The Big Eye

The Newsletter of the Friends of Palomar Observatory

Volume 9, Number 1
April 2014

Upcoming Events:

April 26, 2014 at 7:00 PM
at the Planetarium at Palomar College

Caltech Astronomer
Sasha Hinkley will give at talk

RSVP to sbf@astro.caltech.edu
or call (760) 742-2131

June 14, 2014
Dedication of the Helin Commemorative Exhibit

July 2014
A speaker and star party at the Outreach Center, the date to be announced.

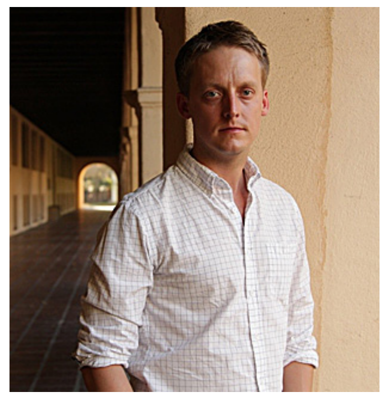
September 27, 2014 at 10:00 AM
A Friends of Palomar Observatory trip to Griffith Observatory

A guided tour of the Observatory with the opportunity to enjoy a planetarium show.

RSVP to sbf@astro.caltech.edu
or call (760) 742-2131

Sasha Hinkley

NSF Postdoctoral Fellow, Caltech



Sasha Hinkley will give a presentation on April 26 in the Planetarium at Palomar College. His talk will be followed by a planetarium show by Mark Lane, Assistant Professor of Astronomy and Director of the Planetarium.

Sasha Hinkley's talk is titled:

The New Era of
Exoplanet Direct Imaging

Abstract: Most of the hundreds of extrasolar planets identified in the past 15 years have been detected indirectly -- through careful monitoring of the planets' effect on their host star's light. By overcoming the extremely large brightness ratio between the stars and their faint exoplanetary companions, we are now able to actually image wide-separation exoplanets using large ground-based observatories such as Palomar. Sasha will describe efforts spanning two hemispheres to implement a new generation of astronomical instruments at observatories like Palomar dedicated to this task. These instrumentation platforms will allow us to extract detailed spectroscopic information about exoplanets, providing insight into the atmospheric chemistries, compositions, and thermodynamic properties of these objects.

Searching the Sky for Dangerous Neighbors

By Annie Mejía

Last September, Palomar Observatory unveiled to the public its new exhibit titled *Searching the Sky for Dangerous Neighbors* at the Addison White Greenway, Jr. Visitor Center. The exhibit focuses on the work of Dr. Eleanor Francis "Glo" Helin (1932 – 2009), a leader in the detection and study of Near-Earth Objects (NEOs) and a prolific observer at Palomar Observatory. Palomar's first research telescope, the venerable 18-inch (0.46-m) Schmidt, serves as centerpiece of the new exhibit along with topical panels, videos, and artifacts that describe the important work of identifying potentially hazardous NEOs and Helin's significant contributions to that work.

Eleanor "Glo" Helin

Eleanor Helin at the eyepiece of the guide telescope on the 18" Schmidt camera

Eleanor Helin was a planetary scientist at the California Institute of Technology (Caltech) and the Jet Propulsion Laboratory (JPL). She was a pioneer in the search and survey of near-Earth asteroids (NEAs)—asteroids that occasionally come close to Earth and can become a potential impact hazard. Helin began her hunt for asteroids in 1972 at Palomar Observatory using the 18-inch Schmidt telescope. She had joined Caltech in 1960 as a geologist interested in meteorites and the impact origin of lunar craters. Over time, her interest shifted to studying potential impactors in Earth's vicinity. Her work with the Palomar Planet-Crossing Asteroid Survey (PCAS) photographic program yielded its first near-Earth asteroid on July 3, 1973. By the end of the program in 1995, PCAS had discovered 65 NEAs, about a fifth of all NEAs known until then.

