Dr. John C. Pearl will present the talk “Into Saturn’s Realm: Results from the Cassini/Huygens Mission” at the May 7 meeting of the National Capital Astronomers.

Abstract of Talk
The Cassini spacecraft, together with the Huygens probe, first orbited Saturn on July 1, 2004. Important discoveries have followed. The composition of the magnetosphere includes relatively abundant H$_3$O$^+$ ions that arise principally from the icy satellites and rings. Phoebe, a heavily cratered satellite, has CO$_2$ and organics on its surface, as has Iapetus. Iapetus is now shown to be heavily cratered, and to possess a 20-km high mountain belt around much of its equator. Enceladus possesses an amazing variety of landforms that indicate numerous episodes of surface activity. Saturn’s main ring system shows ringlets and waves at the finest scales observed. Saturn’s equatorial winds appear to be

(Continued on page 2)

Review of talk by Dr. Michael J. Mumma:
“The Organic Origins Observatory”
by Dr. Walter L. Faust

Dr. Michael J. Mumma was one of the speakers at the April 2 meeting of the National Capital Astronomers at the University of Maryland Astronomy Observatory. He spoke on the topic: “The Organic Origins Observatory” The following is a review of his talk by Dr. Walter L. Faust.

Dr. Mumma began with a discussion of the molecular species with which Earth began its story as a cradle of life-forms, according to the origins of these species within the proto-solar disk. His account exhibited a remarkably detailed picture of this very complex history, and of ongoing research. He began by listing three current Astrobiology Initiatives under the NASA Discovery Program: the Organic Origins Observatory [principal topic today], The Mars Organic Observatory [minor], and The Analysis of Returned Samples [not today].

Earth accumulated a steady rain of icy planetesimals.

At ~20 My age, Earth experienced a giant impact with a Mars-sized object. The debris developed into Mars and the Moon. The Moon formed largely of silica, with some iron. Earth acquired an iron core. For ~ 400 My thereafter, Earth accumulated a steady rain of icy planetesimals, perhaps also with prebiotic organics from cometary nuclei. The concern being with the specific origins of the latter, we inquire how to learn more. The key lies in the D/H isotopic ratio in comets, vs. Earth’s water. Dr. Mumma introduced the factors involved here with a slide depicting the proto-Sun, its accretion disk, materials in-migrating from the interstellar medium, and cosmic rays. Studying these factors involves ion-molecule chemistry, photochemistry, thermochemistry, and mixing.

(Continued on page 3)

Review of talk by Mr. Ian Jordan:
“UMBRAS: The External Occultation Technique for Observing Exoplanets”
by Dr. Walter L. Faust

This review will appear in the June Star Dust.
NCA Events This Month
The Public is Welcome!

NCA Home Page: http://capitalastronomers.org

NCA Mirror- and Telescope-making Classes: Fridays, May 6, 13, 20, and 27 6:30 to 9:30 P.M. 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.

Observing with NCA’s 14-inch telescope: Sunday, May 8, and Saturdays, May 21 and 28 Mike McNeal’s backyard, 5410 Grove St, Chevy Chase, MD, (Friendship Heights Metro). Please make reservations by 10 p.m. the Friday before. See more information on this page. Call Mike at 301-907-9449 or e-mail him at mcnealmi@verizon.net to let him know you are coming.

Exploring the Sky: Saturday, May 14 with NCA’s 14-inch and other telescopes in Rock Creek Park, DC. See next page.

Open house talks and observing at the University of Maryland Observatory in College Park on the 5th and 20th of every month at 9 P.M. The talks are non-technical. There is telescope viewing afterward if the sky is clear.

NCA meeting: Saturday, May 7 at 7:30 P.M. at the University of Maryland Astronomical Observatory on Metzerott Road in College Park, MD. There is observing through the observatory’s telescopes at the end of the meeting if the sky is clear.

Dinner with NCA members and speaker: Saturday, May 7 at 5:30 P.M., preceding the meeting, at the Garden Restaurant in the University of Maryland University College Inn and Conference Center. See map and directions on Page 6.

If you are planning to come to the dinner before the meeting, please tell Benson J. Simon, telephone: 301-776-6721, e-mail st88@ioip.com, so that we can make reservations for the right number of people.

