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A SUPERNOVA SEARCH TELESCOPE

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Abstract

Despite progress in the management and operation of professional, low redshift CCD-based supernova (SN) search programs, many nearby supernovae continue to be discovered by visual searches (e.g., SN 1995ad). Since September 1990, Wren has conducted a visual supernova search using his personal 18-inch, f/4.5 Dobsonian telescope, and for approximately 3 nights a month near full moon, the McDonald Observatory 36-inch telescope. These efforts have led to Wren's visual discovery of SNe 1992H and 1994Y. For experienced visual observers, the supernova discovery rate is limited primarily by the search rate. With the above equipment, Wren's average search rate is approximately 1.4 minutes per galaxy. Increasing the supernova discovery rate requires optimization of the observing environment.

To this end, an innovative supernova search telescope has been constructed at the McDonald Observatory. This telescope will at least halve the observing time per galaxy, from approximately 1.4 minutes per galaxy to less than 0.7 minutes per galaxy, yielding a higher discovery rate per unit observing interval. This new Supernova Search Telescope (SNST) was dedicated in May 1995 as the George B. Wren II SNST. Its construction incorporates the innovative "Fundyscope: optical design (*Sky & Telescope* 1992, **84,** 212). Built with a Dudley Observatory Fullham Award for Innovation, a grant from the Pipeline Inspection Company (Houston, TX), and a National Science Foundation grant, the George B. Wren II SNST incorporates the key Fundyscope design features; a rigid mount, low diffraction optics, and a fixed viewing position. In addition to increased search rate, this SNST will reduce observer fatigue, a critical factor in visual SN search, allowing longer observing sessions.

As constructed, the SNST uses an 18-inch, f/4.5 primary mirror and a 24-inch diameter control mirror. Under the dark McDonald Obvseratory West Texas skies, the SNST will be capable of SN search to visual magnitude +16. Routine operations are expected to begin in January 1996. A sample of 1300+ galaxies will be surveyed. Future plans for this SNST include the acquisition and use of a large-format CCD camera.

Numerous individuals have contributed to this project's realization. Their contribuitons are gratefully acknowledge: J. Craig Wheeler (Professor of Astronomy, UT-Austin McDonald Observatory), Michael Marcario (High Lonesome Optics; Fort Davis, TX), Steve Watkins (Homestead Construction Co.; Houston, TX), John Hudek (Galaxy Optics; Buena Vista, CO), George Grubb (McDonald Observatory Physical Plant), Earl Green (McDonald Observatory Observing Support), and Wayne Rosing (The Robotic Telescope Company; Los Gatos, CA).

BY-PRODUCTS OF A MACHO SEARCH IN *THE BRIGHT STAR CATALOGUE*

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Abstract

Upon the request of NASA scientist Bradley Schaefer, a search has been made for MACHO (MAssive Compact Halo Object) events among the approximately 9100 stars in *The Bright Star Catalogue* (Hoffleit 1982). No conclusive discoveries could be made, as none of the stars for which only a single maximum was reported in a literature search had enough observations to yield a light curve around the maximum. The shape of the curve is characteriestic and therfore crucial for the identification of a MACHO transit. With insufficient data for isolated single observations at maximum, there are not more than ten suspected variables that might have had observed MACHO events, but all with insufficient data to be sure. Seven of these are components of double stars, with separations ranging from 0.5" to 30.4". Depending on the position angle between the component and the relative proper motions of the double and the lensing object, there might be two MACHO events, but separated by large time intervals. (With a favorable position angle and a separation of the components by 30", and the relative proper motion of the double and the MACHO object as fast as the 10" annual prooper motion of Barnard's star, the two MACHO events would occur three years apart; for a separation of 1.0", the interval would be about a month, but all intervals are presumable longer.) In view of the fact that Mt. Stromlo observers, after monitoring some eight million stars approximately 500 times each, found only four MACHOs, it is not surprising that no definitive cases could be found among about 2,000 suspected variables in *The Bright Star Catalogue.*

In the course of the search, numerous double stars were noted to have one component variable but with insufficient observations to ascertain the characteristics of the variation, and in some cases even to identify which component is the suspected variable. I have compiled a catalogue of 33 such instances where the separations of the components exceed 5". In a few cases it seemed that the only maximum for a bright star occurred in Al Sufi's catalogue in the 10th century. After examining numerous early catalogues from Ptolemy in the 2nd century, then Tycho Brahe about 1570, and later, none of the Al Sufi maxima qualified as MACHO events, being confirmed by both Ptolemy and Tycho, a span of some 1400 years.

J. E. Gore, around 1900, wrote extensively on Al Sufi magnitude determinations and gave tables suggesting that some 38 bright stars showed secular variations, important considerations for stellar evolution. All but eight of these could definitely be ruled out on the basis of probable errors in the determinations and likely systematic differences between observers. The eight remaining do show over a magnitude difference between the early and modern magnitude estimates. If secular, the changes are not linear with time. They could even suggest the possibility of periods on the order of millennia. As usual, the need for extensive variable star observations continues to proliferate.

Reference

Hoffleit, D. 1982, *The Bright Star Catalogue,* Yale University Observatory, New Haven, CT.

P CYGNI: MANY PERIODS OR NONE?

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P Cygni (V~4.8) is a luminous blue variable which is the prototype of mass-losing stars. In the distant past, this star showed large (? V~3) variations in brightness on a time scale of years. More recently, it has shown much smaller variations on time scales of weeks.