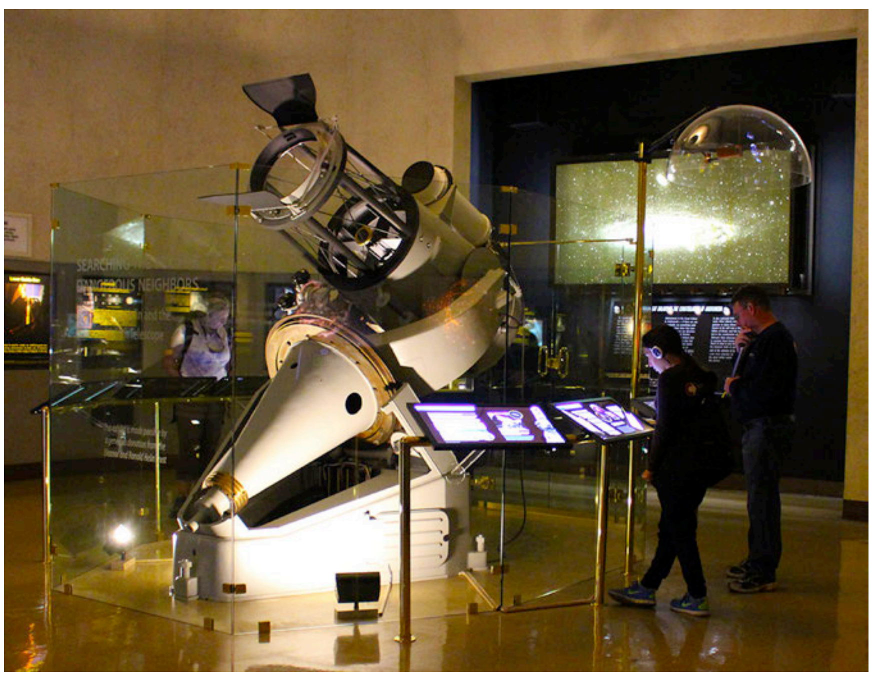
As the technology became available, Helin pressed for automating the search for NEAs. This was accomplished with the Near-Earth Asteroid Tracking (NEAT) project. NEAT began operations in 1996 at Haleakalā Observatory in Maui, Hawai‘i, and at Palomar in 2001 with the Samuel Oschin 48-inch Telescope. In eleven years of observations, NEAT found over 36,000 new Solar System bodies of which 442 are near-Earth asteroids.

Helin was awarded many honors, including NASA's Exceptional Service Medal and the naming of the minor planet (3267) Glo. The USS Helin (NCC-1692), a starship in the Star Trek franchise, was named after her for "having discovered an unprecedented number of asteroids and comets." Indeed, the Minor Planet Center lists Helin among the top discoverers with over 500 asteroids and a dozen comets discovered or co-discovered. The recognition she appreciated most was an honorary doctorate in 1992 from her alma mater, Occidental College in Los Angeles.

The 18" Schmidt Telescope

The 18-inch telescope was the first instrument at Palomar Observatory. It saw first light on September 5, 1936 and was Palomar's only operational telescope until 1949. Beginning in the late 1940s, this instrument was used in conjunction with the newly built 48-inch Schmidt (later to become the Samuel Oschin Telescope) to provide targets for the 200-inch Hale Telescope. Later, between the 1970s and 90s, the 18-inch proved to be a workhorse in the systematic search for minor bodies in the Solar System. In its long and productive life, this instrument has yielded many discoveries, including a large number of asteroids and nearly 50 comets.

Searching the Sky for Dangerous Neighbors was made possible thanks to a generous gift from the trust of Eleanor Helin and her husband Ronald. The restoration of the 18-inch telescope was carried out by members of the Palomar Observatory staff who brought the old instrument back to its former glory. The exhibit is available for viewing to all Palomar visitors during regular visiting hours.



The Helin Commemorative Exhibit at Palomar Observatory.

