Finding My Place in the Universe

Jessica Mink, Smithsonian Astrophysical Observatory

I. Wanting to work with Space and Computers, from elementary school on. (1958-1968)

II. Learning how to be an Astronomer: The Moon and Mars in College (1969-1976)

III. Becoming an Astronomer: Occultations by the Solar System beyond Mars (1976-1984)

IV. Mapping the Galaxy from Space: Milky Way Galactic Structure for SL2 IR2 (1984-1992)

V. Mapping the Universe with Redshifts (=large radial velocities) (1989-2012)

VI. Traveling Through Tme in the Harvard Plate Stacks (2002-2007)

VII. Studying stars and exoplanets with radial velocities (=small redshifts) (1978-2021)

VIII. Working toward inclusion, diversity, equity, and accessibility (2015-2021)

Beginnings

Mapping My Terrestrial Neighborhood

Jessica Mink, LVAAS, June 13, 2021

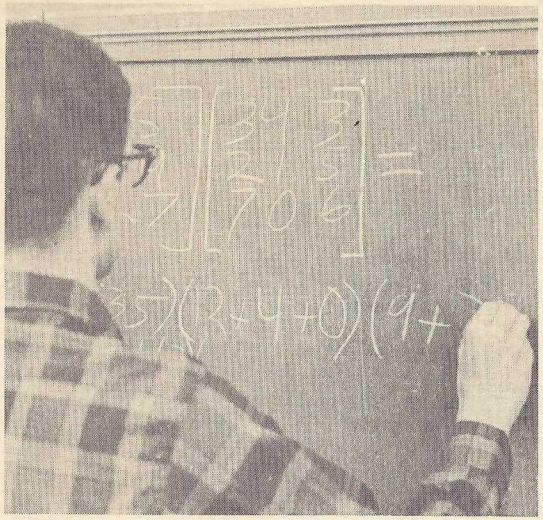
Beginnings

Scrapbooking the Space Program 1959-1970

Jessica Mink, LVAAS, June 13, 2021

Beginnings

Math and Software in High School in 1969



Doug Mink busy multiplying matricies as part of his work for the Math Seminar.

College Preparation:

Seminar Succeeds

The 1969 Senior Math Seminar has started with 19 students participating.

The program, sponsored by Mr. Green, will cover a variety of topics. These include probability and set theory which have been the main cause for the improved Pinochle games in the senior lounge. Also covered is Boolean Algebra, which is the part of Mathematics that studies the truth of statements on the basis of other given statements, and also an introduction to a few of the simple ideas that Calculus is based on.

Participating in the program are Bob Bolier, Tim Covey, Pam Kamphoener, Glenn Knowles, Bob Platt, John Rebik, Bob Becker, Ron Kamp, Ken Prouty, Bill Singer, Helen Woodruff, Peggy Buhrmann, Dave McDonough, Doug Mink, Karen Nelson, Greg Wilharm, Janet Wynn, and Mike Kuzynowski.

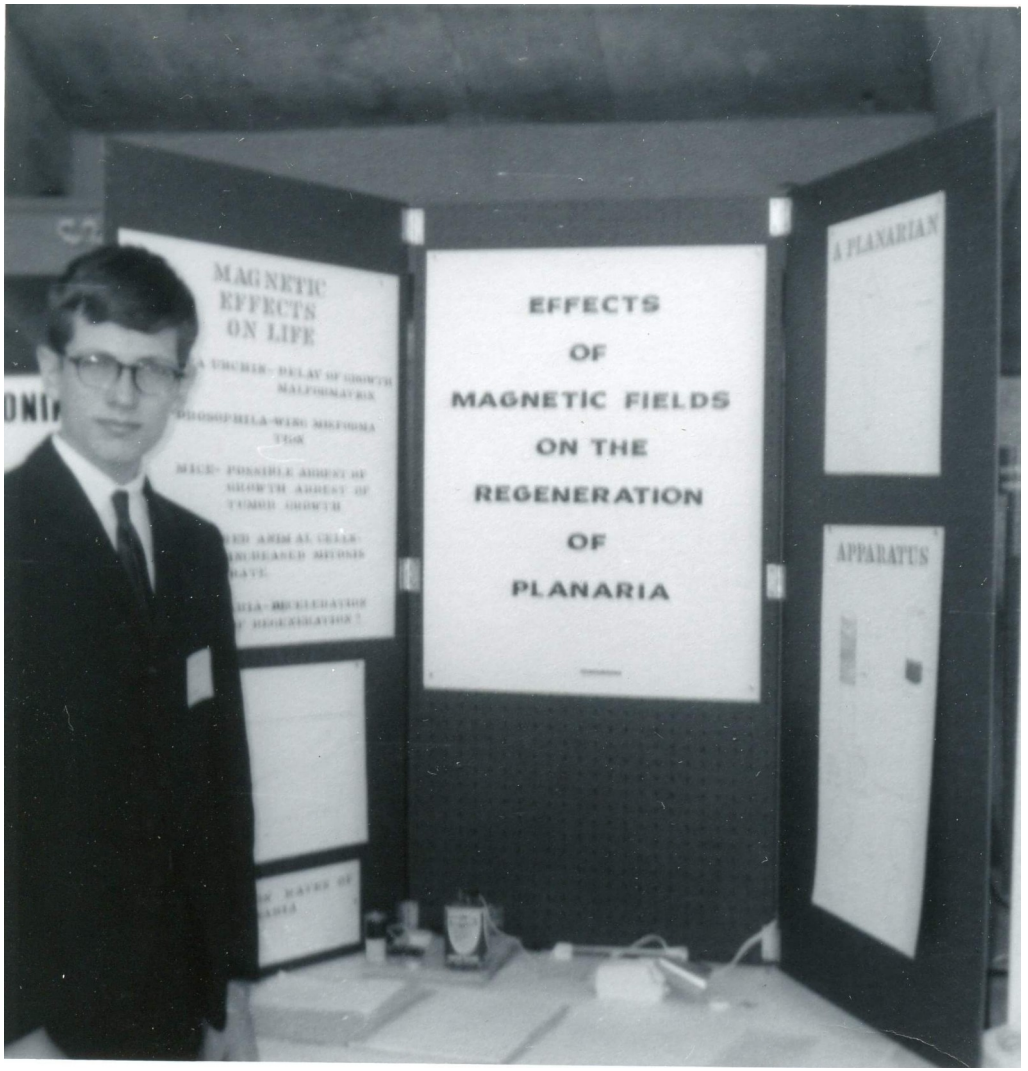
The seminar meets 4A and 5B and covers topics that Dundee graduates find most needed for college.

```
$ IITRAN                                  n = number of questions
  PROCEDURE QUESTAN                       a = number of answers
# GENERAL QUESTIONAIRE ANALYSIS           c = number of correlation
$ WRITTEN BY DOUG MINK, MIT                   checks

$ STEP 1 DECLARE ARRAYS
  INTEGER QSTNR(n), QTABLES(n,a), (A:Z), MAQ(30)
  REAL QCENT(n,a)
# CORRELATION ARRAYS ARE INCLUDED ABOVE
$ ZERO ARRAYS
  QSTNR(*)=0  QTABLES(*,*)=0
$ GET NUMBERS OF MULTIANSWERABLE QUESTIONS
  READ, MAQ(1) A=1 UNTIL MAQ(A)=0 DO A<-A+1 READ MAQ(A) END
$ GET NUMBER OF QUESTIONS AND MAXIMUM NO. OF ANSWERS
  READ, QNO, MAXAN
$ INPUT
  IN: READ, QSTNR(1)
  IF QSTNR(1)<=0 GO TO OUT
  I<-1 UNTIL I=QNO
  DO I<-I+1 READ QSTNR(I) END
```

Beginnings

State Science Fair with Planaria in 1967 (popular in 2021)



ANNALS OF SCIENCE

GROWING IT BACK

Can we persuade the body to regenerate by speaking a language it understands?

BY MATTHEW HUTSON

Each year, researchers from around the world gather at Neural Information Processing Systems, an artificial-intelligence conference, to discuss automated translation software, self-driving cars, and abstract mathematical questions. It was odd, therefore, when Michael Levin, a developmental biologist at Tufts University, gave a presentation at the 2018 conference, which was held in Montreal. Fifty-one, with light-green eyes and a dark beard that lend him a mischievous air, Levin studies how bodies grow, heal, and, in some cases, regenerate. He waited onstage while one of Facebook's A.I. researchers introduced him, to a packed exhibition hall, as a specialist in "computation in the medium of living systems."

Levin began his talk, and a drawing of a worm appeared on the screen behind him. Some of the most important discoveries of his career hinge on the planarian—a type of flatworm about two centimetres long that, under a microscope, resembles a cartoon of a cross-eyed phallus. Levin is interested in the planarian because, if you cut off its head, it grows a new one; simultaneously, its severed head grows a new tail. Researchers have discovered that no matter how many pieces you cut a planarian into—the record is two hundred and seventy-nine—you will get as many new worms. Somehow, each part knows what's missing and builds it anew. What Levin showed his audience was something even more striking: a video of a two-headed planarian. He had cut off the worm's tail, then persuaded the organism to grow a second head in its place. No matter how many times the extra head was cut off, it grew back.

The most astonishing part was that Levin hadn't touched the planarian's genome. Instead, he'd changed the electrical signals among the worm's cells. Levin explained that, by altering this electric patterning, he'd revised the organism's "memory" of what it was supposed to look like. In essence, he'd reprogrammed the worm's body—and, if he wanted to, he could switch it back.

Levin had been invited to present at an A.I. conference because his work is part of a broader convergence between biology and computer science. In the past half century, scientists have come to see the brain, with its trillions of neural interconnections, as a kind of computer. Levin extends this thinking to the body; he believes that mastering the code of electrical charges in its tissues will give scientists unprecedented control over how and where they grow. In his lab, he has coaxed frogs to regenerate severed legs, and tadpoles to grow new eyeballs on their stomach.

"Regeneration is not just for so-called lower animals," Levin said, as an image of Prometheus appeared on the screen behind him. Deer can regenerate antlers; humans can regrow their liver. "You may or may not know that human children below the age of approximately seven to eleven are able to regenerate their fingertips," he told the audience. Why couldn't human-growth programs be activated for other body parts—severed limbs, failed organs, even brain tissue damaged by stroke?

Levin's work involves a conceptual shift. The computers in our heads are often contrasted with the rest of the body; most of us don't think of muscles and bones as making calculations. But how do our wounds "know" how to heal? How do the tissues of our unborn bodies differentiate and take shape without direction from a brain? When a caterpillar becomes a moth, most of its brain liquefies and is rebuilt—and yet researchers have discovered that

The biologist Michael Levin thinks cells use bioelectricity to decide what to become.

ILLUSTRATION BY KHYATI TREHAN

Astronomy at MIT

My first planetary science class was about lunar exploration

DEPARTMENT OF EARTH AND PLANETARY SCIENCES

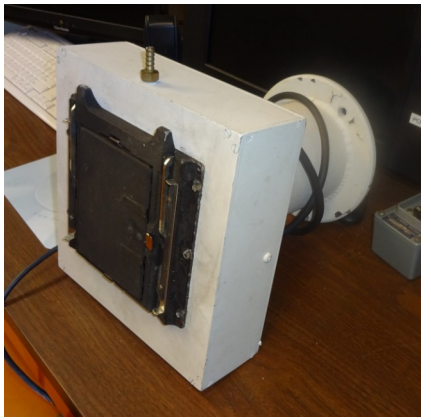
123 THE MOON

Professor Richard S. Naylor

The Department of Earth and Planetary Sciences at M.I.T. is actively engaged in the current exploration of the moon. In this seminar we will share the results and hopefully some of the excitement of this project. Our major goal will be to understand the history of the moon in relation to the solar system. Preliminary results indicate that the moon contains a much clearer record of the early history of the solar system than does the earth. We will see that external events (meterorite flux, cosmic and solar irradiation, etc.) are more clearly preserved in the lunar "geologic" record than on earth. Samples returned by Apollo XI resemble a common earth-rock, basalt, but differ from it in important respects. We will try to explore the ramifications of this observation. We will spend a little time discussing the relative merits of manned versus un-manned and instrumental exploration.

The seminar will meet once a week for lecture and discussion and at less frequent intervals in smaller groups for discussion of research projects. Research materials include references, video-tapes of a major conference on Apollo XI results, Lunar Orbiter photos, Apollo mission photos, and an extensive library of instrumental analyses.

