
THE USNO TRANSIT

Volume 1, Issue 2

April/May, 2009

IYA 2009 “100 Hours of Astronomy” Open House A Success!

In celebration of the 400th anniversary of Galileo’s first use of the telescope, the International Astronomical Union and UNESCO have declared 2009 to be the International Year of Astronomy (IYA 2009). As part of a world-wide celebration of this event, the U.S. Naval Observatory hosted a free-admission Open House on Saturday, 4 April, from 3:00 pm to 10:00 pm. During that time the Observatory’s telescopes were open for inspection, Staff members explained the missions of USNO’s various Departments, and local amateur astronomers shared views of the Sun, Moon, Saturn, and other objects through their telescopes.

The open house coincided with world-wide activities promoted by the IYA, specifically the “100 Hours of Astronomy” activities which took place around the globe from April 2 through April 5. The main goal of this effort was to give as many people as possible the opportunity to look through a good-quality astronomical telescope. To this end, USNO’s open house was extraordinarily successful. In addition to the Observatory’s venerable 12-inch Alvan Clark refractor, volunteers from local astronomy clubs provided nearly two dozen additional telescopes, ultimately entertaining a crowd of about 9000 visitors.

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The Captain’s Corner

Notes from the Superintendent

CAPT Steven Warren, USN



Spring has arrived at the U.S. Naval Observatory. Astronomers, timekeepers and other personnel can be increasingly seen wandering the newly green expanses of the Observatory grounds. It’s a great time of year to take a moment to appreciate the finer point and aesthetics of our work environment.

We are now over a quarter of the way through the International Year of Astronomy (IYOA). Our latest participatory effort in the IYOA, the recent open house, was a major success. This success was entirely enabled by those of you who enthusiastically volunteered your time and expertise to support the event. With an estimated number of attendees at over 8000, the event showcased our mission and our talented workforce. The public departed the event somewhat starry-eyed with a greater understanding and appreciation for the science and wonder of the work we perform. Bravo Zulu to all who participated. Remaining USNO events for IYOA

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Captain's Corner, continued from p. 1

include a Navy Band concert on the Observatory lawn later this year.

Admiral Titley, Commander Naval Meteorology and Oceanography Command (COMNAVMETOCCOM), has been selected as the new Oceanographer of the Navy and will be relieving Admiral Gove on 1 May. This selection is favorable for our organization, as Admiral Titley has an excellent understanding of, and considerable appreciation for, the importance of our mission and the superb work you perform. A selection board will be held in May to select the new COMNAVMETOCCOM from eligible Captains within the Naval Meteorology and Oceanography community.

Initial planning is underway for a 30 June Change of Command where CAPT Scott Steadley will relieve me as your Superintendent. That leaves me approximately two months to enjoy the Observatory experience and to accomplish additional goals. I look forward to my remaining time with you as I begin to make preparations for a smooth transition in leadership of the Naval Observatory.

U.S. Naval Observatory Presents 2008 Gilliss, Newcomb, And Superintendent's Awards

In an "all-hands" ceremony held on January 22, 2009, CAPT Steve Warren, Superintendent, U.S. Naval Observatory, bestowed the institution's highest accolades, the Simon Newcomb Award and the Captain James M. Gilliss Award, on two members of its Time Service Department. In addition, CAPT Warren presented the Superintendent's Award to three individuals who rendered exceptional service to the Observatory.

The **Simon Newcomb Award for Research Achievement** was presented to Dr. Christopher Ekstrom, a Supervisory Physicist in the Time Service Department and an internationally recognized expert in atomic physics, in recognition of the successful completion of a 10-year project to design, develop, and construct rubidium atomic fountains for the DoD Master Clock. The project has been eminently successful, and has to date produced two state-of-the-art fountains, of precision a few parts in 10^{16} , and capable of running continuously on a "24/7/365" basis. The rubidium fountains use laser technology to confine and cool a vapor of rubidium atoms to a temperature of about 10^{-6} °K. The atoms are then launched in a ballistic trajectory resembling a fountain. Laser-induced fluorescence is used to measure the frequency, and create a clock, using the atoms' internal states. This is the most precise operational measurement device known to man.