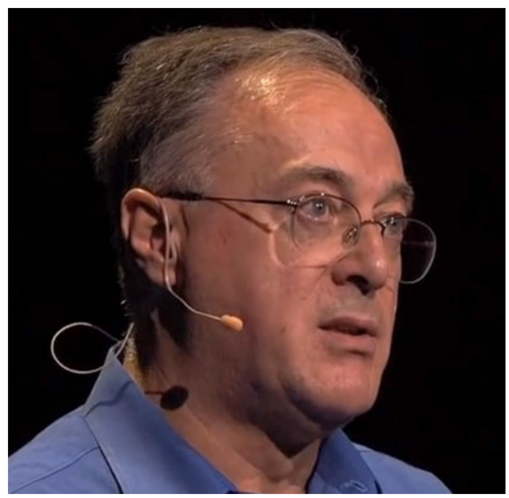
The permanent Helin Commemorative Exhibit titled *Searching the Sky for Dangerous Neighbors* will be officially dedicated on June 14, 2014 by Eleanor and Ronald Helin's son Bruce Helin and his wife Nancy Helin. The event will feature a lecture by the NEOWISE Principle Investigator Amy Mainzer on the state-of-the-art detection of near-Earth asteroids.

The New Astronomy

By Steve Flanders

George Djorgovski, an astronomer and faculty member at Caltech, has pointed out that modern astronomical research proceeds in two modes: on the one hand, targeted observations of selected objects; on the other, surveys representing systematic explorations of large portions of the sky. These two modes are complementary, he argues, and even necessary to each other.

Having been in operation for 65 years, Palomar Observatory continues to support advanced astrophysical research. There are a variety of reasons for this. Among these, a key reason is that from the beginning the Observatory was designed with these two modes of operation clearly in mind, large-scale surveys on the one hand and closely targeted observations on the other. The 48” Samuel Oschin Schmidt camera was installed to conduct surveys and to look for interesting and valuable objects that the 200” Hale telescope would examine in detail.



George Djorgovski speaking at TEDxCaltech on January 14, 2011.

In 1970, the 60” telescope was added and later all three instruments were brought together in a series of highly successful programs that at present has culminated in a program named the Palomar Transient Factory (PTF): The 48” camera photographs 1000 square degree of sky per night; the 60” telescope takes brightness measurements of interesting objects; and the Hale telescope – or other major device – performs spectroscopy and other investigations on the most important objects.

In a sense, however, Djorgovski’s concerns are different from those that lay behind PTF. Under PTF and its successors, we have been looking for anything that is new as determined by comparisons with standard reference images. But Djorgovski is not necessarily looking for things that are new. Rather, he is seeking ways of segregating and identifying large numbers of objects by combing through the massive amounts of data produced by surveys such as the Catalina Real-time Transient Survey (CRTS). In the new astronomy that he is developing, we are moving “from terascale to petascale data streams [where] the telescope is just a frontend to the data streams.” These data streams, he argues, are “where the real action is.”

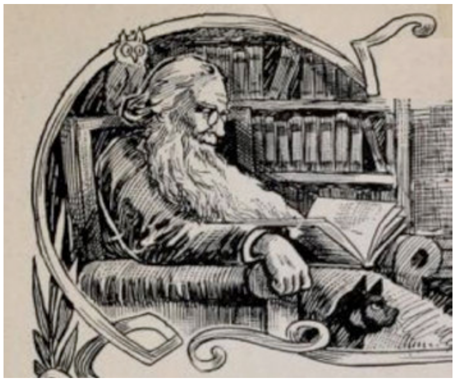
In fact, among other things, Djorgovski is looking for quasars. He is assembling a catalog of Quasi-Stellar Objects (QSOs) and the key to his method is found in the phrase “variabilityselection.” His problem is this: Of the billions of objects swept up repeatedly by CRTS and other surveys, how do we know which ones are QSOs? It is not possible to examine each object individually. But we can select the quasars in these huge datasets by statistical methods and for that reason the new astronomy is statistical astronomy in which initial identifications are made according to the rules of probability distributions.