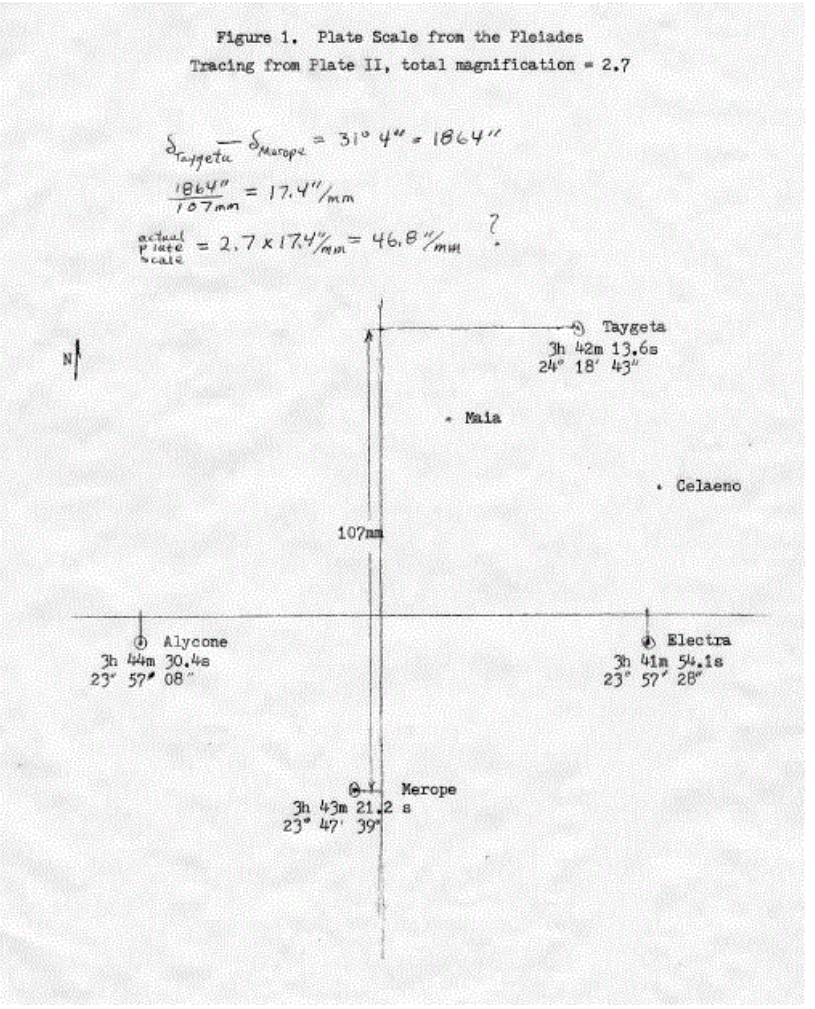
My first observing was taking film images on the Wallace Observatory 16-inch reflector (on the right)



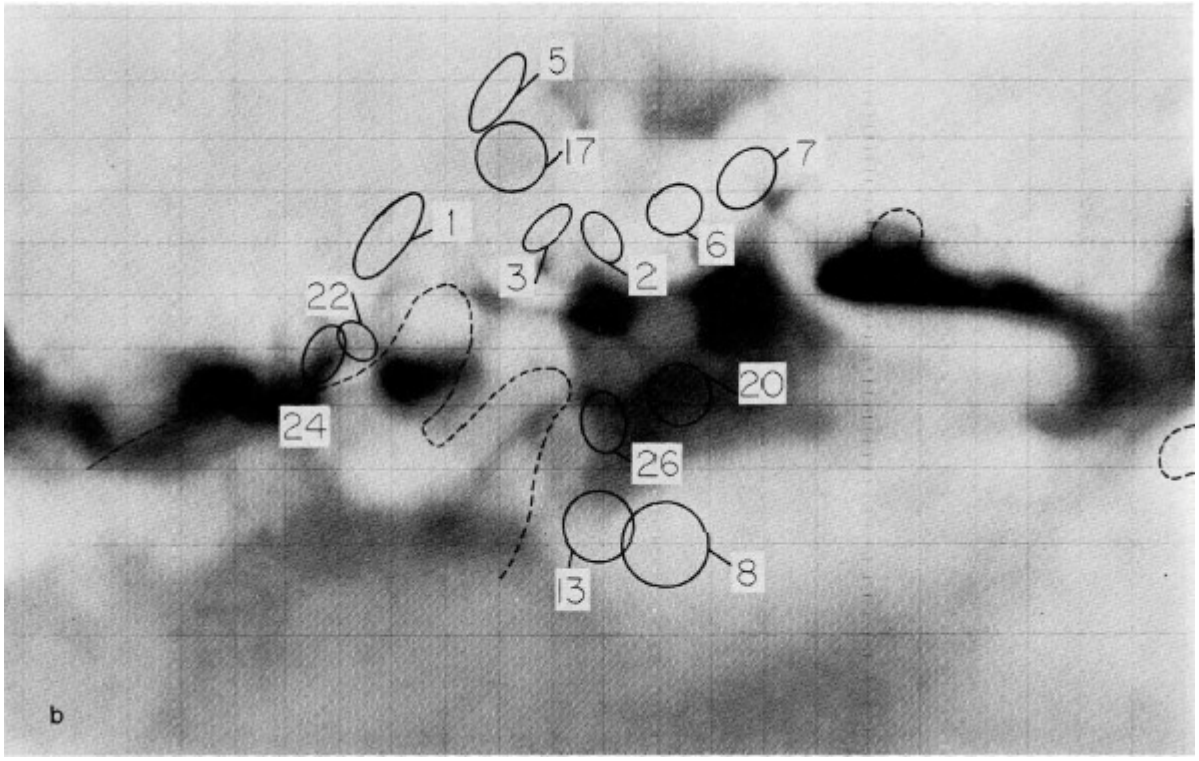
MIT 12.143: Plate Scale and Tracking Accuracy of the MIT Wallace Observatory 16 inch Telescope

December 15, 1971

II. Pleiades (M.45)
exposure: 8 min
film: Kodak Tri-X
development: D-19, 10 min
magnification: 2.7
comment: drive speed not correctly adjusted



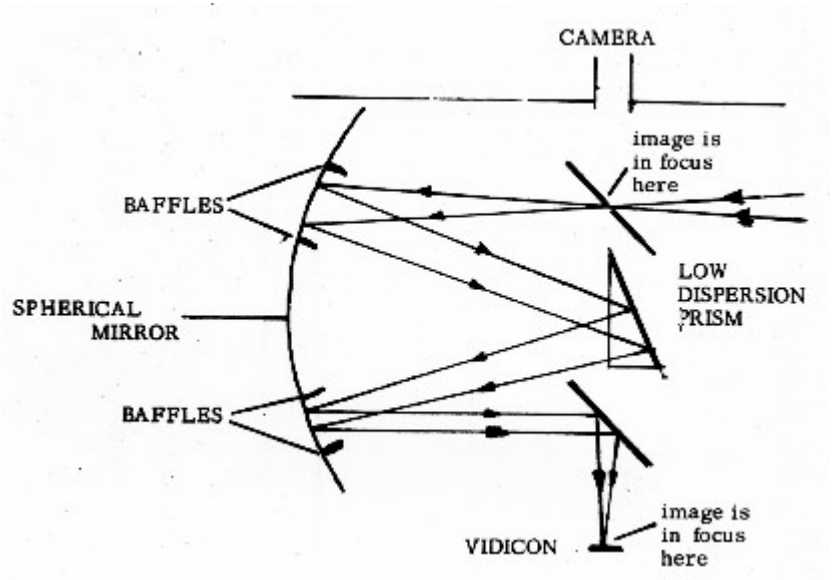
Mars Opposition Photometry

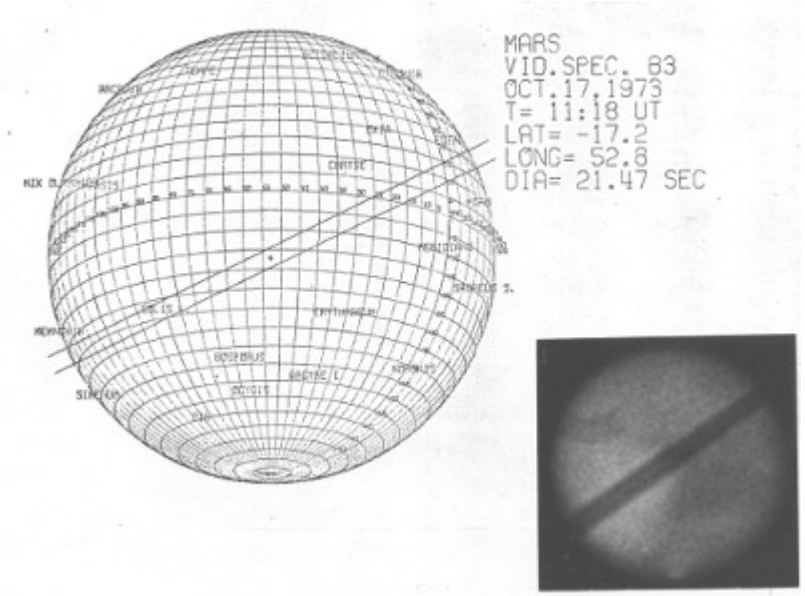


Aperture photos projected on observed planet disk and reprojected onto Mercator projection of Mars

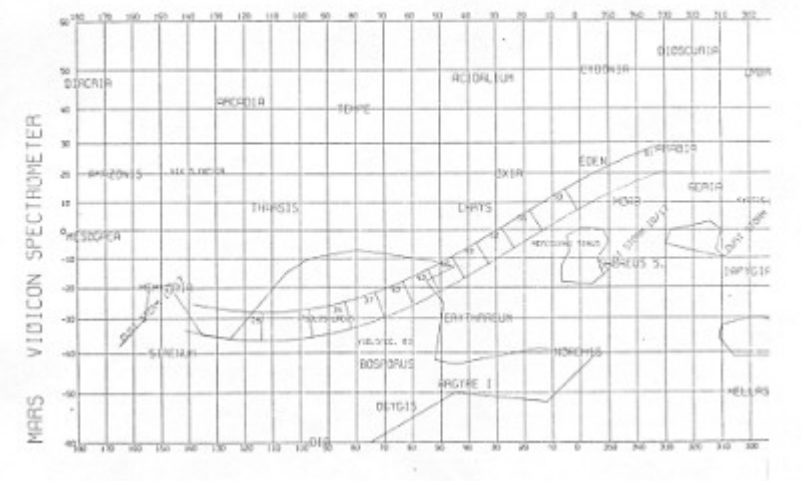
(Mccord, Huguenin, Mink, and Pieters, Icarus 31, 1977)

MIT Vidicon Spectrometer
1973 Mars Opposition



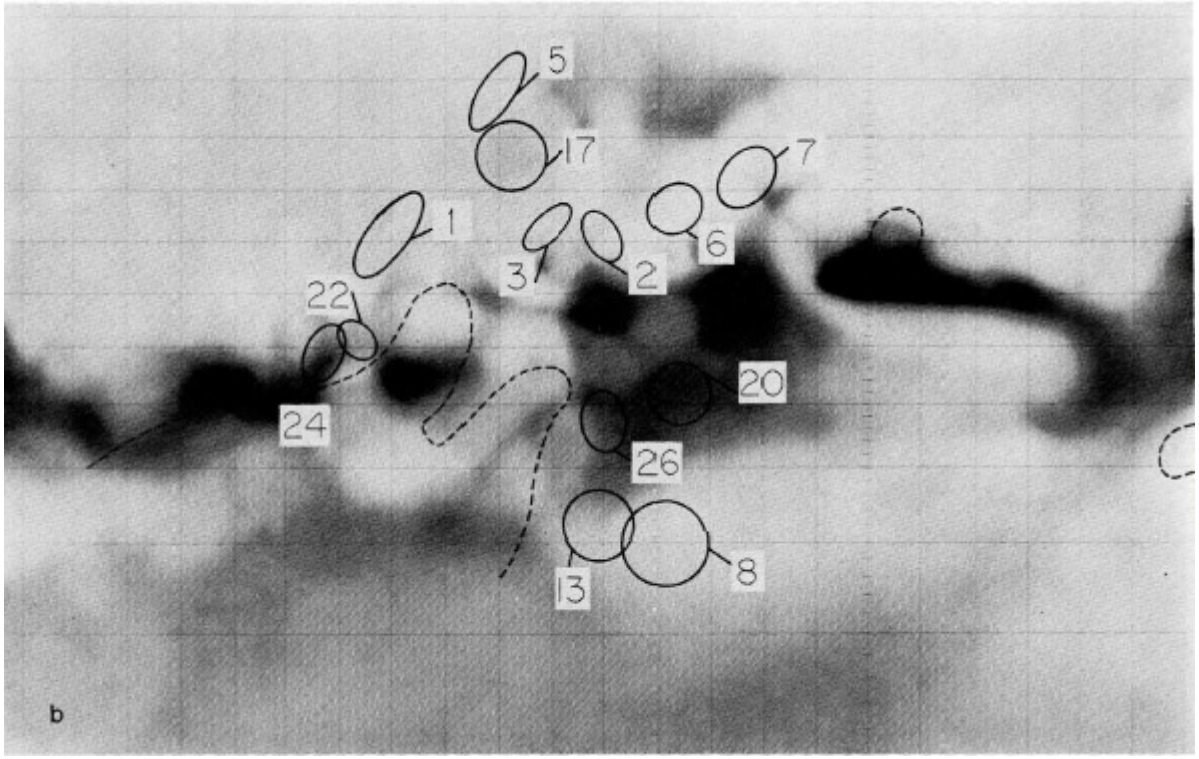


MIT Vidicon Spectrometer with camera monitoring slit in mirror



Spectrometer slit reprojected across Mercator projection of Mars surface
(Mink, MIT S.M. Thesis 1974)

Mars Opposition Photometry



Aperture photos projected on observed planet disk and reprojected onto Mercator projection of Mars

(Mccord, Huguenin, Mink, and Pieters, Icarus 31, 1977)

Not Grad School, But ...

CORNELL UNIVERSITY
Center for Radiophysics and Space Research
Space Sciences Building
Ithaca, New York 14853

Telephone (607) 256-4971 Laboratory for Planetary Studies

March 17, 1976

Mr. Douglas Mink
1055 Beacon Street
Apt. #2
Brookline, MA 02146

Dear Doug:

Thanks for your recent letter. I was glad to hear that your wife, Missy, has been accepted in Ecology and Evolutionary Biology here. Unfortunately, because of a deluge of first rate applicants and a still constricted budget for the support of graduate students, we have not been able to admit you as a graduate student. I am sorry to have to report this, but the competition was simply too tough. On the other hand, if by any chance you will be here, we would certainly be happy to have you work in our laboratory and -- if a little money can be found -- try to pay you at least part time.

With all good wishes,

Cordially,

Carl Sagan

CS/csk
cc: Y. Terzian

CORNELL UNIVERSITY
Center for Radiophysics and Space Research
Space Sciences Building
Ithaca, New York 14853

Telephone (607) 256-4971 Laboratory for Planetary Studies

June 3, 1976

Mr. Douglas Mink
1055 Beacon Street #2
Brookline, Mass. 02146

Dear Doug:

Thanks for your recent letter which, for several different reasons, I was delighted with. I think it certainly is true that once you are here we will have an excellent chance to better assess your skills and abilities and I'm sure it will increase your chance of being admitted to this department. But also we have an extremely interesting job opening up involving data processing and analysis in a set of quite exciting contexts. We are not yet sure that we will have money to support this position, but I would say that the prospects are at least moderately good. Let me urge you to contact -- certainly by the time you are out here but preferably even before -- Dr. James Elliot of this Laboratory to whom I'm sending a copy of this letter. It would probably be a good idea for you to lay out your previous computer and instrumentation experience to Dr. Elliot. I very much hope things will work out well for you.

