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Russell Crotty and Lick Observatory @ SJICA

by David M. Roth

"Look Back in Time," 2016, a mixed media installation inspired by Crotty's residency at Lick Observatory and at UC Santa Cruz, where he was privy to high-level discussions among astrophysicists.

Describing the shape and character of the universe is a mind-bending proposition even for those who claim to understand it. Russell Crotty, an artist who's as comfortable conversing with astrophysicists as he is creating work about dark energy and black holes, has, with help from two collaborating institutions, enhanced our appreciation of scientific inquiry with an exhibit called **Look Back in Time: Russell Crotty and Lick Observatory**. It's one of those rare instances when a merger of art and science produce more than just hollow gestures of interdisciplinary goodwill.

The exhibit has three parts. One is an installation by Crotty based on a two-year residency in which he divided his time between Lick's Mount Hamilton observatory, a research facility managed by the University of California, and the UC Santa Cruz (UCSC) campus, where he engaged with faculty astrophysicists. The second is a mini retrospective of Crotty's earlier (2000-08) works on paper. A third portion, drawn from Lick's Historical Collections Project, consists of photos, optical instruments, logbooks, furniture and memorabilia that take us back – literally – to what Crotty called "the golden age of

Crotty and John Weber at Lick's Great Refractor

astronomical drawing” (1880-1930). The two sides of the show cross-pollinate at every turn, each brimming with unexpected aesthetic and conceptual conjunctions.

The idea for the project originated with John Weber, founding director of the Institute of the Arts and Sciences (IAS), a part of the Arts Division at UCSC; Tony Misch, a former Lick astronomer; and Cathy Kimball, the San Jose Institute of Contemporary Art's executive director and chief curator. Together, on this project, they formed something of a curatorial dream team. Weber was previously director of the Tang Museum at Skidmore College and before that, curator of education and public programs at SFMOMA for 11 years ending in 2004. Misch trained as an artist — he earned an MFA in painting from Otis Art Institute — but upon graduating switched to astronomy. His stunning video animation, made from still photos of the 1908 Comet Morehouse, is one of the show's highlights, on view in the Cardinale Project Room. Since retiring in 2007, he’s taken up the job of cataloging Lick's collection, which dates to 1888, the year the facility was founded as the world’s first mountaintop observatory. (An interview with Misch appears below.) Kimball’s history of presenting contrarian views of both art and science is a long one, well known to Bay Area audiences. Several years back, when the three organizers were discussing which artist to include in this show, Crotty's name sprung immediately to mind: He was the only one they knew who worked from direct astronomical observation.

M28 Globular Cluster in Sagittarius, 2000, Ink on paper mounted on Lucite 24" diameter globe

That distinction places Crotty in rarified company, if not among artists, then certainly among astronomers. “One of the things I learned” during the residency, the artist says speaking from his studio in Ojai, is that professional astronomers “don’t look through telescopes visually anymore. It’s all screens and data collection. A lot of times it’s remote. There’s a technician up on the mountaintop at the telescope and there’s a grad student in the basement at UC Santa Cruz” collecting and analyzing data. “This old idea of the astronomer in the tweed jacket with the cap on, sitting at the eyepiece freezing all night is not really true anymore.” Thus, being able to direct Lick’s technicians to aim its telescopes at any point in the sky constituted a rare opportunity. Crotty, a self-described "serious amateur," called the experience “magical.”

“What they’re doing,” he explained “is adaptive optics. It’s a laser system that shoots into the upper atmosphere and uses mirrors to correct for turbulence," altering "the images before they go into CCD cameras or spectrographs.” The results, he says, “are almost as good as those taken from space.”

M37 in Auriga, 2008, Ink and watercolor on paper on fiberglass sphere 12" globe

The artist traces his fascination with things cosmological to high school when he spotted Jupiter and its moons through a borrowed telescope. Later, while earning BFA and MFA degrees at SFAI and UC Irvine, he put that interest on hold, but returned to it in 1992 while housesitting in the Santa Monica Mountains. There, he built an observatory and "launched into serious astronomical work." His earliest drawings in this vein consisted of "tight grids" done with a ballpoint pen showing "multiples of Jupiter and Saturn." These were preceded by large-scale drawings about surfing, which he described as having "a lowbrow quality, emblematic of what Christopher Knight called the "pathetic aesthetic," in vogue in the early 1990s among such artists as Raymond Pettibon, Mike Kelley and others. "It was," says Crotty in reference to his oeuvre up until around 2008, "all about pushing drawing to extremes," by which he means not just mark making, but also the limits of his own physical endurance. In the mid-2000s, a doctor advised him to find a new way to work, lest the severe case of tendonitis he'd developed become irreversible.