Upcoming NCA Meetings
2005: May 7, and June 4

May Speaker, continued

(Continued from page 1)

considerably slower than when observed by Voyager. A crown jewel of the mission to date is the successful descent of the Huygens probe onto Titan, revealing super-rotating winds, a nearly uniformly mixed haze, and a surface with a wide range of puzzling characteristics. And these results represent only the beginning of the four-year tour.

Bio

Research Area Experience: Free molecular flow in cavities; kinematics of electron impact excitation of atoms to metastable states; co-investigator on Mariner 9 (Mars orbiter) infrared spectroscopy experiment; planetary atmospheric pressure determination from infrared spectra; co-investigator on Voyager (outer planet flyby mission) infrared spectroscopy experiment; thermal infrared studies of outer planets’ satellites; co-investigator on Mars Global Surveyor (orbiter) thermal emission spectroscopy experiment; co-investigator on Cassini (Saturn orbiter) infrared spectroscopy experiment.

Education:
1961 - B.S.E., University of Michigan
1963 - M.S., University of Michigan
1970 - Ph.D., Physics, Univ. of Michigan

Project Working Groups:
Voyager Satellites WG
Cassini Satellite Surfaces WG
Cassini Satellite Orbiter Science Team (SOST)

Cassini Atmospheres Target Working Team
Cassini Cross-Discipline Target Working Team
Cassini Rings Target Working Team
Cassini Magnetosphere Target Working Team

Publications

Do You Want to Get Star Dust Electronically?

Any member wishing to receive Star Dust, the newsletter of the National Capital Astronomers, via e-mail as a PDF file attachment, instead of hardcopy via U.S. Mail, should contact Nancy Grace Roman, the NCA Secretary, at nancy.roman6@verizon.net or 301-656-6092 (home).
Exploring the Sky
by Joe Morris

2005 Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/14</td>
<td>9:00 P.M.</td>
<td>Moon and Saturn near Gemini; Beehive cluster</td>
</tr>
<tr>
<td>6/11</td>
<td>9:00 P.M.</td>
<td>The Big Dipper and the Summer Triangle</td>
</tr>
<tr>
<td>7/16</td>
<td>9:00 P.M.</td>
<td>10-day-old Moon; Jupiter in the western sky</td>
</tr>
<tr>
<td>8/27</td>
<td>8:30 P.M.</td>
<td>Pegasus and Andromeda rising; Hercules</td>
</tr>
<tr>
<td>9/24</td>
<td>8:00 P.M.</td>
<td>Rock Creek Park Day; Andromeda Galaxy</td>
</tr>
<tr>
<td>10/8</td>
<td>7:30 P.M.</td>
<td>Draconid meteor shower peak 10/8</td>
</tr>
<tr>
<td>11/5</td>
<td>7:00 P.M.</td>
<td>Pleiades; possible Taurids meteor shower</td>
</tr>
</tbody>
</table>

Sessions are held in Rock Creek Park once each month on a Saturday night from April through November, starting shortly after sunset. We meet in the field just south of the intersection of Military and Glover Roads NW, near the Nature Center. A parking lot is located immediately next to the field.

Beginners (including children) and experienced stargazers are all welcome—and it’s free!

Questions? Call the Nature Center at (202) 895-6070 or check the Internet sites: http://www.nps.gov/rocr/planetarium http://www.capitalastronomers.org

A presentation of the National Park Service and National Capital Astronomers.

Exploring the Sky is an informal program that for nearly fifty years has offered monthly opportunities for anyone in the Washington area to see the stars and planets through telescopes from a location within the District of Columbia.

We are pleased to announce the winners in the 2005 science fair judging. They are:

**Fairfax County Regional Science and Engineering Fair**

Hillary A. Dennison, *The Effect of Filters on the Clarity of Saturn*

**Prince George’s Regional Science Fair**

Phillip M. Hannam, *X-ray interference at 8.35 Å*

*Patrick M. Hanns, Nature of the Peaks in the Lunar Crater Copernicus*

*Katarzyna A. Oldak, Laplacian Orbit Determination*

**Montgomery Area Science Fair**

Abby Fraeman, *Modeling the distribution of extra solar comets around the star IRC+10216*

Renee Park, *Effects of Atmospheric Turbulence on Simulated Starlight in a Low-Pressure Telescope Environment*

**Review of talk by Dr. Michael J. Mumma, continued**

(Continued from page 1)

[Reviewer: Ion-molecule reactions start with collisions between radicals and molecules. Because of attractive polarization forces, these are characterized by: very large cross sections, high yields, and skeletal scrambling. The cross sections emerge from an orbital calculation for a 1/r^3 attractive center.]. Our probes include UV, optical, and x-ray spectroscopy.