Dr. Ekstrom led an expert team which benefited from his nurturing and professional management style. Through his

hard work and leadership, Dr. Ekstrom also earned the deep respect of the staff of the U.S. Naval Observatory.

Dr. Ekstrom serves the DoD, USNO, national and international scientific communities in other ways. He advises GPS III on the next generation of atomic clocks. He is frequently asked to give invited talks to groups of physicists. For example, he was asked to give the keynote address at the 2008 Symposium of Frequency Standards and Metrology. He also serves on the Technical Program Committee of the annual Frequency Control Symposium.

The **Captain James M. Gilliss Award for Outstanding Service** was presented to Mr. Warren Walls, Supervisory Engineer, Time Service Department, in recognition of his extraordinary dedication and exemplary service for his work revitalizing the Time Service and USNO infrastructure. Mr. Walls implemented a new operational configuration for the USNO Master Clock systems, which maximizes the precision of the Master Clock, minimizes sensitivity to equipment failures, and maximizes its reliability and performance. Mr. Walls' redesign of the electronic infrastructure was a tour-de-force of detailed planning. The design preparation involved the creation of intricate spreadsheets listing components and their interconnections ensuring flawless comprehensive planning and ultimate success of the effort. The design of the components themselves were beyond state-of-the-art, in that Mr. Walls personally researched and set product specifications for manufacturer delivery of parts and materials. The delivery of this complex design was planned equally carefully, through multidimensional Gant charts that grew progressively more detailed as the effort proceeded. The result of Mr. Walls' labors is a new timing infrastructure, stretching from within the new Master Clock Facility all the way to the time-transfer endpoints; a structure that will be controlled through a redesigned computer infrastructure that was planned equally carefully to be less vulnerable to external threats or internal breakdowns.

Mr. Walls' efforts have also benefited other departments of the USNO, and contributed to other mission needs of his own Time Service Department. He designed a new local area network to meet the needs of all USNO departments in a consistent manner. He constructed a secure center for videoconferencing. He received praise from the base police force for his assistance in troubleshooting their security badge system. His flat-panel display of the new clock rooms and their operation, originally intended as a monitoring tool, proved so popular that it is now established in the lobbies of two USNO buildings, for the benefit of tourists and visitors. Mr. Walls' efforts have also been integral in the installation of an improved USNO front gate time display and in the design of new environmental chambers and supporting infrastructure for the Alternate Master Clock Facility.

Mr. Walls' dedication to excellence and his personal commitment and support of the Time Service Master Clock systems and USNO infrastructure have significantly enhanced the mission effectiveness of the U.S. Naval Observatory.

The 2008 **Superintendent's Award for Distinguished Service** is shared by three individuals, each of whom contributed significantly to the mission of the U.S. Naval Observatory.

Lieutenant Colonel William Deagan (USSTRATCOM J844) was recognized for his perseverance, dedication and acute insight into the Joint Milli-Arsecond Pathfinder Survey (J-MAPS) mission. His strong advocacy for the United States Naval Observatory (USNO) has led to greater senior level recognition and awareness of the USNO's mission. His contributions and support will benefit USNO and all DoD for many years to come.

Dr. L. Parker Temple, of the National Reconnaissance Office (NRO) Systems Integration and Engineering division, has been a long-term advocate for Precise Timing and Astrometry programs, particularly those applicable to the National Security Space Intelligence Community. His strong advocacy of the J-MAPS mission is greatly appreciated by the USNO.

Dr. Alan Whitney, Massachusetts Institute of Technology (MIT) Haystack Observatory, has distinguished himself as a prominent contributor to the U.S. Naval Observatory's Very Long Baseline Interferometry (VLBI) and Earth orientation programs. As the head of correlator development for both the Mark 3A and Mark 4 correlators, he has been instrumental in supplying the U.S. Naval Observatory with the state-of-the-art correlators that process the VLBI data used to determine Earth orientation.