With all good wishes,

Cordially,

Carl Sagan

Discovery of Uranian RIngs

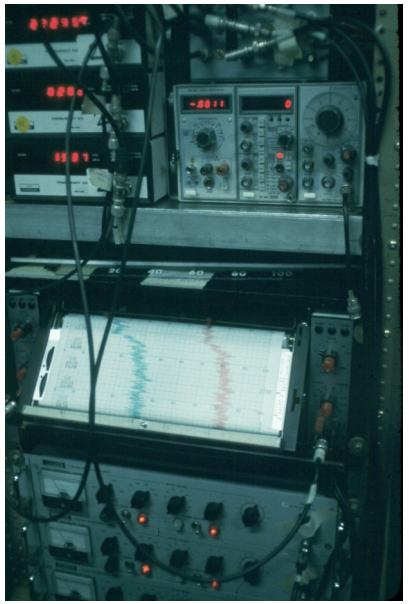
Circular No. 3047

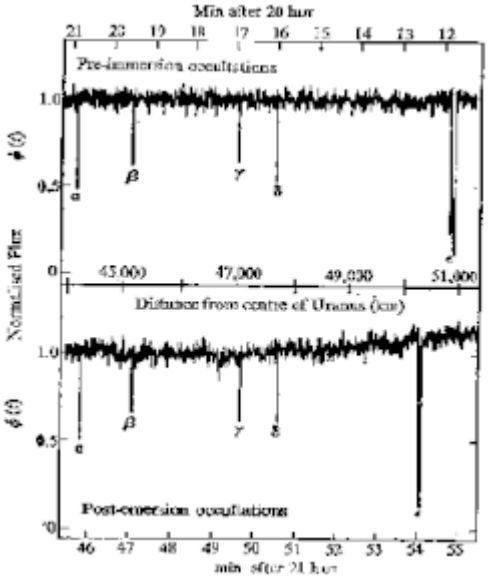
Central Bureau for Astronomical Telegrams
INTERNATIONAL ASTRONOMICAL UNION
Postal Address: Central Bureau for Astronomical Telegrams
Smithsonian Astrophysical Observatory, Cambridge, MA 02138, U.S.A.
Cable Address: SATELLITES, NEWYORK Telex: 921428
Telephone: (617) 864-5758

OCCULTATIONS BY URANUS AND (6) HEBE

R. Barrow, Gerard P. Kuiper Airborne Observatory, has relayed word from Perth of successful observations by J. L. Elliot in the southern Indian Ocean of last night's occultation of SAO 158687 by Uranus. A secondary occultation was also observed, this presumably being caused by a small body (not Miranda) in orbit about Uranus. J. Hers reports that heavy rain prevented observations in the vicinity of Johannesburg.

Preliminary reports reaching D. Dunham, Computer Sciences Corporation, suggest that the central line of the occultation of gamma Cet by (6) Hebe passed between 50 and 90 km north of Mexico City. Near the latter point the event lasted 55, beginning on Mar. 5d02h34m54s UT. A 2.5s-duration occultation was observed in Mexico City itself.





Circular No. 3048

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Smithsonian Astrophysical Observatory, Cambridge, MA 02138, U.S.A.
Cable Address: SATELLITES, NEWYORK Telex: 921428
Telephone: (617) 864-5758

OCCULTATION OF SAO 158687 BY URANUS AND SATELLITE BELT

Amplifying the brief announcement on IAUC 3047, J. L. Elliot reports that several secondary occultations of SAO 158687 on Mar. 10 were observed by E. Dunham, D. Mink and himself from the Kuiper Airborne Observatory and also by R. L. Millis, P. Birch and D. Trout at the Perth Observatory. Both groups independently concluded that these occultations were caused by bodies that are apparently part of a satellite belt about 40 000 km distant from the center of Uranus. The diameters of the satellites range from 100 km to much smaller values. The occultation by Uranus itself was successfully observed from the Airborne Observatory (located at Long. = -90o, Lat. = -50o) and lasted ~ 25 min centered on 21h06m UT. The Uranus occultation did not occur at the Perth Observatory. The secondary occultations took place during an 8-9 min interval around 20h16m UT and during a similar interval around 21h50m UT (although dawn prevented observations of the latter events in Perth).

M. K. V. Bappu, Indian Institute of Astrophysics, cables: "Using the 102-cm reflector at Kavalur (Long. = -5h15m19s.6, Lat. = +12o34'32"), Bhattacharyya and Kuppuswamy found the diminution of SAO 158687 during the occultation by the atmosphere of Uranus to be 0.046 magnitude at an effective wavelength of 7500 A. Visually and photoelectrically they observed the complete disappearance of the star for 8s.9 beginning at 20h19m15s UT and ascribe this to obscuration by a hitherto unknown satellite of the planet."

Computations by the undersigned show that the asymmetry in the times of the satellite occultations about the main occultation (as observed at the Airborne Observatory) is consistent with the existence of a circular belt in the plane of Uranus' equator. Allowance for foreshortening yields the radii of the inner and outer edges of the belt as 44 000 and 51 000 km, respectively. The Kavalur observation suggests occultation by a 100-km-sized body near the outer edge of the belt. Other observers are urged to examine their records for further evidence of this belt. At Sutherland, times of mid-occultation by the belt would have been 20h22m and 21h59m UT; at Mauritius, 20h23m and 21h54m; at Lembang, 20h20m and 21h46m; at Kyoto, 20h22m; at Helwan, 21h56m. Those wishing to attempt to detect the satellite belt directly are advised that at the present opposition it should be located from 3".5 to 4".0 to the north and south of the center of Uranus and from 2".7 to 3".1 to the east and west; the brightest bodies in it are expected to have mv ~ 19.

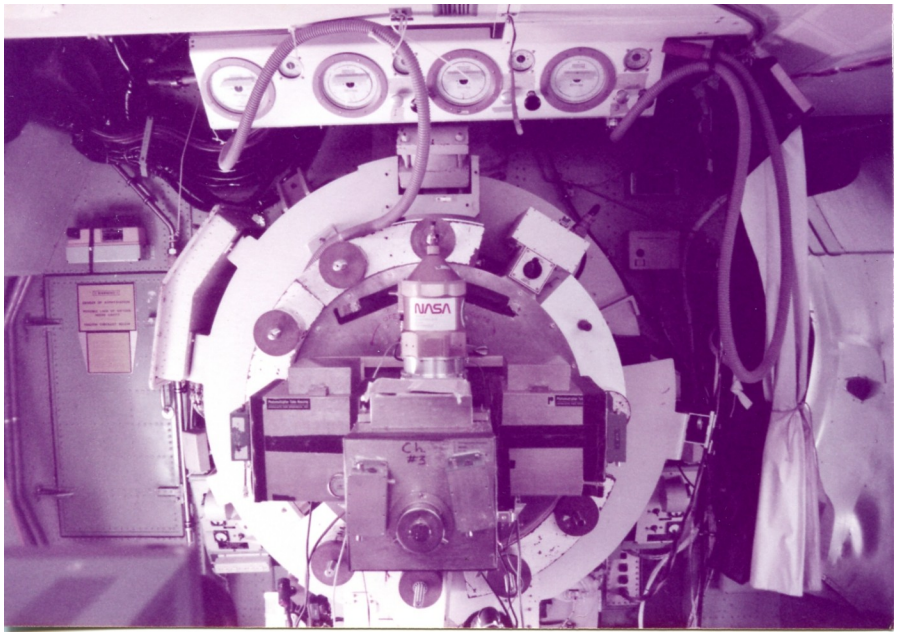
1977 March 14 (3048) Brian G. Marsden

Occultation of SAO 158687 by Uranus and Its Rings

(Eliot, Dunham, and Mink, Nature 261, 328, May 26 1977)

Jessica Mink, LVAAS, June 13, 2021

3-Channel Photometer on KAO



Me, Ted, System Manager, Jim

Occultation Prediction Pipeline

Existing Star Catalog

Compute Search Boxes
Search Star Catalog
Merge resulting regions

Photographic Plates

Compute planetary ephemeris
Take plates on astrograph
Measure plates
Merge plates

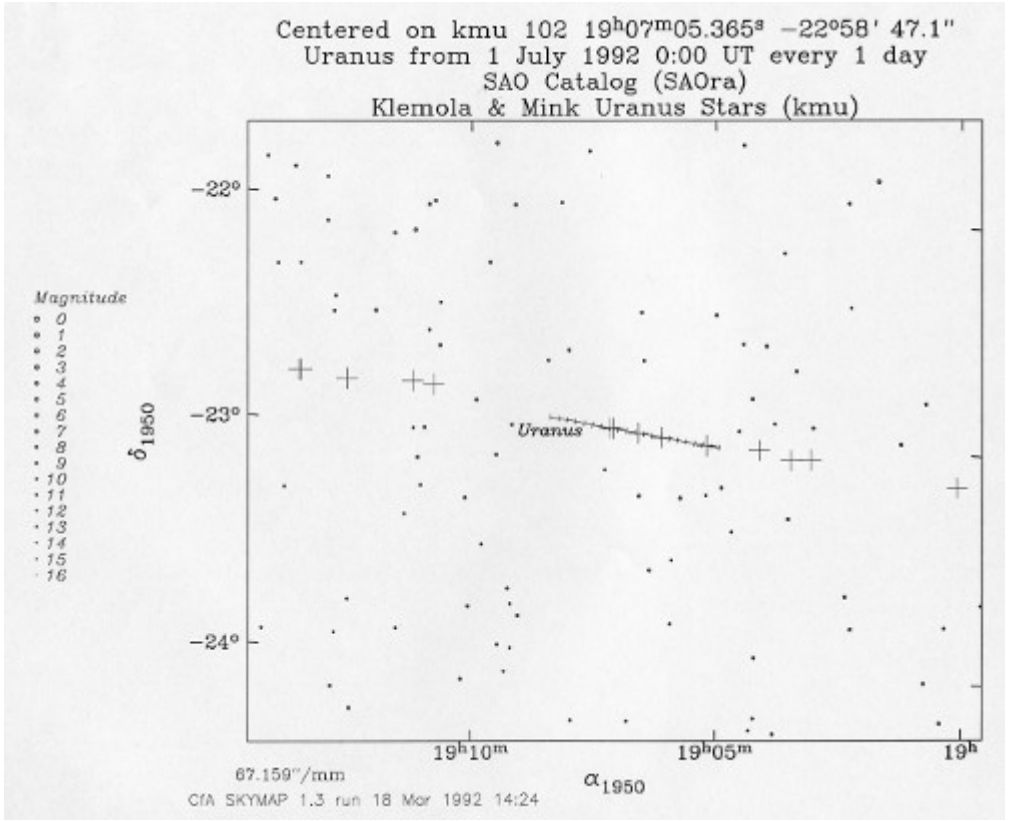
Make candidate catalog

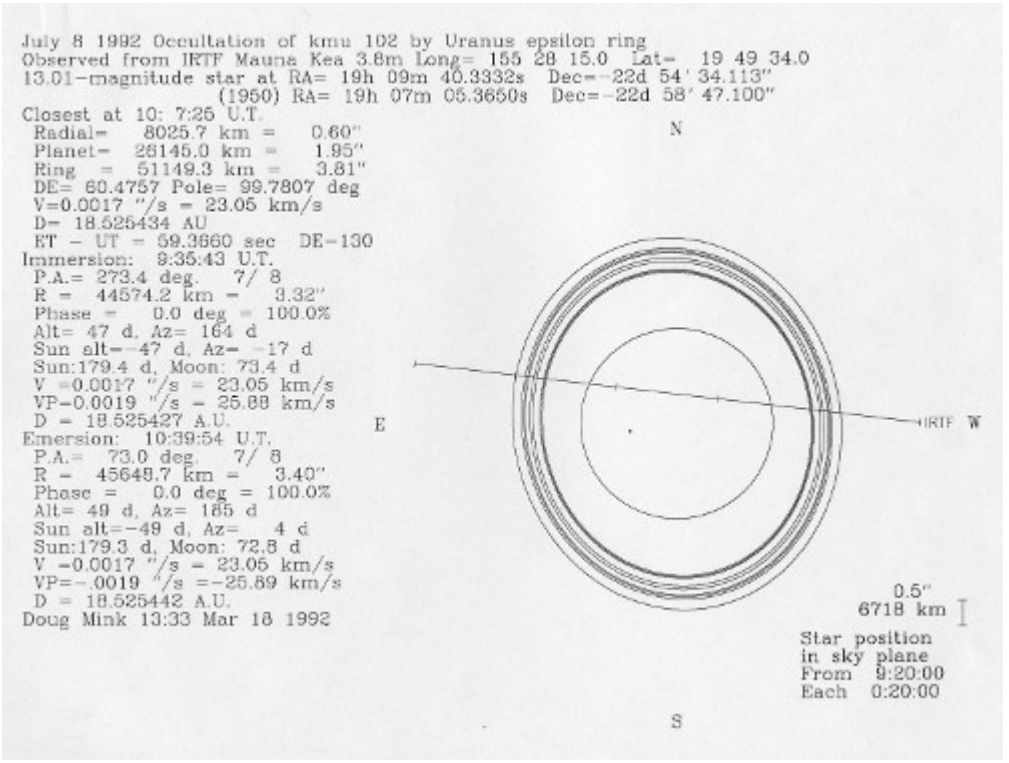
Sort by RA
Remove duplicate entries
Renumber
Make binary file
Find close stars in 10" boxes
Run predictions

Publish close event predictions in AJ article

Jessica Mink, LVAAS, June 13, 2021

Predicting Occultations

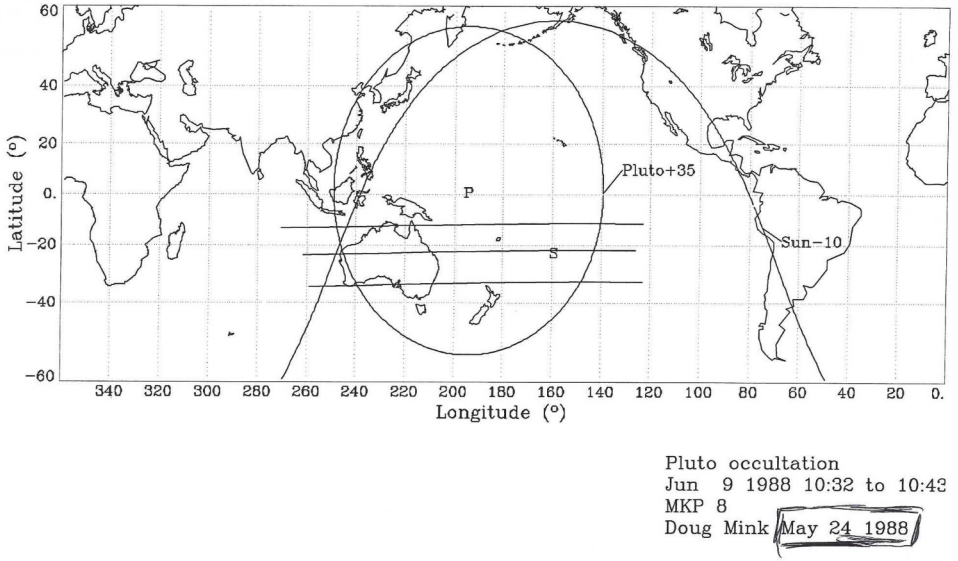




Palomar Sky Survey overlay for stars occulted by Uranus

Sky plane map of Uranus ring occultation of KMU102

Pluto in 1988



My last predicted ground track

The Boston Globe

Nice couple of rays
Friday – Partly sunny, in 60s
Saturday – Sunny, in low 70s
High tide – 8:31 a.m., 8:55 p.m.
Full report – Page 22

FRIDAY, JUNE 10, 1988 *35 cents at newsstands beyond 30 miles from Boston 88 Pages • 25 cents

Key Pluto find in MIT project

By J. Kelly Beatty
Special to the Globe

PAGO PAGO, American Samoa – Pluto is surrounded by what appears to be a substantial atmosphere, a team of astronomers from the Massachusetts Institute of Technology concluded yesterday after making unprecedented observations of the remote planet.

