold layer visible. My conclusion is that the remaining mercury had very slowly formed an amalgam with both the gold and the nickel. However, it was not possible to remove it with a gloved finger.]
6. Dipping the mirrors into mercury that had had most of the coating removed by FeCl or HCl + CuSo4 didn’t seem to make any noticeable difference. A mirror that was first put into mercury and was then put into Green River or ferric chloride worked about the same as just Green River or Ferric Chloride.

Continued on Page 3
Photo: Partly-stripped mirror being held above a plastic container of Green River by a piece of wood. Note the gold flaking off.

OK, so I was able to remove most of the coating with either Green River or FeCl. And if I had been willing to wait for some period of days with the mirrors immersed, they might have removed everything, but I was too impatient.

Bill Rohrer, an NCA ATMer and metalworker, volunteered to take the flakes of gold and mercury off my hands. (He collects almost anything interesting made out of metal.)

Now, I needed to figure out how flat the mirrors were.

I did have a method for testing that: some reference flats and a monochromatic light box which I built and which filters out everything except the green 546.1 nm mercury-vapor line from ordinary fluorescent or ‘black-light’ bulbs. One puts the transparent reference flat on top of the questioned flat, under the green light, and then looks for Newton’s fringes. If the fringes are perfectly straight, the mirror is as flat as the reference surface. If they are a little curved, then one can quantify how much it deviates.

Result? Perfectly flat as far as I could tell.

Unfortunately, this method does not work for mirrors that are already coated. Or at least, not for me.

I decided to try coating the 2 mirrors that had been stripped with Green River and etchant, and a single mirror that had never been touched by me. I did the normal washing job on the 2 stripped mirrors, and left the other one alone. Then I loaded them all into the vacuum chamber, brought the vacuum down to below 10^-4 Torr (mm of mercury), and melted and evaporated the small slug of aluminum, as usual.
Martha Hope Wills Warren, 67, loving wife of former NCA President, Wayne H. Warren Jr., and an NCA member herself since 1988, died on May 9, 2010 following a short battle with cancer.

Born February 16, 1943 in New Haven, Connecticut, Martha and Wayne met in 1966 when both were employed by Bell Telephone Laboratories in Murray Hill, New Jersey. Following graduate school at Indiana University, the couple moved to Maryland in 1975 when Wayne took a job at NASA’s Goddard Space Flight Center. Martha was employed as a Human Resources Specialist at the University System of Maryland for 25 years.

Martha developed an interest in astronomy through her association with NCA members and her participation for many years on occultation expeditions with Wayne, and David and Joan Dunham. She was a regular attendee at NCA meetings.

Martha is survived by her husband of 43 years, Wayne H. Warren Jr., her son Kenneth of Baltimore, daughters Sandra of St. Augustine, Florida and Katherine of Greenbelt, three grandchildren, and six nieces.

A memorial service was held on Saturday, May 22, from 1:00 to 4:00 p.m., at the offices of the University System of Maryland, where Martha had been employed since 1984 December.

Donations in Martha’s name may be made to the

Lung Cancer Research Foundation, 845 Third Avenue, New York NY 10022: (https://www.lungcancerresearchfoundation.org/donate.htm)

and/or to Capital Hospice, Philanthropy Office, 2900 Telestar Court, Falls Church VA 22042: (http://www.capitalhospice.org/support/donation/).
Occultation Notes

D following the time denotes a disappearance, while R indicates that the event is a reappearance.

When a power (x; actually, zoom factor) is given in the notes, the event can probably be recorded directly with a camcorder of that power with no telescope needed.

The times are for Greenbelt, MD, and will be good to within +/-1 min. for other locations in the Washington-Baltimore metropolitan areas unless the cusp angle (CA) is less than 30 deg., in which case, it might be as much as 5 minutes different for other locations across the region.

Some stars in Flamsteed's catalog are in the wrong constellation, according to the official IAU constellation boundaries that were established well after Flamsteed's catalog was published. In these cases, Flamsteed's constellation is given in parentheses and the actual constellation is given in the notes following a /.