The combination of nearly perfect spring weather and high-profile publicity seemed to bring visitors out in droves. The Observatory has not hosted an Open House since May of 2001. That event drew an estimated 1500 people, and a similar turnout was expected this time. According to CDR Scott Merritt, CO of Naval Support Activity North Potomac, 8336 visitors had been counted by “clicker” at the main security checkpoint in Building 56, but at times there were so many people streaming through the magnetometers that it was hard for the volunteer count-keeper to stay apace.

Most of the crowd arrived at dusk, but fortunately an armada of telescopes was on hand to greet them. Views of the gibbous Moon and planet Saturn flashed through eyepieces in telescopes ranging from modest 80mm refractors to the massive 15-inch home-built Dobsonian reflector brought in by Alan Bromborsky of the National Capital Astronomers. In addition to this large instrument, amateurs from NCA and the Northern Virginia Astronomy Club provided nearly a dozen telescopes in the 8- to 12-inch range. Even the smaller instruments produced repeated “Oohs” and “Ahhs” from the appreciative visitors.

Each Department had space to set up an exhibit, and each time I “made the rounds” to see how things were going the exhibit spaces were filled with visitors eager to learn about the nuances of atomic time-keeping or the basics of celestial navigation.

“I thought no one would be coming,” said Time Service Department Head Demertios Matsakis, “They would think this was a boring exhibit. But they are all over the place, I’ve talked myself hoarse.”

Norbert Zacharias from the Astrometry Department set up his small solar telescope near the entrance to Building 2 to entertain visitors waiting in line to see the “Great Equatorial” telescope.

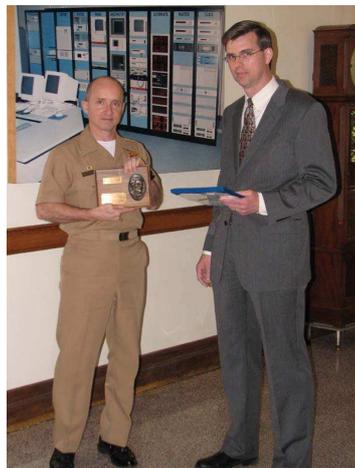
“From what I have experienced this was a great success,” he said. “Many people seemed to be interested in what we are doing, and having the posters out in the entrance area to the 26-inch was a very good idea. Some people, disappointed to have the line cut just in front of them, could be entertained easily. It was a great opportunity to talk about our mission beyond general astronomy and looking at a telescope. Even showing the ‘boring’ Sun with no sunspots in a little telescope got the visitors excited.”

“I would like to offer my thanks to all who volunteered to assist with our Open House over the weekend,” said USNO Superintendent CAPT Steve Warren in an email to the staff and volunteers after the event. “It appears to have been a huge success



Dr. Chris Ekstrom receives his citation and Simon Newcomb Award plaque from CAPT Steve Warren.

Mr. Warren Walls receives his James M. Gilliss Award citation and plaque from CAPT Warren.

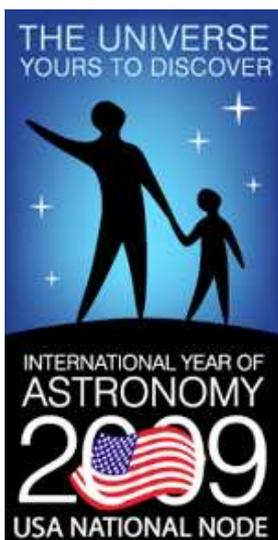


based on some of the immediate feedback I received from our guests. The Open House was a great chance to display the important and interesting work you do every day while showcasing the history of the U.S. Naval Observatory. The International Year of Astronomy rolls on and we plan to conduct other events this year to participate in the celebration of astronomy.”

“There were very few complaints, everyone had a great time, and I can't believe how respectful of the grounds everyone was,” said CDR Andy Lomax, Deputy Superintendent. “The place did not look like we just hosted that large a group.”