If the observations – made from a NASA plane equipped with a large telescope – are confirmed by more careful analysis, the discovery will end years of debate among researchers, some of whom believe Pluto's gravity is too weak to retain any gas around it.

PLUTO, Page 12

Key find in study of Pluto recorded by astronomers in MIT project

■ PLUTO
Continued from Page 1

The revelation also will fuel major changes in man's knowledge of the frigid little world, which only recently has begun to give up its secrets after six decades of obscurity.

Even its diameter, currently believed to be about 1,500 miles – considerably smaller than that of Earth's moon – was wildly uncertain until a few years ago.

Even in the largest telescopes, neither Pluto nor its own moon, Charon, appears as anything more than a faint pinpoint of light. They lie at the outer fringe of our planetary system at an average distance of 3.7 billion miles from the sun.

The high-flying expedition was led by James L. Elliot and Edward W. Dunham of MIT's department of Earth and planetary sciences.

From a remote point high over the Pacific Ocean, 3,500 miles south of Hawaii, they were able to watch Pluto pass in front of a faint star, an astronomical phenomenon known as an occultation.

In effect, the overlapping of Pluto and the star caused the planet to cast a small circular shadow across space that raced over the Pacific at about 40,000 m.p.h.

The entire event, which occurred at 6:37 a.m. EST or shortly after midnight at the plane's location, lasted only 80 seconds.

Elliot and Dunham said they believe some kind of gas must surround Pluto because the star's light disappeared and reappeared gradually, rather than abruptly.

"I congratulate them on succeeding with this because it is very difficult," said Dr. Brian Marsden, associate director for planetary sciences at the Harvard-Smithsonian Center for Astrophysics in Cambridge. "Getting the aircraft in the right place at the right time was certainly a remarkable feat."

Several observing teams in Australia and Hawaii tried to catch a glimpse of the star's disappearing act. At least one of them was able to observe the occultation with a portable telescope from a point north of Brisbane, Australia, said Lawrence Wasserman, an astronomer with the Lowell Observatory in Flagstaff, Ariz., in a telephone interview.

Collectively, the results may lead to a more accurate estimate of Pluto's diameter, by far the smallest of the solar system's nine planets.

No occultation by Pluto ever was recorded before, although astronomers have attempted to predict and view several of them since the planet was discovered in 1930. Such events are rare because Pluto moves very slowly, taking about 250 years to circle the sun.

From Earth, Pluto's disk appears 300 million times smaller than that of Earth's full moon, too small to sweep over many of the stars lying along its apparent path in the sky.

During one near-miss in 1980, a star was covered briefly by Charon. By noting how long the star remained out of view, the sole witness, a South African astronomer, calculated that Charon must be at least 800 miles in diameter, a large fraction of the size of Pluto. Pluto and Charon are the solar system's best example of double planet.

Because of its great distance from the sun, Pluto's temperature never rises above minus 415 degrees Fahrenheit. It is currently "summer" on Pluto, because its markedly elliptical orbit has brought it inside the orbit of Neptune and will keep it there until 1999.

Elliott and Dunham are not sure what kinds of gas surround Pluto, but at such frigid temperatures, there are only a few possibilities.

The presence of methane was detected in 1976, but it could be in the form of a liquid or ice as well as gas. Other possibilities are argon, nitrogen, oxygen, carbon monoxide and neon. The planet itself is thought to consist of roughly equal amounts of ice and rock.

J. Kelly Beatty, senior editor at Sky and Telescope magazine, accompanied the astronomers on the observation flight.

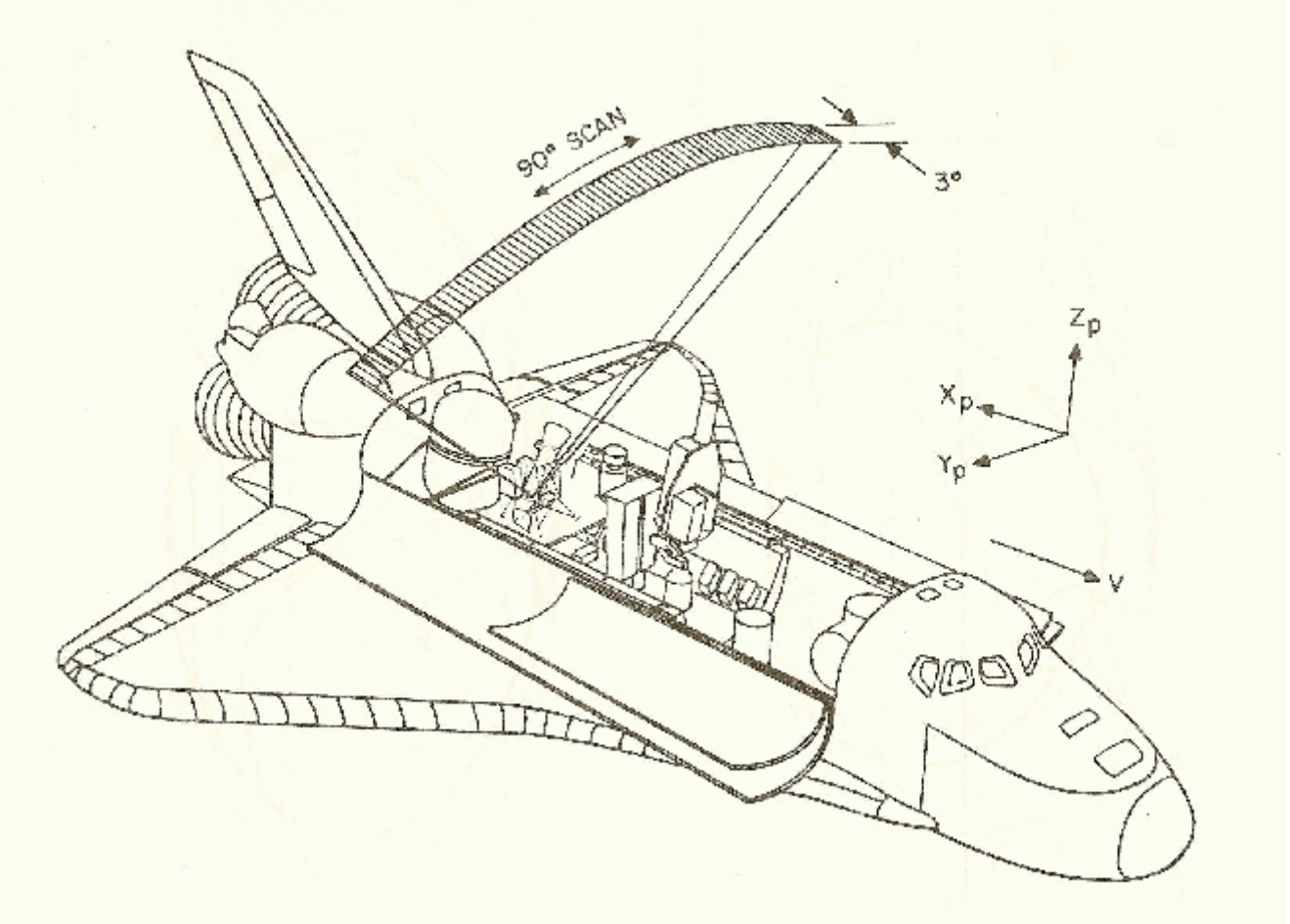
Pluto's shadow

Dark band shows passage of Pluto's shadow across Pacific.

Globe staff graphic/Anthony Schultz

Boston Globe article with my track re-projected.

All-Sky IR Mapping from Space



Spacelab 2 Infrared Telescope

(Space Shuttle Challenger, July 1985)

Jessica Mink, LVAAS, June 13, 2021

For Maps, Write a Graphics Terminal

XTERM(1) X Window System XTERM(1)

NAME

xterm - terminal emulator for X

SYNOPSIS

xterm [-toolkitoption ...] [-option ...] [shell]

DESCRIPTION

The xterm program is a terminal emulator for the X Window System. It provides DEC VT102/VT220 and selected features from higher-level terminals such as VT320/VT420/VT520 (VTxxx). It also provides Tektronix 4014 emulation for programs that cannot use the window system directly. If the underlying operating system supports terminal resizing capabilities (for example, the SIGWINCH signal in systems derived from 4.3BSD), xterm will use the facilities to notify programs running in the window whenever it is resized.

The VTxxx and Tektronix 4014 terminals each have their own window so that you can edit text in one and look at graphics in the other at the same time. To maintain the correct aspect ratio (height/width),

SEE ALSO

resize(1), luit(1), uxterm(1), X(7), pty(4), tty(4)

Xterm Control Sequences (this is the file ctlseqs.ms).

http://invisible-island.net/xterm/xterm.html
http://invisible-island.net/xterm/ctlseqs/ctlseqs.html
http://invisible-island.net/xterm/xterm.faq.html

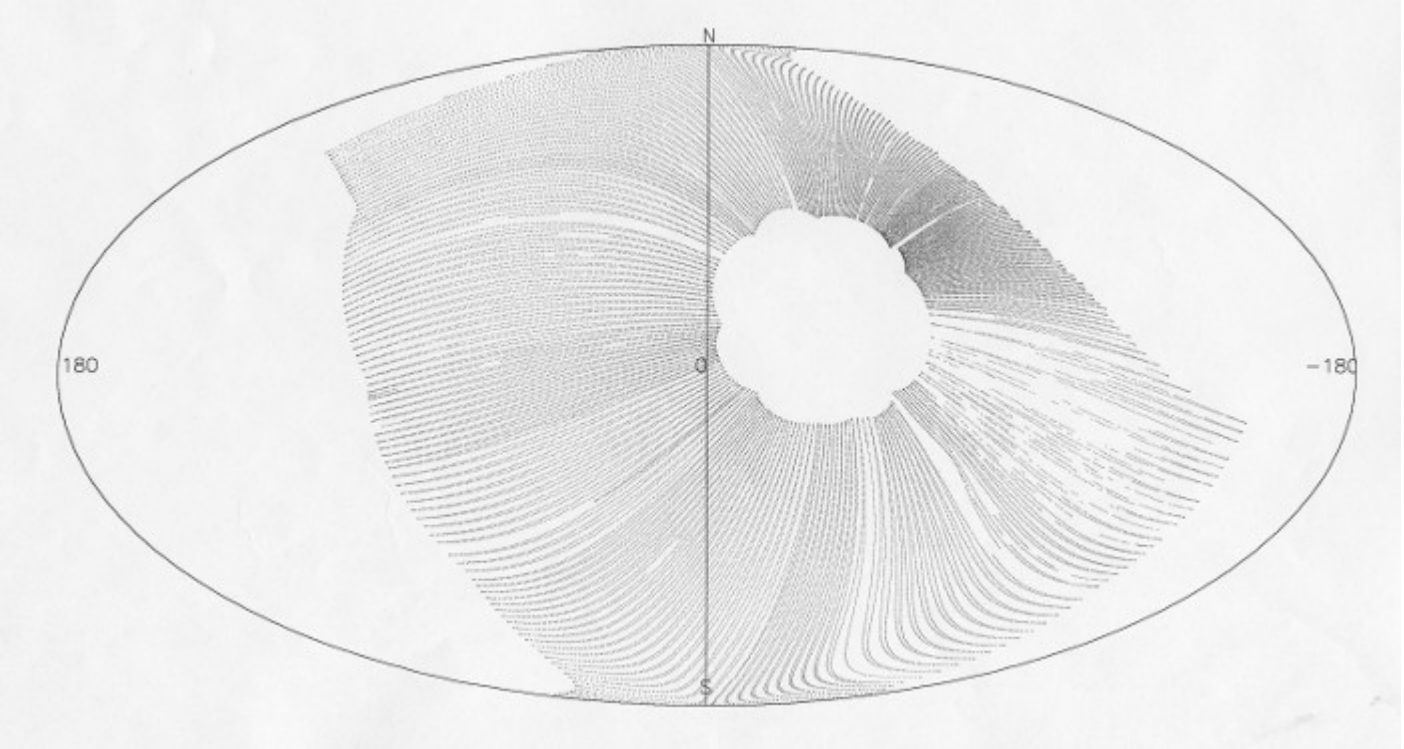
AUTHORS

Far too many people, including:

Loretta Guarino Reid (DEC-UEG-WSL), Joel McCormack (DEC-UEG-WSL), Terry Weissman (DEC-UEG-WSL), Edward Moy (Berkeley), Ralph R. Swick (MIT-Athena), Mark Vandevoorde (MIT-Athena), Bob McNamara (DEC-MAD), Jim Gettys (MIT-Athena), Bob Scheifler (MIT X Consortium), Doug Mink (SAO), Steve Pitschke (Stellar), Ron Newman (MIT-Athena), Jim Fulton (MIT X Consortium), Dave Serisky (HP), Jonathan Kamens (MIT-Athena), Jason Bacon, Jens Schweikhardt, Ross Combs, Stephen P. Wall, David Wexelblat, and Thomas Dickey (invisible-island.net).