Mid-Atlantic Occultations and Expeditions

Dr. David Dunham

Asteroidal Occultations

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>EDT</th>
<th>Star</th>
<th>Mag.</th>
<th>Asteroid</th>
<th>dmag</th>
<th>s &quot;</th>
<th>dur. Ap.</th>
<th>Location</th>
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<tbody>
<tr>
<td>Jun 10</td>
<td>Thu</td>
<td>1:20</td>
<td>2UC29470232</td>
<td>13.1</td>
<td>Aguntina</td>
<td>9</td>
<td></td>
<td>9 DE, MD, WA, WV, DC?</td>
<td></td>
</tr>
<tr>
<td>Jun 10</td>
<td>Thu</td>
<td>23:50</td>
<td>2UC37917435</td>
<td>11.1C</td>
<td>Artemis</td>
<td>8</td>
<td></td>
<td>9 NJ, MD, NC, nVA, sPA</td>
<td></td>
</tr>
<tr>
<td>Jun 24</td>
<td>Thu</td>
<td>23:39</td>
<td>2UC31245613</td>
<td>12.8</td>
<td>Anaeas</td>
<td>2.4</td>
<td>12</td>
<td>9 NJ, MD, FO, OH? n/VA?</td>
<td></td>
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<tr>
<td>Jun 30</td>
<td>Wed</td>
<td>0:10</td>
<td>TYC03050665</td>
<td>12.6</td>
<td>Bredichina</td>
<td>1.4</td>
<td>6</td>
<td>9 WA, WV, VA, NC, MD</td>
<td></td>
</tr>
<tr>
<td>Jul 3</td>
<td>Sat</td>
<td>3:19</td>
<td>2UC32395626</td>
<td>11.8</td>
<td>Bianca</td>
<td>0.8</td>
<td>7</td>
<td>7 LI, NJ, sPA, MD, WV</td>
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<tr>
<td>Jul 6</td>
<td>Thu</td>
<td>17:59</td>
<td>Yed Prior</td>
<td>2.7</td>
<td>Roma</td>
<td>10.8</td>
<td>6</td>
<td>1 NY, BE, wFR, WI, sFR</td>
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</tr>
<tr>
<td>Jul 10</td>
<td>Sat</td>
<td>2:46</td>
<td>2UC22014220</td>
<td>12.6</td>
<td>Irma</td>
<td>1.0</td>
<td>6</td>
<td>9 MA, CT, NJ, MD, nVA</td>
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<tr>
<td>Jul 18</td>
<td>Sun</td>
<td>21:51</td>
<td>2UC22032118</td>
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<td>Ixion</td>
<td>8.0</td>
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<td>2UC19774482</td>
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<td>9 MA, NJ, MD, VA, DC</td>
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<td>Jul 24</td>
<td>Sat</td>
<td>4:28</td>
<td>2UC41492644</td>
<td>12.5</td>
<td>Pretoria</td>
<td>2.2</td>
<td>6</td>
<td>9 WA, VA, sMD, NJ, CC</td>
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<tr>
<td>Jul 25</td>
<td>Sun</td>
<td>24:59</td>
<td>TYC24160555</td>
<td>10.2</td>
<td>Irmingrund</td>
<td>4.9</td>
<td>2</td>
<td>5 MA, sPA, MD, DC, VA</td>
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<tr>
<td>Jul 27</td>
<td>Tue</td>
<td>2:20</td>
<td>2UC31395704</td>
<td>12.9</td>
<td>Rocksefella</td>
<td>2.0</td>
<td>4</td>
<td>9 sMD, VA, TN, DC</td>
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<tr>
<td>Aug 4</td>
<td>Thu</td>
<td>4:18</td>
<td>TYC75120596</td>
<td>11.5</td>
<td>Nanette</td>
<td>4.4</td>
<td>2</td>
<td>8 PA, MD, VA, NC, SC</td>
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<tr>
<td>Aug 19</td>
<td>Thu</td>
<td>23:43</td>
<td>TYC6320335</td>
<td>11.1</td>
<td>Unorama</td>
<td>0.3</td>
<td>6</td>
<td>7 App. Mtns to Coast</td>
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<tr>
<td>Sep 21</td>
<td>Sat</td>
<td>5:52</td>
<td>SAO94100</td>
<td>8.5</td>
<td>Psyche</td>
<td>2.7</td>
<td>10</td>
<td>3 TX, TN, NC, sMD</td>
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</tr>
<tr>
<td>Sep 3</td>
<td>Fri</td>
<td>5:10</td>
<td>SAO96927</td>
<td>9.3</td>
<td>Gussia</td>
<td>6.4</td>
<td>2</td>
<td>4 WV, wMD, sPA, NJ</td>
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<tr>
<td>Sep 7</td>
<td>Sat</td>
<td>5:58</td>
<td>TYC45021119</td>
<td>11.9</td>
<td>Semiramis</td>
<td>1.3</td>
<td>4</td>
<td>7 wVA, MD, NC, NJ</td>
<td></td>
</tr>
<tr>
<td>Sep 11</td>
<td>Sat</td>
<td>1:54</td>
<td>2UC3061589</td>
<td>11.4</td>
<td>Diana</td>
<td>1.7</td>
<td>7</td>
<td>7 TN, eKY, eOH, wPA</td>
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</tr>
</tbody>
</table>

Lunar Grazing Occultations (*), Dunham plans no expedition

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>EDT</th>
<th>Star</th>
<th>Mag.</th>
<th>Star</th>
<th>% alt CA</th>
<th>Location</th>
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</thead>
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<td>2UC43061589</td>
<td>11.4</td>
<td>Diana</td>
<td>1.7</td>
<td>7 TN, eKY, eOH, wPA</td>
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Total Lunar Occultations

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<th>Day</th>
<th>EDT</th>
<th>Ph</th>
<th>Star</th>
<th>Mag.</th>
<th>% alt CA</th>
<th>Sp.</th>
<th>Notes</th>
<th>Location</th>
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<td>Jun 16</td>
<td>Wed</td>
<td>23:11</td>
<td>EC1454</td>
<td>7.0</td>
<td>27+</td>
<td>7</td>
<td></td>
<td></td>
<td>4 Winfield, Eldersbrg &amp; Baltimore, MD</td>
</tr>
<tr>
<td>Sep 4</td>
<td>Sat</td>
<td>5:13</td>
<td>SAO79102</td>
<td>7.82-35</td>
<td>ON</td>
<td>Occoquan, VA, Clifton &amp; Marlton, MD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Explanations & more information are at http://iota.jhuapl.edu/exped.htm. Good luck with your observations.
Results here? They all looked pretty good. In fact, the one I hadn’t touched looked the best, since I think I left some paper towel residue on the others.