Examples of that obsession – which he's since relinquished — greet visitors at the entrance to the SJICA in the form of two large, paper-covered fiberglass spheres on which he's made intricate drawings depicting starry skies. They hang at eye-level from the ceiling alongside framed 2-D works and a six-foot-long table upholding a bound "book" (*Field Charts for Nocturnal Recreations*, 2005) of similarly conceived drawings so large and weighty, two gallery assistants are required to flip the "pages." What distinguishes these works is that viewing them feels more akin to looking at tightly woven textiles than it does to stargazing.
Their silver-gray-black surface textures are impossibly dense, rivaling even those seen in Bruce Conner's mandala drawings. The alternately luminous/dark tonality of the drawings, says the artist,

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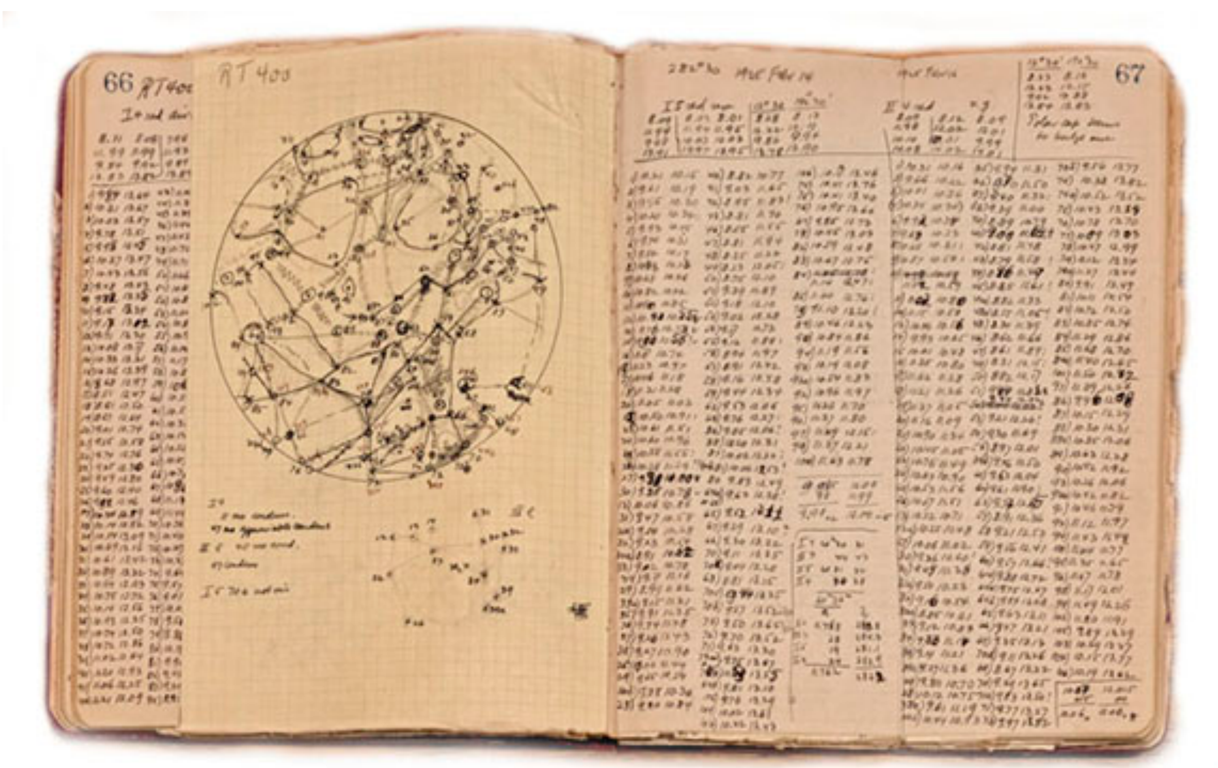
Field Charts for Nocturnal Recreations, 2005, Ink and watercolor on paper and vellum in 10 pages bound on table, 72 x 61 x 7”

corresponds to what astronomers call “seeing conditions.” By portraying them in the round, on planet-shaped objects, Crotty effectively situates viewers *in* space, which runs counter to our habit of looking *up* at the sky. That, the artist told me, was not an attempt on his part to upend the normal order of things, only a byproduct of seeing the cosmos through the circular vignette of a telescope. It’s an artistic masterstroke, and, quite possibly, a singular invention.