Patch #330 2017-06-20 XTERM(1)

All Sky IR Mapping from IRT



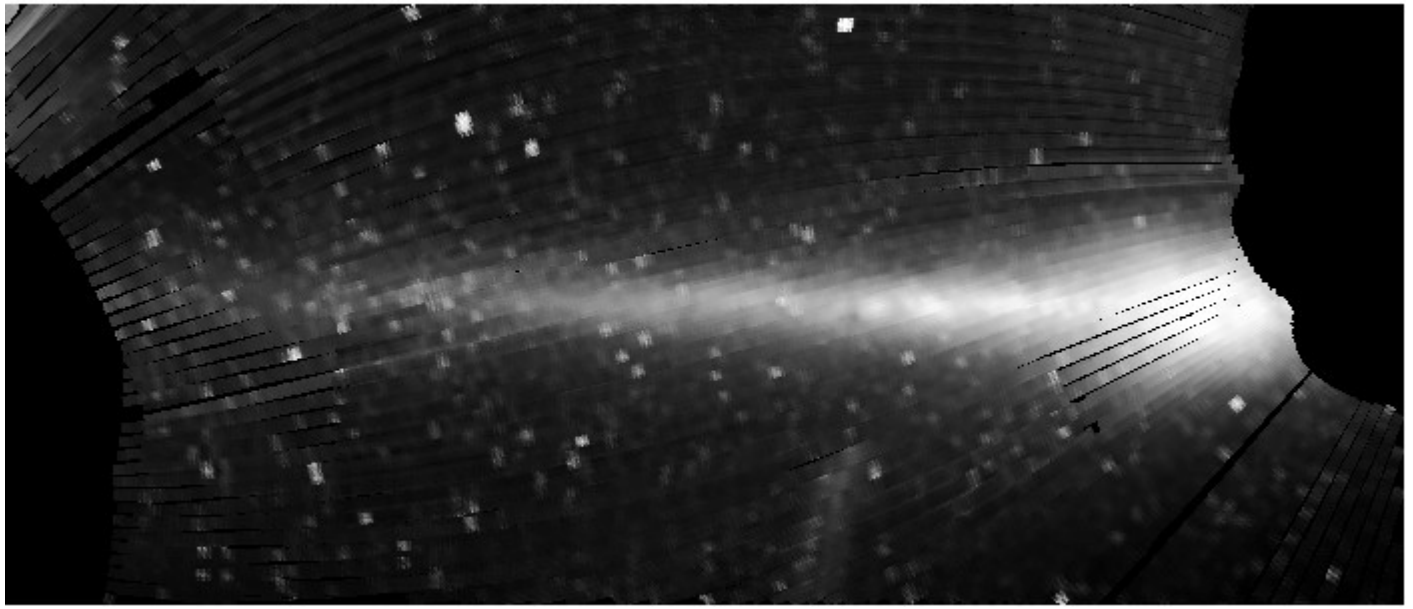
1985 Day 213, Orbit 4, 50,964 0.1-sec frames

Spacelab 2 Infrared Telescope

(Space Shuttle Challenger, July 1985)

Jessica Mink, LVAAS, June 13, 2021

Galactic Center from Spacelab 2



Linear Projection in Galactic Coordinates
(Mink, August 1990, unpublished)

Jessica Mink, LVAAS, June 13, 2021

Galactic Center from Spacelab 2

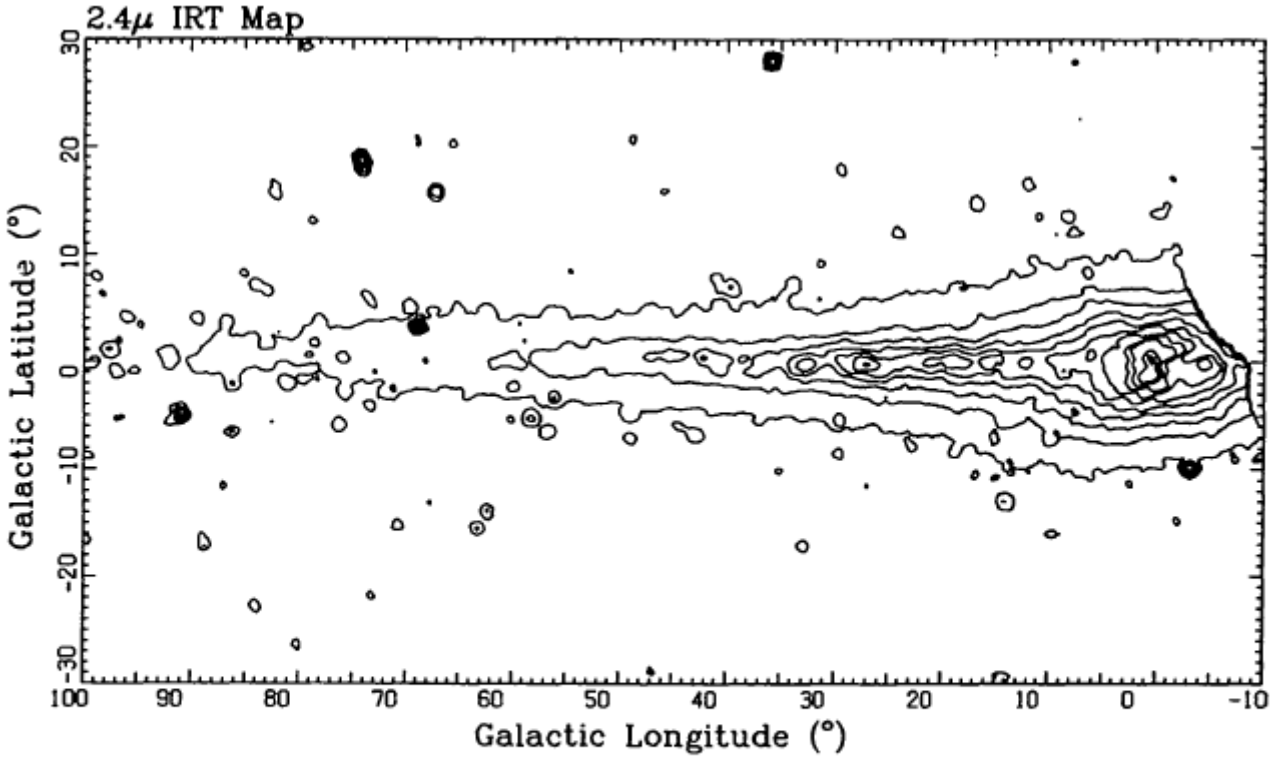
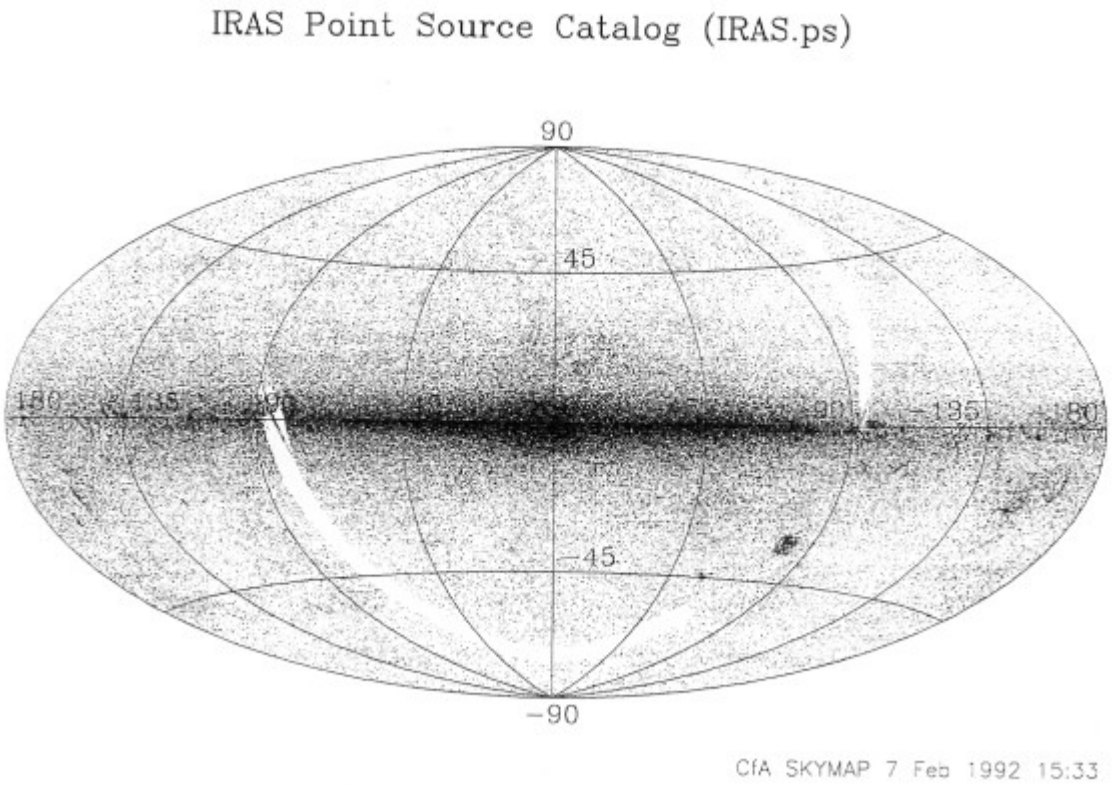


FIG. 5.—Contour map of the 2.4 μm emission from the Galactic plane region. The contours are spaced logarithmically in 10 steps between 0.67×10^{-10} and 16×10^{-10} W cm^{-2} μm^{-1} sr^{-1}.

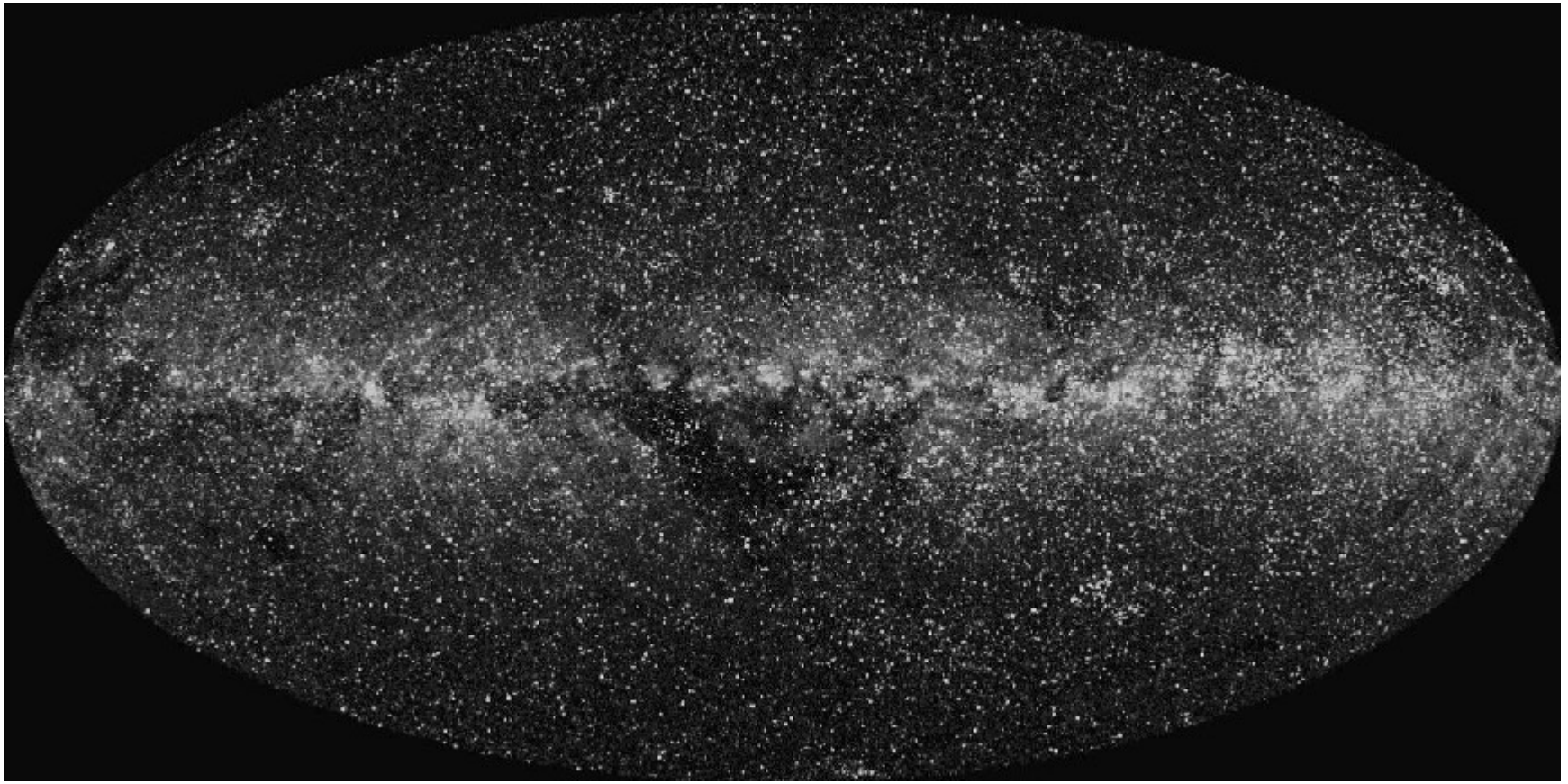
Linear Projection in Galactic Coordinates