From Dr. Mumma’s humorously anthropocentric perspective, the significance of stars lies in the creation of heavy nuclei and as potential suns furnishing gravity for planetary systems, and supplying them heat and light.

Two families of comets are recognized, as distinguished by origin: those from the Oort Cloud, and those associated with Jupiter (earlier thought to come from the Kuiper Belt). Using images of IP/Halley, 19P/Borrelly, and 81P/Wild-2, he illustrated that their gross appearance does not correlate with origin, but with age and attendant loss of overburden.

Emphasizing that impacts were quite frequent early-on, Dr. Mumma described:

- Efforts to construct a taxonomy of chemical processes based on interstellar heritage, dependence upon the radial distance from the Sun, and especially the chemical gradients in the protoplanetary disk. The chemistry was diverse. In environments exceeding their sublimation temperatures, ices vanished (those of H2O, CH4, CO …). Hence, those found are primordial, the temperatures never having been high.
- Characterization of organic volatiles and water in dozens of comets, hundreds of circumstellar disks, dozens of exoplanets, and other solar system planets. The prior picture of simple accumulation from micron-sized icy granules has been replaced as follows: Most of the cometary flux at early Earth was due to gravitational

(Continued on page 5)
## Mid-Atlantic Occultations and Expeditions

*by David Dunham*

### Asteroidal Occultations

<table>
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<tr>
<th>Date</th>
<th>Day</th>
<th>EDT</th>
<th>Star</th>
<th>Mag</th>
<th>Asteroid</th>
<th>dmag</th>
<th>s in.</th>
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<td>22:25</td>
<td>TYC18820135</td>
<td>11.4</td>
<td>(106) Dione</td>
<td>2.2</td>
<td>4 7 SOH, SW, VA</td>
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</tr>
<tr>
<td>May 14</td>
<td>Sat</td>
<td>2:13</td>
<td>PPM 292574</td>
<td>9.9</td>
<td>Honda</td>
<td>5.5</td>
<td>2 6 Carolinas?</td>
<td></td>
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<td>Mon</td>
<td>3:28</td>
<td>TYC57150773</td>
<td>10.8</td>
<td>4835 1989BQ</td>
<td>7.3</td>
<td>4 6 MD; NY? NC?</td>
<td></td>
</tr>
<tr>
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<td>Wed</td>
<td>3:47</td>
<td>2UC22321398</td>
<td>11.7</td>
<td>Garumna</td>
<td>3.5</td>
<td>5 8 NC; SW?</td>
<td></td>
</tr>
<tr>
<td>May 20</td>
<td>Fri</td>
<td>21:26</td>
<td>TYC13920962</td>
<td>9.7</td>
<td>Kassandra</td>
<td>3.6</td>
<td>3 4 ePenn, NJ, NYC</td>
<td></td>
</tr>
<tr>
<td>Jun 3</td>
<td>Fri</td>
<td>22:56</td>
<td>TYC14001181</td>
<td>10.4</td>
<td>Sulamitis</td>
<td>4.8</td>
<td>2 5 OH, SW, WA, ENC</td>
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</tr>
<tr>
<td>Jun 5</td>
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<td>3:39</td>
<td>TYC50180409</td>
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<td>Ornamenta</td>
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<td>8 8 nNewEngland, NY</td>
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### Grazing Occultations