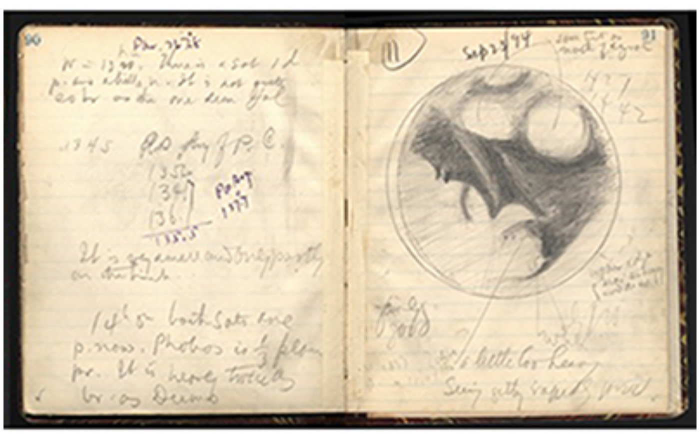
Lick’s portion of the show, assembled by Misch, is the ideal counterpoint to Crotty’s labor-intensive drawings; it shows how astronomers worked in the pre-digital era: observing, measuring and sketching by hand what they saw. The centerpiece is a wall-mounted cabinet containing 132 file boxes filled with logbooks, 25 of which are open to view.



Astronomer's observation logbook

Each contains precisely recorded numerical calculations derived from spectrograms — photos of light coming off stars. Recorded on 4 x 5-inch glass plates between 1896 and 1928, they resemble jagged, horizontal versions of Barnett Newman's "zips." From these astronomers were able to glean knowledge not only about the existence of stars and their rotational patterns, but also their chemical makeup – a boggling notion when you consider the raw, inchoate quality of the negatives. (For an example, see the Tony Misch interview below.)

Such documents challenge the sensational, wiz-bang view of astronomy promoted by TV showmen like Neil deGrasse Tyson. They "demonstrate," says Misch, "that doing science is made up of many slow, painstaking and often repetitive acts, but that in those acts — especially when seen in the aggregate — there lies a subtle beauty every bit as wondrous as the breathtaking pictures that usually illustrate astronomy."



E.E. Barnard Notebook, circa 1892-1895

Mounting the exhibit at the SJICA, rather than in a science or history museum, he says, "allowed the objects' quiet visual poetry to be better felt, with a minimum of didactic interference. I also wanted visitors to experience the palpable connection to the human hand in the scientific process: the hand-written labels on well-worn file boxes and drawing styles of individuals, the inked notations on the photographic plates, the wear and tear of handling on the instruments."

Of the many on view, the one that grabbed and held my attention longest was a telescope clock drive. The hand-cranked mechanism resembles, in a very rudimentary fashion, a pulley-and-weight driven grandfather clock. Its purpose was to keep celestial objects in focus as the Earth turned. I tried envisioning the calculations needed to design such a device and came up short, math never being my strong suit.

Nevertheless, I remained awestruck by the simple elegance of it, the precision of its meshing gears, the carefully calibrated weight, and the fact that it actually worked. I experienced similar feelings looking through a loupe at E.E. Barnard's glass plate photos (1892-1895) of the Milky Way, noting how the chemistry contained in "microscopic grains of silver" as Misch called them, enabled me, more than century hence, to travel through space and time.

Telescope clock drive with flyball governor, c. 1890

These things also captivated Crotty during his mountaintop residency, when he poured over the archives with Misch. But when it came to creating *Look Back in Time*, the work for which the entire project is named, it was the esoteric discussions being carried out among astronomers on the UCSC campus that led him to visualize the history of the cosmos as an installation. The roadmap for that effort, says Crotty, came from astrophysicist Garth Illingworth. "He showed me a chart called *The History of Everything* that depicted the current universe all the way back to the Big Bang. It kind of stuck in my head." Later, when Crotty's wife, Laura Gruenther, who he credits with helping him design and build the exhibit, suggested he "do more than just wall pieces it all clicked: I decided to approach it three dimensionally."