(Kent, Mink, Fazio, Koch, Melnick, Tardiff, Maxson, ApJS 78:403-408, 1992)

All-Sky Maps meet Catalogs



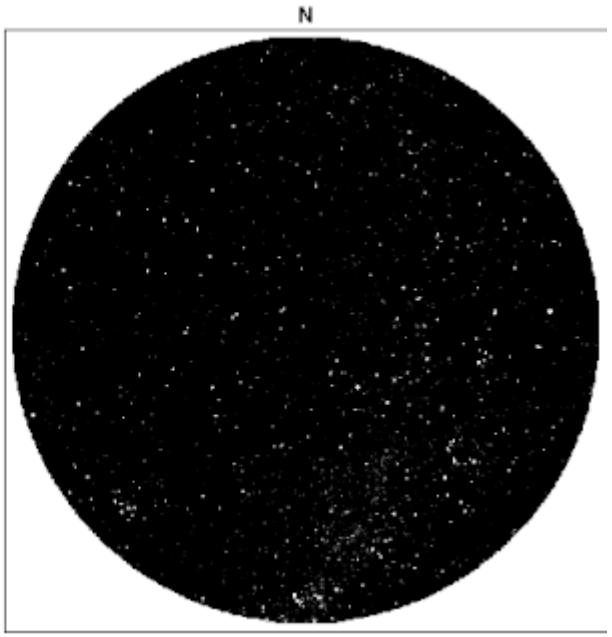
All-Sky Maps meet Catalogs



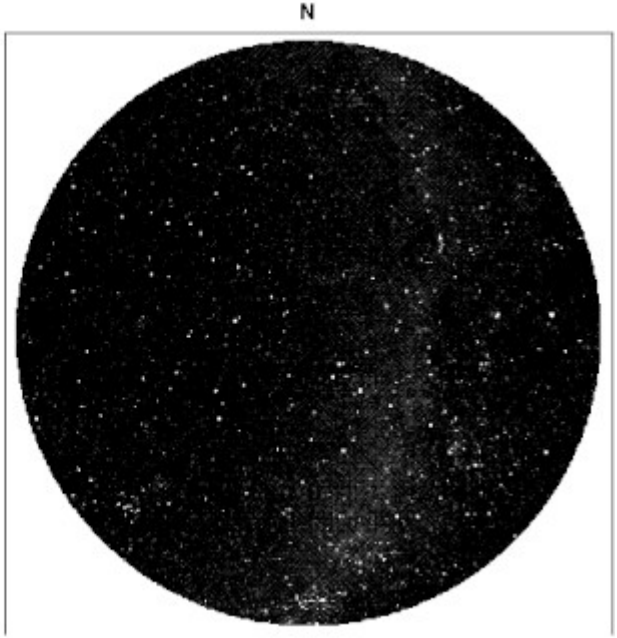
Space Telescope Guide Star Catalog, Galactic Plane, Aitoff Projection
(Mink, D.J. 1994. In Astronomical Data Analysis Software and Systems III, A.S.P. Conference Series, Vol. 61, 1994, Dennis R. Crabtree, R.J. Hanisch, and Jeannette Barnes, eds., p. 191)

Galileo's Telescope Expands the Sky

Rome, Italy
April 14, 1611 7:00 PM
Sky to 6th magnitude
(Naked eye)



Rome, Italy
April 14, 1611 7:00 PM
Sky to 8th magnitude
(Galileo's telescope)

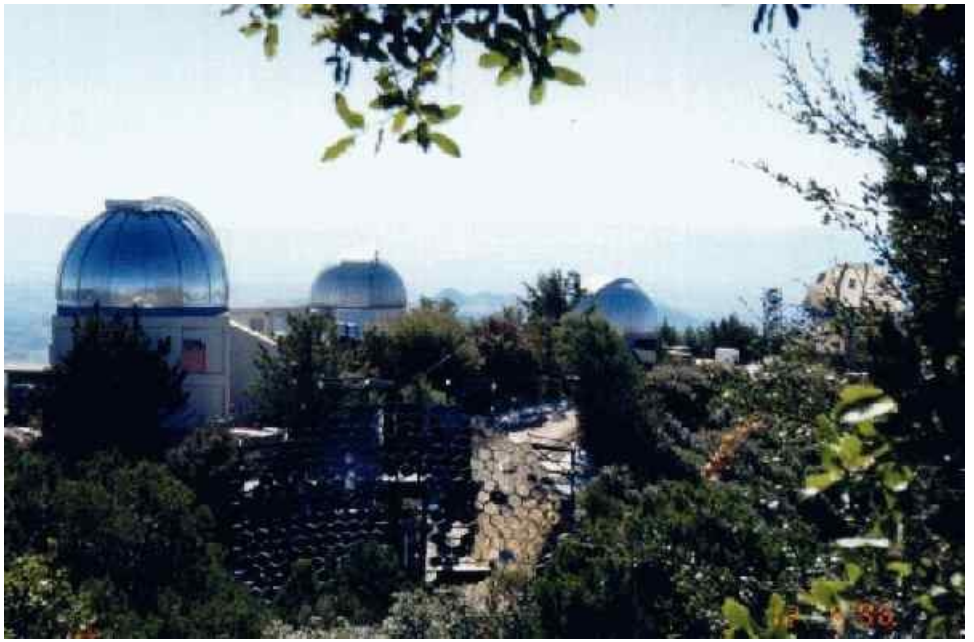


Polar projections centered on local apex in Rome

Owen Gingerich will present a keynote address at a conference sponsored by the American Academy of Rome celebrating the moment in 1611 when Galileo Galliei proudly presented the "telescope" to the intelligentsia of Rome... the Academy asked Paine Professor of Astronomy and director of the Harvard-Smithsonian Center for Astrophysics Irwin Shapiro and his Center colleague Douglas Mink to produce a map of the stars as they appeared over Rome on the night of April 14, 1611. For their efforts, Shapiro and Mink received a Jeroboam of champagne; Gingerich, however, got a trip to Rome.
(Harvard Gazette, April 10, 1997)