We have analyzed 550 photoelectric observations of P Cyg from the AAVSO and other sources. These cover the interval 1985 to 1993. We used Fourier and autocorrelation techniqaues to look for strict periods and for characteristic time scales, respectively. Variations seem to occur on time scales of 30 to 50 days (? V~0.10) and 100 to 120 days (? V~0.05).

Our results are compared with recent theoretical calculations by A.N. Cox and his collaborators (unpublished).

** Allen Attard and Matthew Szczesny were participants in the University of Toronto Mentorship Program, which enables outstanding senior high school students to work on research projects with University faculty.*

THE STUDY OF VARIABLE STARS: A WINDOW TO UNDERSTANDING THE PROCESS OF SCIENCE FOR STUDENTS IN OUR SCHOOLS

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Variable star astronomy affords young students the opportunity to do "real" science. Instead of learning science by parroting factoids from lifeless textbooks, doing research-type activities using aspects of variable stars brings reality and vitality to the process of science for students. Also, astronomy spins a magical web in young minds and allows educators to build into the curriculum mathematical, statistical, and conceptual frameworks nested within astronomical topics

Janet Mattei and John Percy, with the help of the AAVSO staff and a grant from the National Science Foundation (NSF), are creating a novel new curriculum to bring variable star astronomy and research activities into middle, high school, and college classrooms. Using slides, videos, computer analysis, and direct observation, the Hands-On Astrophysics (HOA) program introduces students to the process of science using a blend of interactive computer, graphing, statistical, and open-ended problem-solving activities.

AAVSO members can contribute to this educational effort by going into our schools on a volunteer basis and by continuing to support the outreach efforts of the organization.

4TH MAGNITUDE

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Presented at the Annual Meeting of the AAVSO, October 14, 1994

Abstract

The normal clear-sky transparency in the City of New York deepened to 4th magnitude as of 1 July 1994; the prevailing rating until then was 3½ to 4. This darkening of the skies over New York City is the result of major campaigns to reduce excessive light emissions into the air. In the 1990s there arose several brand new schemes to further mitigate this emission. These can be divided into three main categories; renovation of building frontages and facades; rebuilding of mass transit services; and replacement of street lighting. While the second mechanism is peculiar to New York City, the other two can be implemented, at a suitable scale, in most other towns.

Renovation of buildings is a continuing project driven by the need to improve and modernize the structures for new generations of tenants and visitors. In this process, obsolete and wasteful lighting is torn out and its emissions are permanently removed from the sky. With the pace and scale of rebuilding in the New York City--it "builds" the equivalent of an entire boston every decade--the decrease in light emissions is rather noticeable over the years. This program is often combined with general beautification of the streetscape.

In 1990, New York City began the immense work of simply pulling out the old cobraheads and other obnoxious steetlights and setting down star-friendly ones. This started in several areas, such as Grand Central and Ladies Mile, and is spreading steaily over the entire City. As of the fall 1994 meeting, major swaths of the City are bathed in this new illumination. The magnitude of this work boggles astronomers who visit the New York City! There are now more star-friendly streetlights in New York City than in any other town in the country, and the work continues.

Remaking the transit system is not a mainstream mechanism for improving the astronomer's lot. In fact, it is actually one of the most potent weapons there is, because the transit system pulls people from their light-spewing, sky-graying automobiles. Providing car drivers with reliable, quick, attractive, clean transport induces them to leave their star-killing cars home. Projects currently underway include the total rehabilitation of the LIRR wing of Penn Station, groundbreaking on the New Penn Station and facelifts on certain subway stations. Although this method of light abatemant is not directly applicable elsewhere, it has been underway in New York City since 1990, and is the country's largest-ever civilian public works project.

The reduction of excessive light emissions in New York continues and will enlarge as the century closes. Can it be many years until we see the Milky Way from Central Park?

WHY ARE OUR SKIES SO DARK?

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Presented at the Annual Meeting of the AAVSO, October 30, 1993

Abstract

Astronomers visiting New York note that it's a "dark" city. By this they mean that our streets and sky are not filled with the blazing lights so common in other towns across the country.

Our cityscape is rather subdued for its huge population and uban vigor. The author showed some of the structural features that inhibit the use of the typical town lighting schemes. Two are highlighted: the fronts of stores and the skyscrapers. The former may be a model for other towns, but the latter is pretty much unique to New York. Storefronts are built to cover and shield lamps from overhead view. Huge brilliant headsigns are banned. Many stores do quite well with essentially no outdoor lights at all. Other shops are built as interior spaces not open to the outside air. And virutally no shop has a carpark to light up.

In New York City, a structure can combine residence, institutional, retail, commercial, corporate, and factory tenants. To accomodate this mulitple use the the structure extends upward to nosebleed heights--literally scraping the sky when the clouds hang low. Thus within a hectar of less there can be tenants who in a rural setting could occupy a square kilometer of countryside. All that land and all those roads "must" be lit up. The skyscraper eliminates this "outside" and quenches the need or desire to install exterior illuminations. The entry lighting of a 150-m office tower with shops, a bank, and a school in it may handlily be outshined by a stand-alone suburban bank. Densification of many facilities into a skyscraper also makes for easy access among them. They are a short walk or elevator ride away, not many kilometers of driving in a star-killing car.

New York City, with its peculiar structural features, has checked the rampant spread of excess and waste light emissions, rendering its skies about the darkest of any world city. In this sense, yes, New York is a dark city.