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<td>SAO 78191</td>
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<td>12N</td>
<td>Hagrsntn, M. Ashtn, Laurel, MD</td>
</tr>
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<td>Wed</td>
<td>23:07</td>
<td>X08777</td>
<td>9.9</td>
<td>13+</td>
<td>6 12N</td>
<td>Opal, Stafford, &amp; King George, VA</td>
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<tr>
<td>May 12</td>
<td>Thu</td>
<td>22:46</td>
<td>ZC 1093</td>
<td>6.6</td>
<td>20+</td>
<td>12N</td>
<td>Sheri1 &amp; Kingston, NY &amp; NJ, CT</td>
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<td>Tue</td>
<td>0:47</td>
<td>SAO 99175</td>
<td>8.8</td>
<td>57+</td>
<td>20N</td>
<td>NwFreedom, PA; Fallston &amp; Joppa, MD</td>
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### Total Lunar Occultations

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<td>Wed</td>
<td>22:30</td>
<td>D SAO 78191</td>
<td>7.7</td>
<td>13+</td>
<td>45</td>
<td>17N A0 Graze, n.DC suburbs</td>
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<tr>
<td>May 12</td>
<td>Thu</td>
<td>22:16</td>
<td>D 47 Gem</td>
<td>5.8</td>
<td>20+</td>
<td>24</td>
<td>7S A4 ZC 1088</td>
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<td>May 12</td>
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<td>20+</td>
<td>21</td>
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<td>D ZC 1105</td>
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<td>21+</td>
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<td>D ZC 1211</td>
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<td>28+</td>
<td>46</td>
<td>-3S A1 D dark Baltimore &amp; n.e.</td>
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<tr>
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<td>38+</td>
<td>32</td>
<td>50S A close equal dbl, sep &quot;.1&quot;</td>
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<td>23:18</td>
<td>D ZC 1334</td>
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<td>38</td>
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<td>D Antares</td>
<td>1.1</td>
<td>100-</td>
<td>14</td>
<td>24N M1 Az. 219; ZC 2366</td>
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<td>May 24</td>
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<td>R Antares</td>
<td>1.1</td>
<td>99-</td>
<td>5</td>
<td>82S M1 Az. 230; term. 9&quot; away</td>
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<td>R 43 Oph</td>
<td>5.3</td>
<td>97-</td>
<td>10</td>
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<td>Jun 4</td>
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<td>R ZC 407</td>
<td>7.2</td>
<td>6-</td>
<td>2</td>
<td>44S K0 Azimuth 69 deg.</td>
</tr>
</tbody>
</table>

David Dunham, e-mail dunham@starpower.net, more info. http://iota.jhuapl.edu
Phone home 301-474-4722; office 240-228-5609; car 301-526-5590
Review of talk by Dr. Michael J. Mumma, continued

(Continued from page 3)

deflection by Jupiter and Saturn from nearby material, which indeed began with 95% of the mass of the Solar system. This cometary material has largely been exhausted, ejected by Jupiter and Saturn into interstellar space. Some objects formed the Oort cloud. The Kuiper Belt comprises others, evidently of the same composition, further pushed out by Neptune. Hence the Oort Cloud is a repository of material we wish to study.

To sort out these issues, Dr. Mumma asserted the need for new observatories: to measure the DHO/H₂O ratio and compare it with Earth’s ocean; to separate several dozen organic species; and to distinguish native vs. distributed sources of volatiles. High angular resolution is needed, of 0.6 arc-sec pixels, a 10 arc-sec slit on the sky.

We need to measure chemical heterogeneities within the cometary nuclei; and to track changes over minutes, hours, and days, so as to discern distinct emissions from different vents, etc. on rotating objects. High spectral resolving power is requisite, and no presently orbiting system meets the requirements. Nothing aloft has such resolving power.

Dr. Mumma displayed two dozen catalogued chemical species. He stated that such a system can also be used upon the atmospheres of planets around other stars, studying the chemical gradients. He showed some very recent results and pointed out that such instruments could also be employed to study Mars, studying methane, ethane, formaldehyde, etc.

**Organic Origins Observatory**

Representative performance was given for the following parameters.