Observing from the Ground At SAO

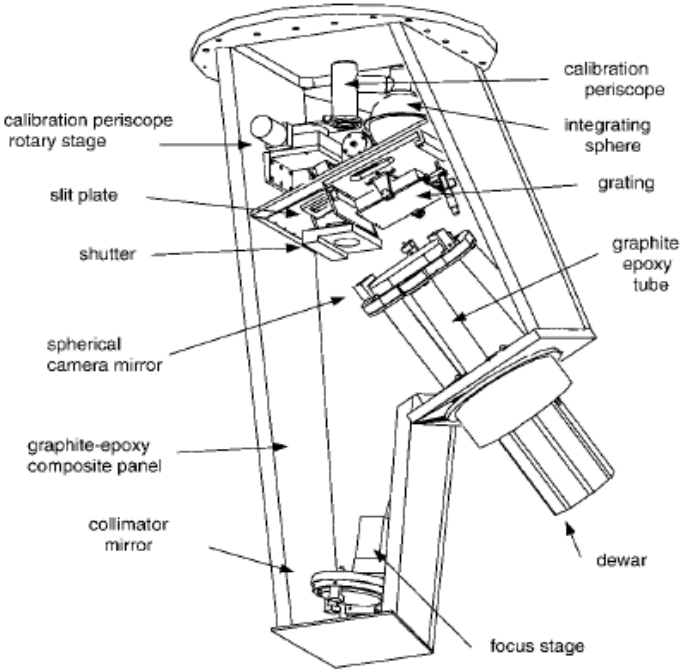
Mt. Hopkins Ridge with Telescopes



Mt Hopkins Ridge Telescopes
1.5-meter is on left

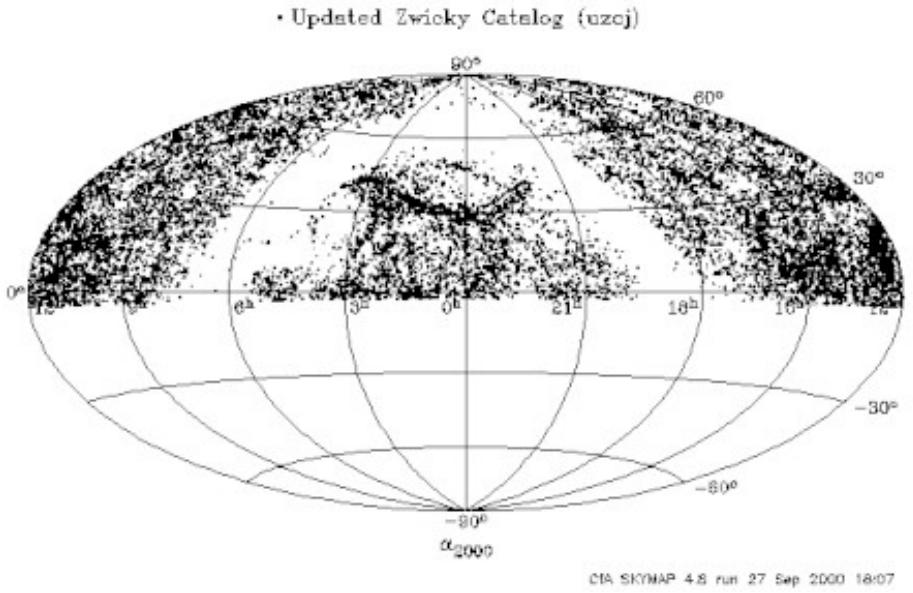
FAST Single Slit Spectrograph

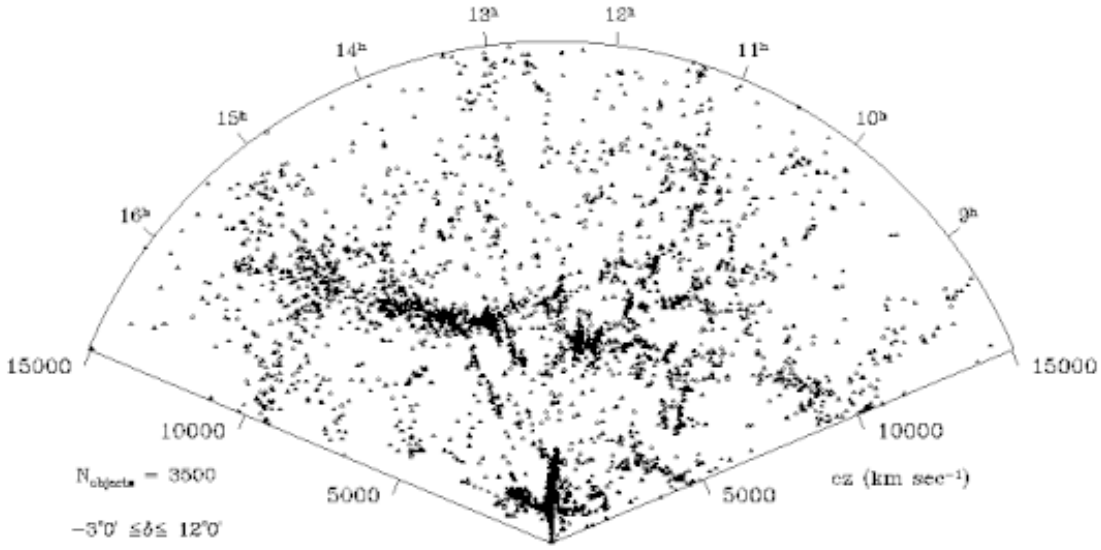
FAST mounted on the 1.5-meter Reflector



FAST Spectrograph

Updated Zwicky Catalog Galaxies with Redshifts



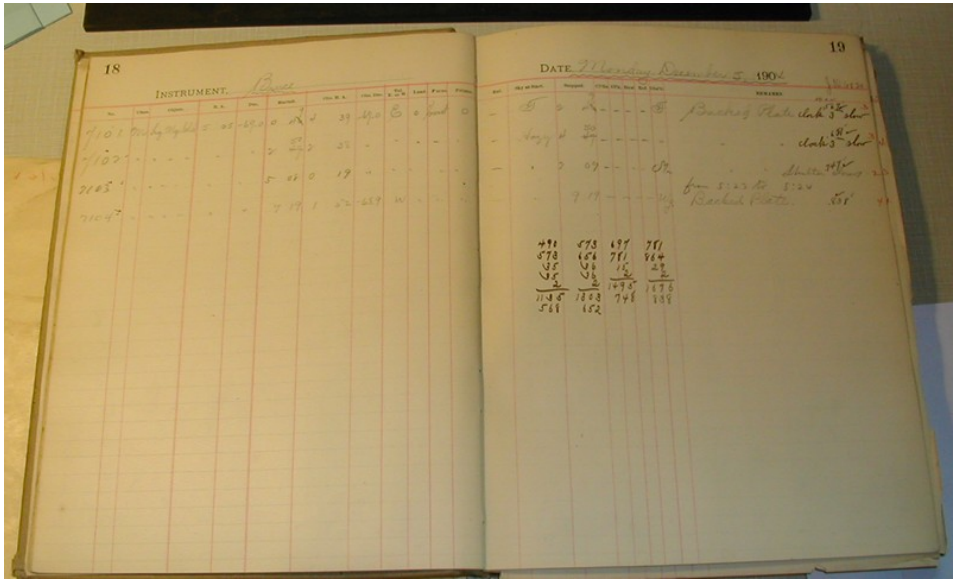


Updated Zwicky Catalog galaxies displayed on an Aitoff-Hammer all-sky projection

Galaxies RA 8h - 17h, Dec -3° - +12°, cz < 15,000 km/sec

Putting Positions on Harvard's Plates

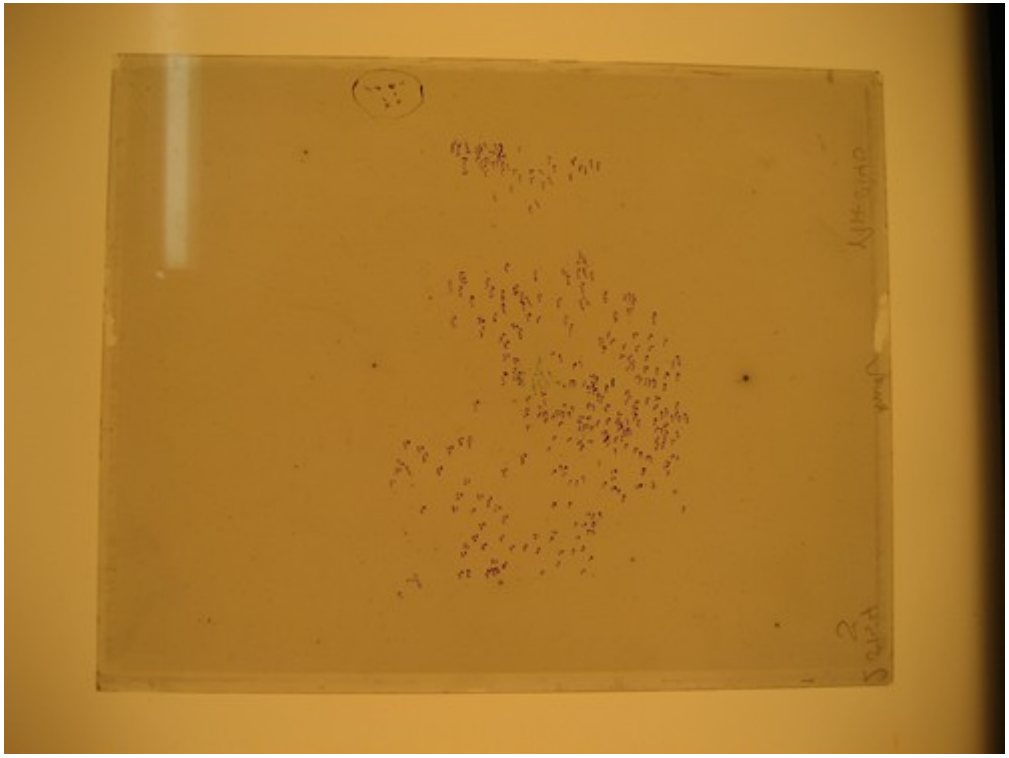
Mink, D.; Doane, A.; Simcoe, R.; Los, E.; Grindlay, J. (2006). "The Harvard Plate Scanning Project" in Virtual Observatory: Plate Content Digitization, Archive Mining and Image Sequence Processing, iAstro workshop, Sofia, Bulgaria, 2005 proceedings, Sophia: Heron Press Ltd.



From hand-written cards and logbooks

Putting Positions on Harvard's Plates

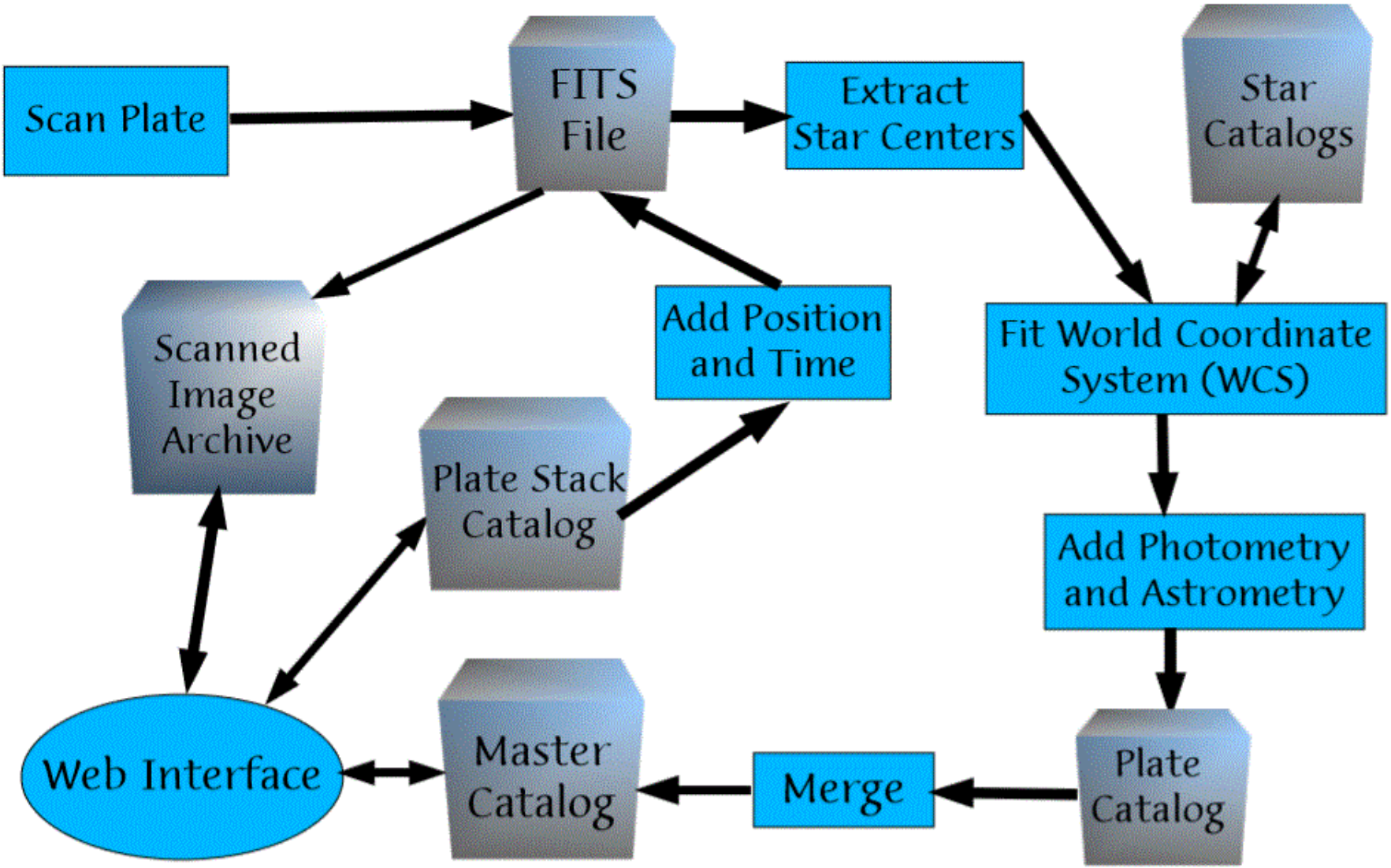
Mink, D.; Doane, A.; Simcoe, R.; Los, E.; Grindlay, J. (2006). "The Harvard Plate Scanning Project" in Virtual Observatory: Plate Content Digitization, Archive Mining and Image Sequence Processing, iAstro workshop, Sofia, Bulgaria, 2005 proceedings, Sophia: Heron Press Ltd.



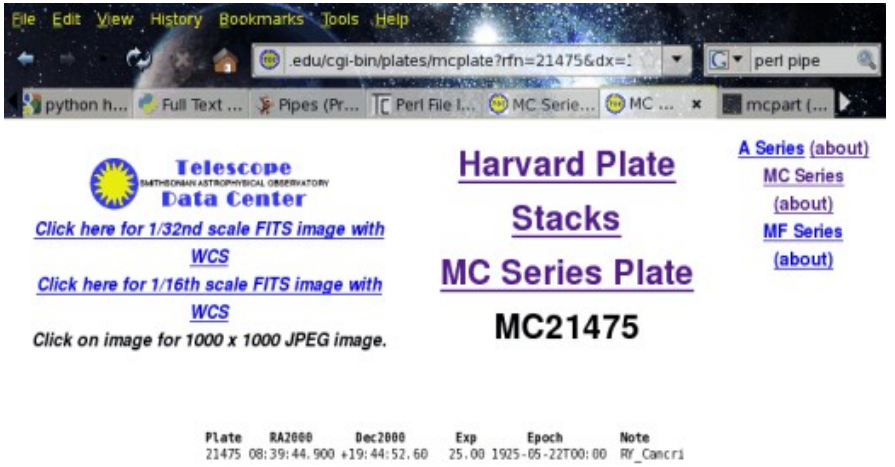
From three floors of cabinets of glass plates

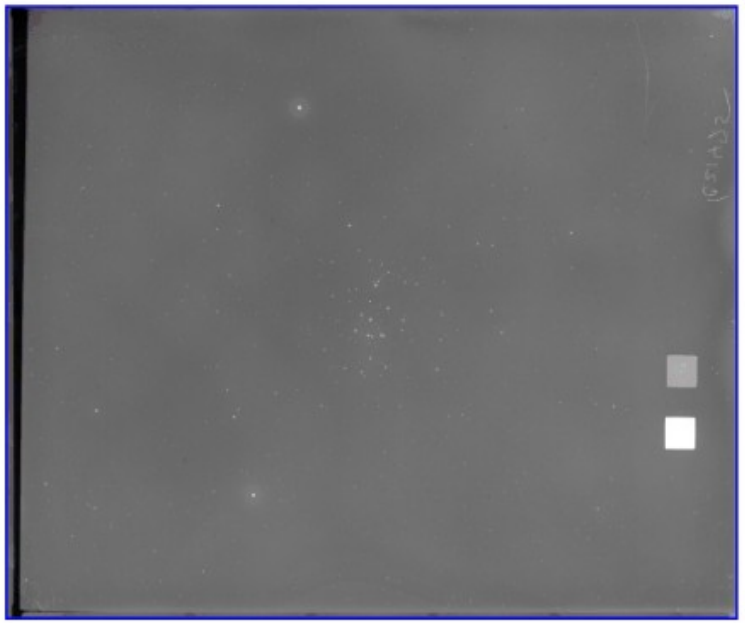
Jessica Mink, LVAAS, June 13, 2021

Harvard Plate Pipeline



Putting Positions on Harvard's Plates



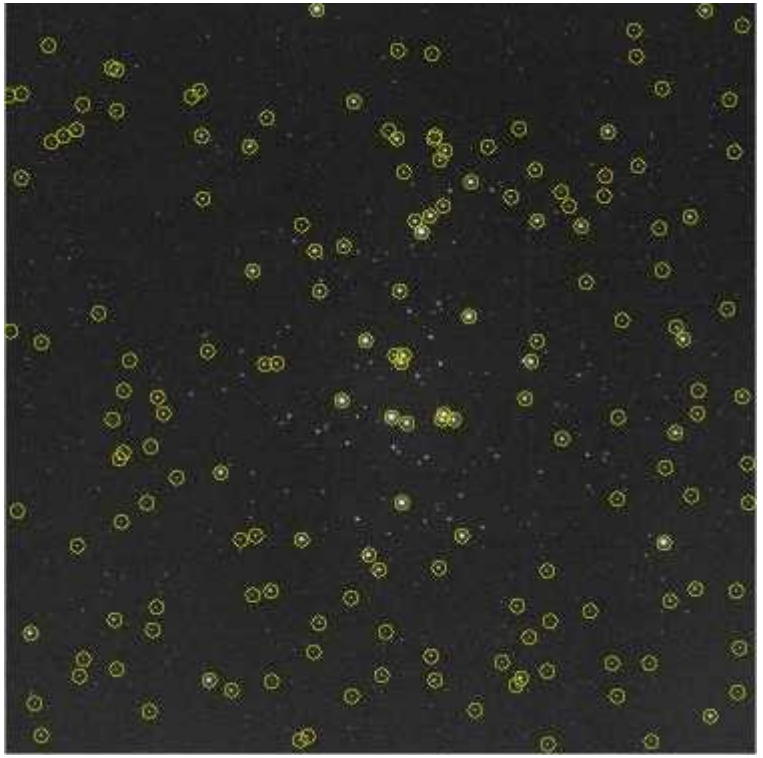


From glass to bytes on home-built scanner

Jessica Mink, LVAAS, June 13, 2021

Putting Positions on Harvard's Plates

M44 in Plate MC21438



M44 in Plate MC21438
with Tycho 2 Catalog stars marked

Zoom in and overplot stars using WCS

Jessica Mink, LVAAS, June 13, 2021

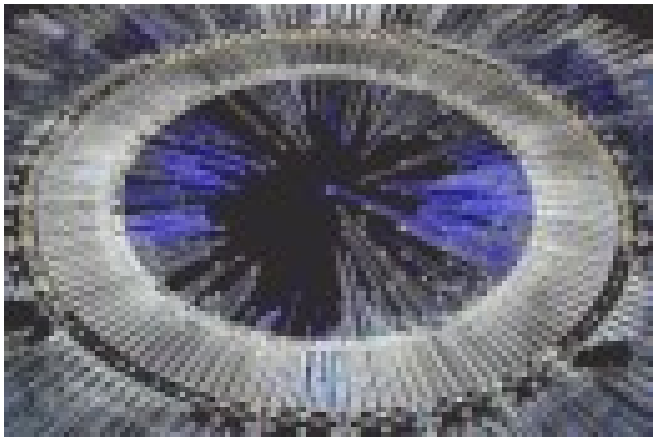
Putting Positions on Harvard's Plates

100,000th Plate Scanned, April 7, 2015

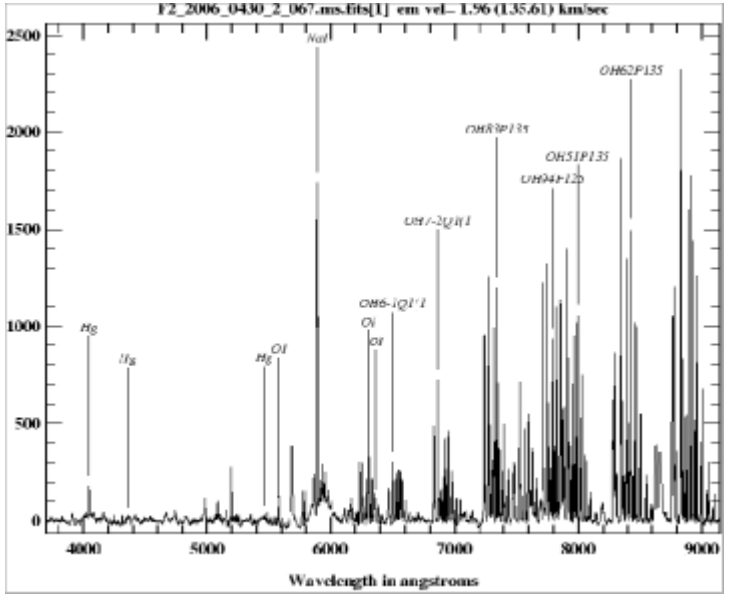
MITPAL 50th, April 17, 2018

Redshifting Into the Universe

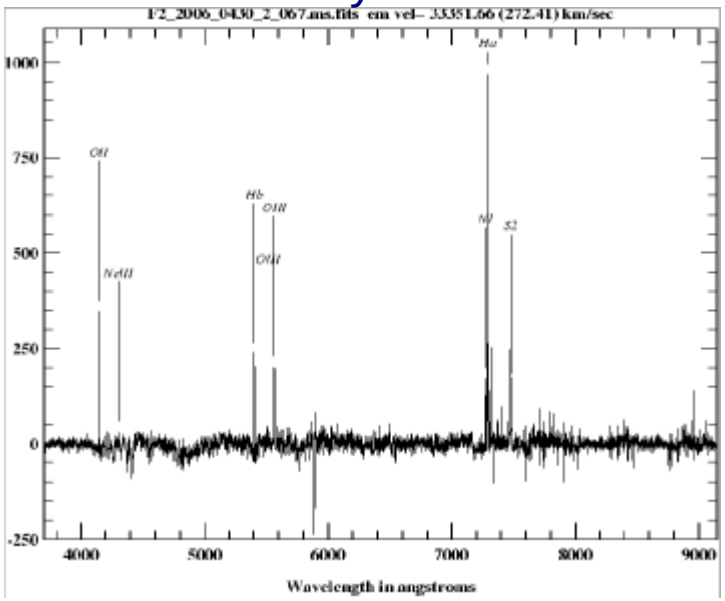
300-fiber spectrograph on the 6.5-meter MMT