A key assumption is that variations in brightness are statistically predicable and distinct by class of object. Many types of objects vary in brightness. Repeated observations of the brightness and other attributes of a great many objects may be reduced statistically to clusters from which QSO candidates may be identified.

This identification, however, is based on a mathematical probability. Djorgovski has been using the spectrographs on the Hale telescope to conduct targeted observations of selected objects to test the accuracy of his statistical model.

And Djorgovski is extending this approach well beyond his study of quasars. This statistical method, he suggests, can be used to classify any type of celestial object that varies in brightness over time. Indeed, if you consider flare stars, dwarf novae, and blazars, these are “vastly different phenomena,” he suggests. Yet to a casual viewer “they all look the same.” Even so, Djorgovski concludes, we can distinguish among these and find objects real interest only when the variability of the various attributes of these objects is described statistically.

Needless to say, we have come a long way from the time when Clyde Tombaugh found Pluto by surveying night after night one small patch of sky at a time.



Ask This Old Docent

Dear Old Docent:

I love to hear the story of how George Ellery Hale built the largest telescope in the world four times, how he raised six million dollars in 1928 to build Palomar Observatory, and how he brought together people from Caltech and Corning and Westinghouse and other institutions to bring the telescope project to a successful conclusion. It's a riveting story but, as you tell it on the tours, most of your time is spent describing ***how*** the telescope was built. I'd like to know more about ***why*** it was built.

Signed,
Riveted-in-Riverside

Dear Riveted:

It is a fascinating, even as you say, a riveting story on which we do not always spend as much time as we should. Why was the Observatory built? This topic concerns the science that has been done at Palomar Observatory and there is a long and short answer to your question.

First, the short answer is that astronomers always want larger telescopes. With each increase in the size of the collecting surface, more light passes to the cameras and fainter the objects are recorded. Larger telescopes can resolve finer details on planets and galaxies and the like. It is true that astronomers do not need a specific reason to build larger telescopes. For good reason, they know for certain that, with more light gathering and better resolution, they will find new and unexpected things important to the understanding of our universe.

But, second, as that may be, George Ellery Hale had some very specific things in mind when he sought to build the 200" telescope. And the long answer to your question is tied to problems that were being discussed in the 1920s about the nature of our universe. In summary, the 200" telescope was built to solve a problem of scale and distance that could not be solved using the largest telescope of the 1920s, the 100" Hooker reflector at Mt. Wilson.

And, of course, I must caution you at everything in this story is open to exception and qualification. For example, the 100" telescope was in fact capable of supporting the required observations but, as it turned out, only under the blackout conditions of wartime. Edwin Hubble, for another example, is often credited with a great many things that he did not do entirely by himself. Sometimes with attribution, sometimes without, he borrowed heavily from others.

But he drew lots of threads together. He synthesized the work of others and made a convincing case that others had not been able to make. To that extent, he demonstrated that the "spiral nebulae" were not gas clouds in our galaxy but were in fact separate "island universes" many equivalent in size to the Milky Way and at great distances from us. Most importantly, he demonstrated that with a few exceptions these external galaxies were moving away from us at very great speed.

The difficulty was that he could not say with any certainty how far these objects were or fast they were moving away. He could not with confidence measure the distance scale of the universe.

To establish this distance scale, he needed to make observations of certain classes of variable stars that, because each type has an intrinsic brightness, can be used to estimate distance. Hubble needed to be able to observe these variable stars in the Andromeda and other neighboring galaxies and, as they understood the problem at the time, the 100” telescope was not up to the task. Its optics could not achieve the resolution required and, hampered by the lights of Los Angeles, could not reach the faint magnitudes of these objects.

And so the Hale telescope was designed to be large enough to make the required observations under the then dark skies of northern San Diego County. In the first five years of operation, researchers at Palomar including Walter Baade doubled our understanding of the size the universe. It was the first great scientific accomplishment of this observatory. By 1959, Alan Sandage had refined and revised the work done earlier. With his own observing program, he brought the distance scale of the universe close to its modern value.

FRIENDS OF PALOMAR OBSERVATORY