In this, the artist takes fantastic liberties, mixing elements of Pop, Abstract Expressionism, post-Minimalism and Funk to build a semi-transparent, walk-through environment whose comic character reflects the challenge of trying to make visual sense of 13 billion years of cosmic upheaval. "There's a lot we left out," Crotty allows, "but the meat on the bones" – the development of universe as outlined by Illingworth — "is all there." The installation occupies about 675 square feet of space and consists of 16 semi-transparent, bioresin-covered pieces of fiber mesh suspended from the ceiling, each festooned with different elements: drawings, thread-like tendrils, gloopy masses, globular shapes and much else.

Installation view: Look Back in Time

Within and between the layers hang 26 sculptural objects. They call to mind the otherworldly forms of Lee Bontecou, the cubo-futurist paintings of Tom Holland (with whom Crotty studied at SFAI) and Karl Blossfeldt’s close-up photos of plants, which, as it happens, were taken at around the same time Lick’s earliest images were being recorded. You can also detect references to hard edge abstract painting in the multi-colored scrims Crotty uses to represent light and similarities to Yayoi Kusama’s “infinity nets” in the dots and circles he uses to depict our current galaxy. Making these choices, says the artist, meant filtering what he learned from the scientists through his own sensibility and experience of art history.

“A lot of the astronomers,” he recalls, “were really interested in the earliest galaxies. They were trying to figure out how these things were formed and what they looked like. One astronomer

Detail: Look Back in Time

described cigar shapes; another talked about blue blobs. As an artist I thought, 'You know, I can work with that.'" He did so by hanging a series of ungainly blue-and-white shapes in front of the panel called *The Cosmic Dark Ages*. As for the veiny skeins encased in gluey blue resin that appear on that same panel – "those came from computerized simulations I saw of the universe that have this web-like filamentary structure." And the multi-colored strips Crotty chose to depict light in the panel titled *The Visible Spectrum*. Programmers, he reports, used those colors to highlight globular clusters displayed on a computer screen.

"My sense of wonder," he says, "is in the realm of numbers and quantitative information. But as an artist, I'm approaching it like a postmodernist…with *feeling*. You might not get the science" he concedes, "but you'll walk away with an aesthetic experience."

# # #

Look Back in Time: Russell Crotty and the Lick Observatory at *San Jose Institute of Contemporary Art* *through February 26, 2017.*

Cover image: Tony Misch, Animation of the 1908 Comet Morehouse, 2003, made from positive scans of 29 of A. Estelle Glancy's glass plate photos.

An Interview with Tony Misch, Curator of the Lick Observatory Historical Collections Project

Tell me a little about yourself, your job at Lick and the work you do as an artist.

I have a BFA from the University of Washington and an MFA from Otis Art Institute of Los Angeles County, both in painting. In 1982, three years out of grad school, I accepted a temporary job as an observer at the Carnegie Institution's Mt. Wilson Observatory. What was intended to be a half-year's recess from my painterly ambitions became a 25-year career in astronomy, the last 20 of which were spent as a resident support astronomer with University of California's Lick Observatory, where I mostly dealt with the practical details of observational astronomy.

Tony Misch

In 2008, a year after retiring from Lick, I proposed to the observatory that I undertake, with their blessing, a project to protect, preserve, and interpret the remarkable trove of historical materials that had more or less haphazardly accumulated on Mount Hamilton over the course of its 125 years of operation. This became the Historical Collections Project, an ongoing effort that still has the greatest part of its work lying ahead of it. Until now, the work I do as an artist (a title I don't generally assume) has not incorporated astronomy. This comes in part from personal preferences and in part from a conservative training. I incline to the formal, finding my greatest satisfaction in laws of the surface. My limited output in the last several years has been more or less figurative drawings, paintings, and prints. I do feel, however, that at some level the SJICA exhibition has been for me an artistic act.

How did this show come about?