- Spectral range and resolution: The prime wavelength range is 2.5 to 5.0 μm. Resolving power ~ 30,000. The spectrometer design would employ a Cross-Dispersed Echelle, 1 to 5 μm range; HgCdTe detector, 2k x 2k pixels; 10" slit, \( \lambda/\Delta\lambda = 85,000 \).
- Cooling, expendables, power consumption: There will be no Dewars, no stored cryogen, but passively cooled optics and detector; instrument optics < 50 K, detector focal plane 38 K. 511 watts power.
- Mission life: 3 y required, 6 y generally, up to 20 y. Orientation is by momentum wheels. The sole expendable will be 30 kg of reaction gas, to dump angular momentum occasionally.
- Target Access: Maximum pointing flexibility, with all the sky available except within 60° of the Sun line. Operational avoidance of Earth is necessary.
- Moving target capability: Slit-viewing guide camera, dynamic pointing control loop, 1 arc sec/ sec rate.
- Data storage and delivery: Collection rate up to 220 Gbit/day. Downlink rate to 78 Mbit/sec. Store 556 Gbit, downlink and ground system to match the instrument.
- Observatory: Cassegrainian with a pri-

Dr. Mumma gave us the following additional information about the planned Mars Organic Observer:

- Science Objectives: Map organic source/sink regions. Establish sources of methane, water, and related species. Achieve 15 km resolution on surface; ultimately desire tens of meters (only 300 km is available from Earth). For methane, seek detection of 1 ppb (at 3 σ) in one hr, locally. Evaluate sinks, heterogeneous chemistry; hope for use of lander, ultimately.
- Test factors affecting methane origins and release: Dependence upon surface temperature (season, time of day). Study isotopic species. Study chemical sequences (CH₄, CH₃OH, H₂CO…) and homologous series (CH₄, C₂H₄H₂, …).
- Mission Duration: 3 Earth-years required, 6 year goal; two full Mars years goal. Provide long dwell-time over specific sites.
- Observatory: 30 cm telescope, < 50 K optics, 35 K focal plane/detector. Mass TBD. Watts consumption TBD. Echelle grating spectrometer, resolving power > 24,000. No moving parts. Target pre-set spectral regions for methane, etc. Slit-viewing camera. Data collection rate TBD. Downlink rate TBD (optical communications?).
- Orbit: L1 Lissajous, oriented back to the Sun and facing Mars; 10⁴ km inside Mars’ solar orbit, far enough not to be thermally loaded by Mars itself. Launch vehicle TBD.
- Cost of mission TBD; expect preliminary design completion within a few weeks.

Dr. Mumma stated that this observatory will “revolutionize the infrared science of planetary systems.” He noted that many more infrared scientists have been attracted to seek involvement than can actually be accommodated.


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**One science objective is to map organic source/sink regions.**

Dr. Mumma showed drawings of the complete observatory. The optics reside within a cylindrical sun shade, while the spectrometer lies within a hexagonal wafer at one end.

**Mars Organic Observer**

The essential questions are whether Mars is “alive,” biologically and geochemically. Hubble found areas with atmospheric methane and water. A rather intense methane source was observed near the equator. Water vapor was absent at the poles, frozen out.
Getting to the NCA Monthly Meeting and the Dinner
Before the Meeting

Jeff Guerber

NCA meetings are now held at 7:30 p.m. at the University of Maryland Observatory, in College Park on Metzerott Rd. between University Blvd. (MD-193) and Adelphi Rd. To get there from the Capital Beltway (I-495), either take US Rt. 1 south about a mile, turning right onto MD-193 West, then at the first light turn right onto Metzerott; or, take New Hampshire Ave. (MD-650) south, turn left at the second light onto Adelphi Rd., two more lights, turn left onto Metzerott, and proceed about a mile to the observatory. The observatory is on the south side of Metzerott Rd., directly opposite the UM System Administration building; you can park there if the observatory lot is full, but be careful crossing Metzerott Rd.

At 5:30 p.m., before the meeting, please join us for dinner at the Garden Restaurant in the UMD University College Inn and Conference Center, 3501 University Blvd. East at Adelphi Rd. From the Beltway, either take New Hampshire Ave. south, turn left onto Adelphi, and at the third light (passing Metzerott) turn left onto University then immediately right into the garage; or, take US-1 south, turn right onto University Blvd. west, and take it to the intersection with Adelphi Rd. Park either in the garage (costs), or in Lot 1 nearby (free). To get to the Observatory, exit to the right onto University Blvd. (MD-193) east, and at the second light turn left onto Metzerott Rd.

Observing after the Meeting

Elizabeth Warner

Following the meeting, members and guests are welcome to tour through the Observatory. Weather permitting, several of the telescopes will also be set up for viewing.

Are You Coming to Dinner?