USNO Staff volunteers included John Bangert (AA), Sally Bosken (Lib), Brenda Corbin (Ret), Tom Corbin (Ret), Christopher Dieck (AD), Amy Fredericks (AA), Ralph Gaume (AD), Christine Hackman (EO), Bill Hartkopf (AD), QMC Bob Jerge (AA), Dr. Kenneth Johnston (SD), George Kaplan (Ret), CDR Andy Lomax (DS), Demetrios Matsakis (TS), Angela McKinley (TS), Wendy Puatua (AA), Victor Slabinski (EO), Nick Stamatakos (EO), Beth Stetzler (EO), Mark Stollberg (AA), Tom Swanson (TS), Sean Urban (AA), CAPT Steve Warren, Bill Wooden (EO), Marion and Norbert Zacharias (AD).

“Off-site” volunteers included John Anderson (NOVAC), Larry Angrimson (NOVAC), Alex Berger (NOVAC), Byron Bergert (NOVAC), Sam Bosken (USNO spouse), Dori Boulden (TSA), Alan Bromborsky (NCA), Woody Davis (NOVAC), David DeVorkin (NASM), Dr. Roger Firestone (NOVAC), Joshua Fried (NOVAC), John Gemmill (NOVAC), Bron Gervais (NOVAC), Doug Herbert (NOVAC), Stan Herman (NOVAC), Paul Hueper (NCA), Marty Larson (NGA), Alex Lim (NOVAC), Euro Micelli (NOVAC), Jay Miller (NCA), Charles Murphy (NOVAC), Sean O'Brien (NASM), Kevin O'Neill (NOVAC), Myles Rice (NOVAC), Milton Roney (IDA), Chip Sufitchi (NOVAC), Bruce Wood (FEMA), and Brian Zemba (NOVAC).



USNO's N4A Assigned to Special Duty on Inauguration Day

From the *Cordele Dispatch*, Cordele, GA



Our own LTJG (SC) Jon Singleton was a member of the 2009 Armed Forces Inaugural Committee, which supported the 56th Presidential Inauguration on Jan. 20.

The joint-service committee was charged with coordinating all military ceremonial support for the inauguration. As a joint committee, it included members from all branches of the U.S. armed forces, including Reserve and National Guard components.

Military personnel have participated in the inauguration of the American president since 1789, when members of the Army, local militia units and Revolutionary War veterans escorted George Washington to his first inaugural ceremony at Federal Hall in New York City.

Almost 225 years later, the military continues to honor the commander-in-chief. Participation by the armed forces included musical units, marching bands, color guards, salute batteries, and honor cordons. Soldiers, marines, sailors, airmen, and Coast Guard members assigned to the committee also provided assistance to the Presidential Inaugural Committee, a not-for-profit, partisan organization representing the president-elect, and the Joint Congressional Committee on Inauguration Ceremonies.

The Secretary of Defense authorized more than 700 service members to be assigned to the inaugural committee to help coordinate Department of Defense support in and around the District of Columbia. More than 5,000 service members participated in the celebration, both in view of the public and behind the scenes.

Singleton served as a military assistant with the Armed Forces Inaugural Committee based at Fort Leslie J. McNair, Washington, D.C. He is regularly assigned to the U.S. Naval Observatory in Washington, and has served in the U.S. Navy for three years.

Some Pictures from the Open House



John Bangert (AA) demonstrates basics of celestial navigation to Open House visitors



Amateur-provided telescopes set up on the helipad in front of Building 1



Visitors get an eyeful of the Moon through one of the amateur-provided telescopes.



The line for the 12-inch telescope stretched back to the Library at times!

The USNO Asteroid Connection

Over the years a number of individuals associated with the USNO have had the honor of having asteroids named for them. In addition, several asteroids have been discovered by USNO astronomers, including (31) Euphrosyne, the first asteroid discovered at an American observatory. Here's a list of these distant worlds that figure in our history, along with the name of the honoree and their dates of service to USNO or an affiliated program.