But once again, I had no idea how flat the mirrors were. And given my limitations with the light box, that method wouldn’t work. Bob Bolster suggested I use something called the Ritchey-Common test that is described in a book by Daniel Malacara, involving a spherical mirror and bouncing a beam off the diagonals at 45 degrees. I wasn’t sure I could do that test, so I asked around to see if somebody had an interferometer that they wouldn’t mind using. A correspondent from Alaska, Stanley Truitt, who works at Mauna Kea, volunteered to do so. So I sent the mirrors off by mail for him to test.

There was a saga of waiting for a new red laser to arrive from the mainland, and with somebody upgrading the fringe analysis software whilst the laser was unavailable. And since he had not been trained in using the new software, the fringe pattern images are not available, or even saved. The wavelength used and referenced is 633 nm. The surface errors, normal incidence, are stated below:

<table>
<thead>
<tr>
<th>Mirror</th>
<th>Process</th>
<th>Peak-to-Valley Wavelength deviation (633 nm)</th>
<th>Root Mean Square</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Overcoated gold, not stripped</td>
<td>0.246</td>
<td>0.044</td>
<td>-0.149</td>
</tr>
<tr>
<td>B</td>
<td>Stripped, mostly, with Green River</td>
<td>0.165</td>
<td>0.025</td>
<td>-0.012</td>
</tr>
<tr>
<td>C</td>
<td>Stripped, mostly, with Ferric Chloride</td>
<td>0.208</td>
<td>0.043</td>
<td>-0.084</td>
</tr>
</tbody>
</table>

**Bottom line?**

Recall that 0.246 is just about ¼ wave, 0.165 is just about 1/6 wave, and 0.208 is about 1/5 wave.

If you are satisfied with ¼ wave p-v error on a diagonal mirror, then putting an aluminum coating right over the gold will produce acceptable results. If you prefer 1/5 or 1/6 wave, then you should strip off the old gold coating with ferric chloride or Green River, and be prepared to wait several days for all of the coating to come off. And then you have to wash the blanks, etc, etc.

In all, a very interesting experiment in applied chemistry, physics, and optics.

P.S.: Let me know if you are interested in one of the diagonal flats for your own home-built telescope. The ones that I strip first will cost a bit more, but all will go for much less than a comparable 1.5” minor-axis diagonal mirror from any commercial outfit.
Maps and Directions for Three Brothers Restaurant in Beltsville, MD

Three Brothers is located at 10961 Baltimore Avenue (Route 1), just south of its intersection with Powder Mill road (Route 201).

Calendar of Events

NCA Mirror- and Telescope-making Classes: Tuesdays June 1, 8, 15, 22, 29 and Fridays, June 4, 11, 18, 25, 6:30 to 9:30 pm at the Chevy Chase Community Center, at the northeast corner of the intersection of McKinley Street and Connecticut Avenue, N.W. Contact instructor Guy Brandenburg at 202-635-1860 or email him at gfbrandenburg@yahoo.com. In case there is snow, call 202-282-2204 to see if the CCCC is open.

Open house talks and observing at the University of Maryland Observatory in College Park on the 5th and 20th of every month at 8:00 pm (Nov-Apr) or 9:00 pm (May-Oct). There is telescope viewing afterward if the sky is clear.

Dinner: Saturday, June 12 at 5:30 pm, preceding the meeting, at the Three Brothers Italian Restaurant (301) 595-8888. See map and directions on left hand column of this page. Note that the dinner is in a different place than its usual location, but we will have the meeting at the Observatory as usual.

Upcoming NCA Meetings at the University of Maryland Observatory

Jun 12, 2010  Science Fair Winners

David Zhang: "Automatic Feature Detection and Information Retrieval from the Large Scale Database Obtained by SOHO"

Shubham Chattopadhyay: "Is it Possible to Measure Skyglow with a Digital Camera?"

Ben Wing: "Supernova Project"

Megan Tripplet: "Asteroid Mining: Payload Launcher"

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Paper copy of Star Dust $10
Sky & Telescope $33
Total $48

Individual/Family Membership $10
Paper copy of Star Dust $10
Sky & Telescope $33
Total $53

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Mr. Michael L. Brabanski, NCA Treasurer; 10610 Bucknell Drive, Silver Spring, MD 20902-4254
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Next NCA Mtg:
June 12
7:30 pm
@ UM Obs
Science Fair
Winners & Pizza!