If you are planning to come to the dinner before the meeting, please tell Benson J. Simon, telephone: 301-776-6721, e-mail st88@ioip.com, so that we can make reservations for the right number of people.

Do You Need a Ride?

Please contact Jay Miller, 240-401-8693, if you need a ride from the metro to dinner or to the meeting at the observatory. (Please try to let him know in advance by email at rigell@starpower.net.)

Support the IDA

Join the International Dark-Sky Association
3225 N. First Avenue Tucson, AZ 85719-2103
www.darksky.org

National Capital Astronomers, Inc.
SERVING SCIENCE & SOCIETY SINCE 1937

NCA is a nonprofit, membership-supported, volunteer-run, public-service corporation dedicated to advancing space science, education, and related sciences through publication, education, participation, and inspiration, via research, lectures, presentations, publications, expeditions, and public interpretation. NCA is the astronomy affiliate of the Washington Academy of Sciences. NCA is an IRS Section 501(c)(3) tax-deductible organization. All are welcome to join NCA.

SERVICES & ACTIVITIES:

Monthly Meetings feature presentations of current work by researchers at the horizons of their fields. All are welcome; there is no charge. See monthly Star Dust for time and location.

NCA Volunteers serve in a number of capacities. Many members serve as teachers, clinicians, and science fair judges. Some members observe total or graze occultations of stars occulted by the Moon or asteroids. Most of these NCA members are also members of the International Occultation Timing Association (IOTA). Observing - Michael McNeal, mcnealmi@verizon.net; Telescope Making - Guy Brandenburg; Star Dust Editor - Elliott Fein

Publications received by members include the monthly newsletter of NCA, Star Dust, and an optional discount subscription to Sky & Telescope magazine.

Consumer Clinics: Some members serve as clinicians and provide advice for the selection, use, and care of binoculars and telescopes and their accessories. One such clinic is the annual event held at the Smithsonian Institution National Air and Space Museum.

Fighting Light Pollution: NCA is concerned about light pollution and is interested in the technology for reducing or eliminating it. To that purpose, NCA is an Organization Member of the International Dark Sky Association (IDA). Some NCA members are also individual members of IDA.

Classes: Some NCA members are available for educational programs for schools and other organizations. The instruction settings include star parties, classroom instruction, and school-teacher training programs that provide techniques for teaching astronomy. NCA sponsors a telescope-making class, which is described in the Star Dust "Calendar of Monthly Events."

Tours: On several occasions, NCA has sponsored tours of astronomical interest, mainly to observatories (such as the National Radio Astronomy Observatory) and to the solar eclipses of 1998 and 1999.

Discounts are available to members on many publications, products, and services, including Sky & Telescope magazine.

Public Sky Viewing Programs are offered jointly with the National Park Service, and others. Contact: Joe Morris, joemorris@erols.com or (703) 620-0996.

Members-Only Viewing Programs periodically, at a dark-sky site.

NCA Juniors Program fosters children’s and young adults’ interest in astronomy, space technology, and related sciences through discounted memberships, mentoring from dedicated members, and NCA’s annual Science Fair Awards.

Fine Quality Telescope, 14-inch aperture, see "Calendar of Monthly Events."

MEMBERSHIP CATEGORIES AND ANNUAL DUES RATES

All members receive Star Dust, the monthly newsletter announcing NCA activities. As an added optional benefit to extend your knowledge of astronomy you may also choose Sky and Telescope magazine at the discounted rate of $33.

Student Membership: .................................................. $15 .............. with Sky and Telescope.... $48
Standard Individual or Family Membership: ............... $27 ................... with Sky and Telescope.... $60

You are welcome to make contributions in any amount in addition to the dues shown above.

Contribution amount: ____________________________

Yes, I'd like to join NATIONAL CAPITAL ASTRONOMERS!

Name: __________________________ Date: ____/____/_____
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Telephone: __-__-______ ZIP Code: __________

Would you prefer to get Star Dust by e-mail? ____

Present or Former Occupation (or, If Student, Field of Study): __________________________

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Please mail this form with your check payable to National Capital Astronomers, to:

Mr. Jeffrey Norman, NCA Treasurer; 5410 Connecticut Avenue, NW #717; Washington, D.C. 20015
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