Asteroids named for USNO personnel

(855) Newcombia	--	Simon Newcomb, NAO, 1858 - 1897
(1455) Mitchella	--	Maria Mitchell, NAO, 1849 - 1868
(1642) Hill	--	George W. Hill, NAO, 1861 -
(1745) Ferguson	--	James Ferguson, 1854 -
(1750) Eckert	--	Wallace Eckert, 1940 - 1945
(1798) Watts	--	Chester B. Watts, 1911 - 1959
(1919) Clemence	--	Gerald Clemence, 1930 - 1963
(2023) Asaph	--	Asaph Hall (III), 1862 - 1893
(2796) Kron	--	Gerald Kron, NOFS, 1963 - 1973
(2974) Holden	--	Edward S. Holden, 1873 -
(3118) Claytonsmith	--	Clayton Smith, 1959 - 1993
(3216) Harrington	--	Robert Harrington, 1965 - 1991
(3217) Seidelmann	--	P. Kenneth Seidelmann, 1962 -
(3225) Hoag	--	Arthur Hoag, NOFS, 1950 - 1965
(3236) Strand	--	Kaj Aa. Strand, 1958 - 1977
(3299) Hall	--	John S. Hall, 1948 - 1958
(3368) Duncombe	--	Raynor Duncombe, 1942 - 1975
(3743) Pauljaniczek	--	Paul Janiczek, 1967 - 1997
(4008) Corbin	--	Tom & Brenda Corbin
(4853) Marielukac	--	Marie Lukac, 1971 - 2001
(5105) Westerhout	--	Gart Westerhout, 1977 - 1993
(5175) Ables	--	Harold Ables, NOFS, 1963 - 1996
(5367) Sollenberger	--	Paul Sollenberger, 1914 - 1953

(5951) Alicemonet	--	Alice Monet, 1977 -
(5952) Davemonet	--	David Monet, 1984 -
(6363) Doggett	--	LeRoy Doggett, 1965 - 1996
(6473) Winkler	--	Gernot Winkler, 1966 - 1995
(6696) Eubanks	--	T. Marshall Eubanks, 1988 -
(7011) Worley	--	Charles Worley, 1961 - 1998
(7393) Luginbuhl	--	Chris Luginbuhl, NOFS, 1981 -
(11941) Archinal	--	Brent Archinal, 1987 -
(13497) Ronstone	--	Ronald Stone, NOFS, 1981 - 2006
(16074) Georgekaplan	--	George Kaplan, 1971 -
(16015) Snell	--	Sabrina Snell, SEAP intern
(20287) Munteanu	--	Andre Munteanu, SEAP Intern
(29085) Sethanne	--	Sethanne Howard, 2000 -
(33529) Henden	--	Arne Henden, NOFS, 1995 - 2007
(52266) Van Flandern	--	Tom Van Flandern, 1963 - 1984
(129564) Christy	--	James Christy, 1962 - 1982

Asteroids Discovered by USNO personnel

(31) Euphrosyne	1854 09 01	Ferguson, J.
(50) Virginia	1857 10 04	Ferguson, J.
(60) Echo	1860 09 14	Ferguson, J.
(536) Merapi	1904 05 11	Peters, G. H.
(886) Washingtonia	1917 11 16	Peters, G. H.
(980) Anacostia	1921 11 21	Peters, G. H.
(1745) Ferguson	1941 09 17	Willis, J.
(10819) Mahakala	1993 04 19	DeYoung, J.

Abstracts of Recent Papers by USNO Staff

From the Editorial Review Board

Imitating quantum mechanics: Qubit-based model for simulation

Steven Peil
U.S. Naval Observatory

Accepted to *Physical Review A*

We present an approach to simulating quantum computation based on a classical model that directly imitates discrete quantum systems. Qubits are represented as harmonic functions in a 2D vector space. Multiplication of qubit representations of different frequencies results in exponential growth of the state space similar to the tensor-product composition of qubit spaces in quantum mechanics. Individual qubits remain accessible in a composite system, which is represented as a complex function of a single variable, though entanglement imposes a demand on resources that scales exponentially with the number of entangled qubits. We carry out a simulation of Shor's algorithm and discuss a simpler implementation in this classical model.