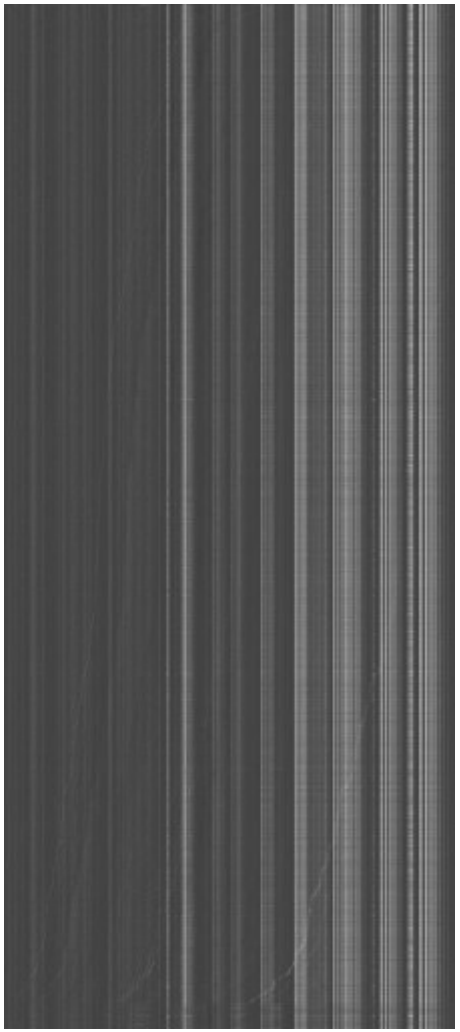
Redshifting Into the Universe



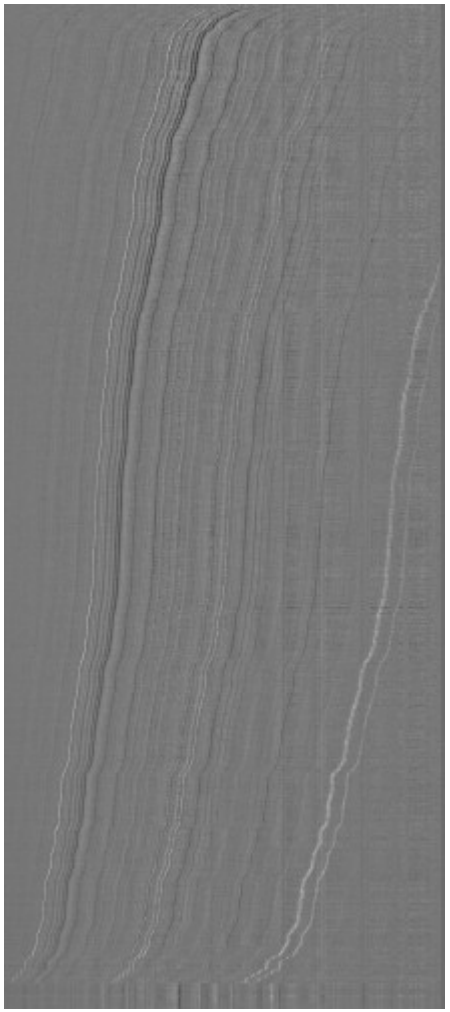
Before Sky Removal



After Sky Removal



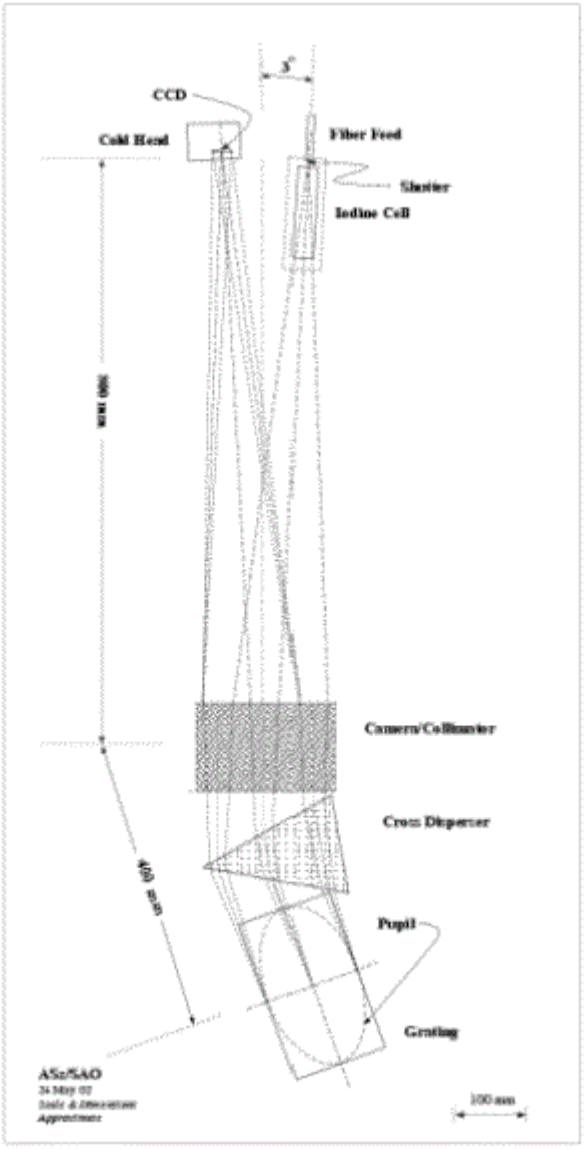
Before Sky Removal



After Sky Removal

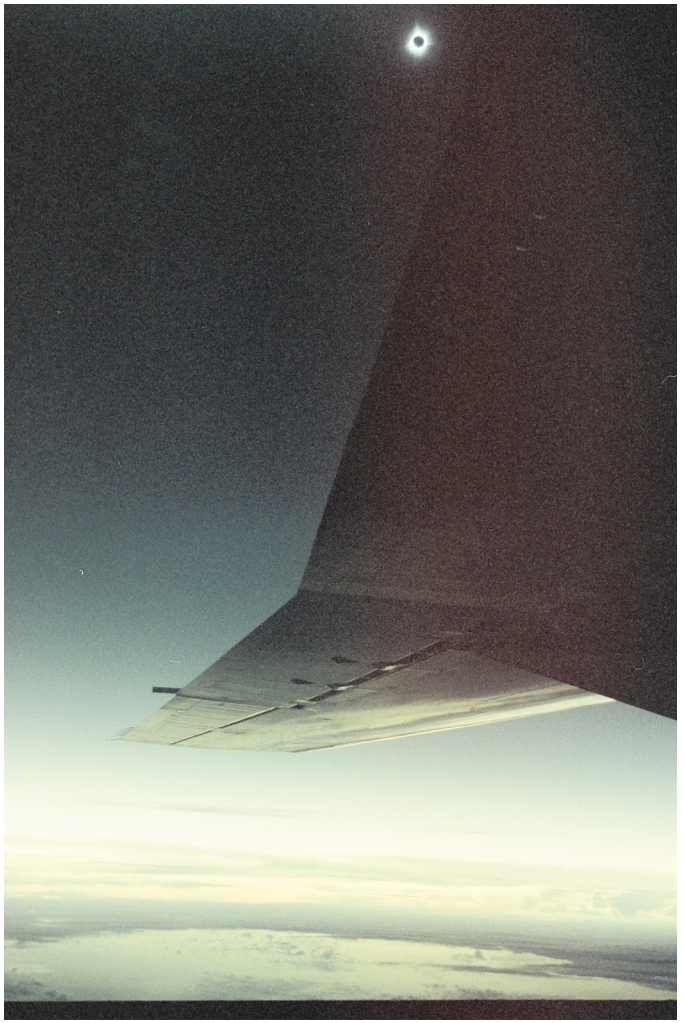
12,553 Spectra from the Hectospec SHELS survey

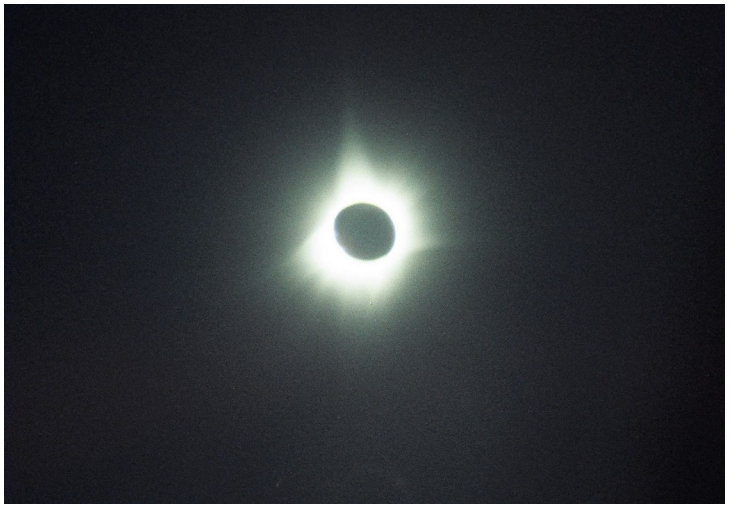
TRES 51-order Echelle Spectrograph



My Life in Eclipses

Total Eclipse from the KAO, July 11, 1983

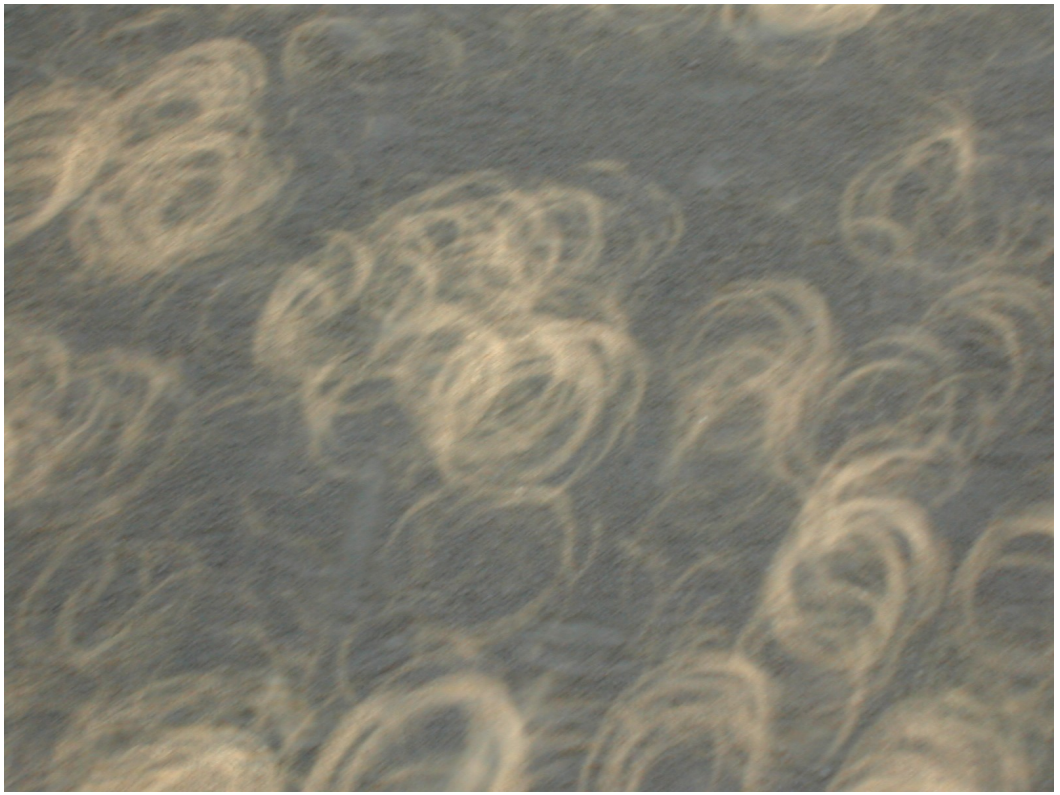




Jessica Mink, LVAAS, June 13, 2021

My Life in Eclipses

Annular Eclipse in El Escorial, Spain, October 3, 2005



My Life in Eclipses

Partial Eclipse from Cambridge, Massachusetts, August 21, 2017

Jessica Mink, LVAAS, June 13, 2021

My Life in Eclipses

Partial Annular Eclipse in Roslindale, Massachusetts, June 10, 2021

Jessica Mink, LVAAS, June 13, 2021