From The Ground Up I: Light Pollution Sources in Flagstaff, Arizona

Luginbuhl, Christian B. (USNOFS); Lockwood, G. Wesley (Lowell Observatory); Davis, Donald R. (Planetary Science Institute); Pick, Kevin and Selders, Jennifer (Northern Arizona University)

Publications of the Astronomical Society of the Pacific, Volume 121, issue 876, pp.185-203 Publication Date: 02/2009

We develop an estimate of the complete outdoor lighting of Flagstaff Arizona, as well as lighting-use densities (lumens per acre) for a number of different land uses. We find a total outdoor light output of 173 million lumens (Mlm) including sports lighting, and 139 Mlm without sports lighting, with an uncertainty of about 7%. The average fraction escaping directly upward from light fixtures is estimated to be 8.3%. After correcting approximately for near-ground blocking described in the accompanying paper by Luginbuhl et al., total uplight is estimated at 17.9 Mlm or 12.2 Mlm with and without sports lighting, respectively. Of these 17.9 Mlm, 33% arise from sports lighting, when it is on; when sports lighting is off, commercial and industrial lighting account for 62% with the remainder dominated by residential (14%) and roadway lighting (12%). We show that the 1989 Flagstaff lighting code that limited total outdoor lighting on new construction has reduced the growth rate of lighting, resulting in a 17% growth in light escaping into the sky from 1989 to 2003, compared to a 43% increase expected if the 1989 code had not been

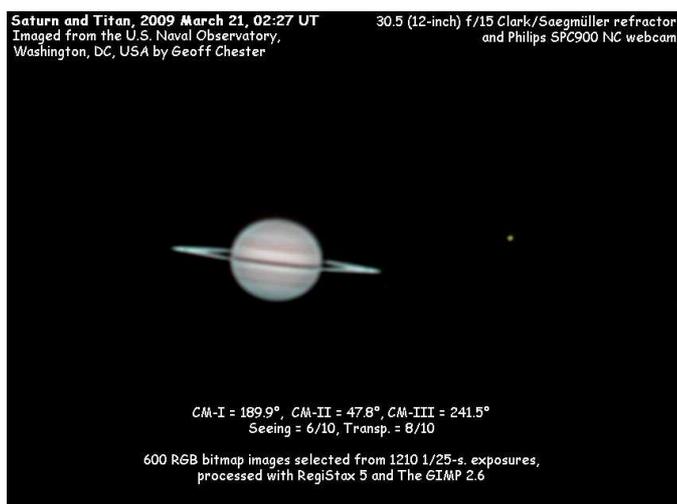
enacted. If all legally nonconforming lighting installed before 1989 were to be brought into compliance with the code, we would expect sky glow in Flagstaff to actually decrease by 36% compared to that in 2003; if all lighting, including residential, could be converted to fully shielded fixtures, sky glow would decrease to about half the current value. The implications for the most effective ways to address sky glow through lighting codes are discussed.

From the Ground Up II: Sky Glow and Near-Ground Artificial Light Propagation in Flagstaff, Arizona

Luginbuhl, Christian B. (USNOFS); Duriscoe, Dan M. (National Park Service); Moore, Chadwick W. (National Park Service, CIRA); Richman, Angela (National Park Service, Curecanti NRA); Lockwood, G. Wesley (Lowell Observatory); Davis, Donald R. (Planetary Science Institute)

Publications of the Astronomical Society of the Pacific, Volume 121, issue 876, pp.204-212, Publication Date: 02/2009

We present panoramic sky brightness measures in the Johnson V band made at the US Naval Observatory Flagstaff Station. We find that these measures show much less sky glow from Flagstaff than expected using the total light output and unshielded fraction determined recently by Luginbuhl et al. and Garstang's 1991 modeling approach. We suggest the difference arises principally from the diminution of upward-directed light after emission from light fixtures and reflection from the ground due to interaction with structures and vegetation. This interaction not only reduces the effective albedo, it also disproportionately reduces flux emitted upward at angles near the horizontal. We explore the size and consequences of this factor in light pollution modeling, and propose a modified upward angular distribution function to account for this effect.



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Superintendent

Captain Steven Warren, USN

Deputy Superintendent

Commander Andrew Lomax, USN

Scientific Director

Dr. Ken Johnston

Editor

Geoff Chester

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Please address all contributions to:

Editor: Geoff Chester, B1, Room Q
762-1438. FAX: 762-1489

e-mail: geoff.chester@navy.mil