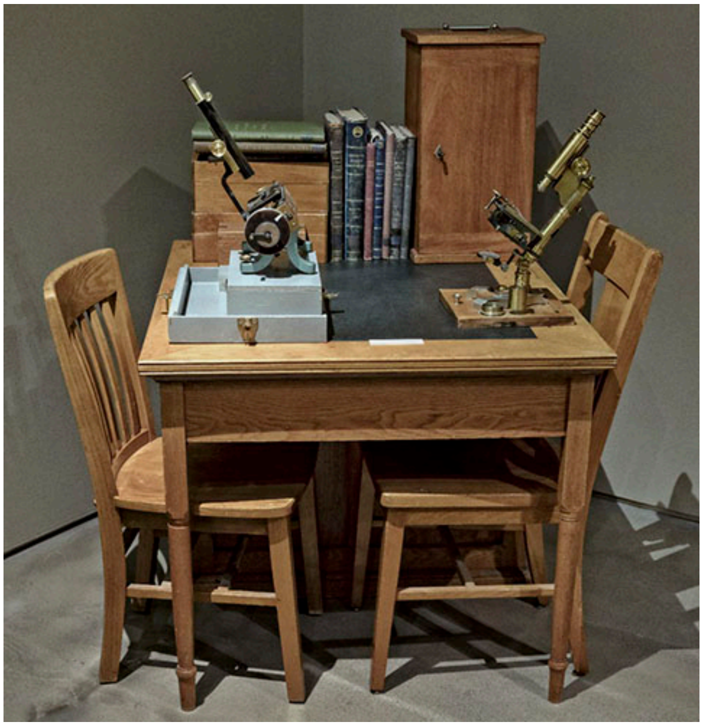
The seed was planted by John Weber. As director of the then still new Institute of the Arts and Sciences (IAS), John saw a natural collaborator in Lick Observatory, headquartered on the same campus. He contacted UC Observatories interim director Sandra Faber who, knowing of my background in the arts and my work with the historical collections, put him in touch with me.

Watercolor rendering of Lick Observatory

On his first visit to the Mount Hamilton, John immediately recognized the collection's potential to delight, inspire, and inform. He really "got" it. I think from that first day there was little doubt in either of our minds that we'd be working together in some kind of collaboration. The form that it would take was still fluid . . . and to some extent would remain so throughout. (One of the great pleasures of working with John is his willingness to entertain all sorts of possibilities while at the same time gently and skillfully guiding the process.) Russell, who accompanied John on his next visit, was clearly taken with the observatory, both modern and historical. He's a generous, modest, and easygoing guy, and a perfect partner for the embryonic, evolving shape of the collaboration. We knew that our working together would lead to some sort of culmination but for me, at least, the SJICA show only became a certainty with the awards of Warhol Foundation and NEA grants.

How do you see art and science collaborating? How, in your estimation, does one inform the other?

I think most forms of collaboration (save the traitorous sort) are good. They encourage communication, cross-pollination, and at their best can spawn new ideas (evolution can be seen as a form of open-ended, albeit sometimes ruthless, collaboration). The so-called art-science intersection is, I think, potentially rich but often precarious. The latter comes from the common lack of understanding (or misunderstanding) of each discipline by the practitioners of the other.



Furniture, microscopes and books from Lick's archive

This too often results in a superficial use (or misuse) of scientific ideas by artists, or to the facile identification by non-artists of beautiful pictures from the natural world as art.

I've long been interested in the art-science comparison, but I'd say that my close association with both cultures has left me skeptical of easy connections. I think the best and most valuable approach lies more in the asking of questions than in the seeking for similarities. As part of the IAS-Lick-Crotty project, we ran a workshop that mixed art and science undergraduates for two days on Mount Hamilton, called *Seeing and Knowing in Art and Astronomy*. I had prepared a carefully reasoned and completely unsatisfactory presentation on the subject, which I abandoned at the last moment and instead presented the students with the following, as starting points for further thought/discussion:

TRUE or FALSE:

1. Science is understood, art is experienced.

2. Art is accessible, science is arcane.

3. Science is mensurate, art makes its own rules (or perhaps has none).

4. Science is analytical, art is intuitive.

5. Both science and art are descriptive.

6. Artists and scientists are really different, i.e. think differently.

7. Art is about seeing, science is about knowing.

Detail: Lick logbook archive shelf

Can you describe the curatorial concept for your side of the show?

I wanted first and foremost to present objects in such a way as to decouple the truth of the observing process from the breathless reports of Discovery (with a capital D) that constitute too much science journalism. I wanted to demonstrate that doing science is made up of many slow, painstaking, and often repetitive acts, but that in those acts—especially when seen in the aggregate—there lies a subtle beauty every bit as wondrous as the breathtaking pictures that usually illustrate astronomy.

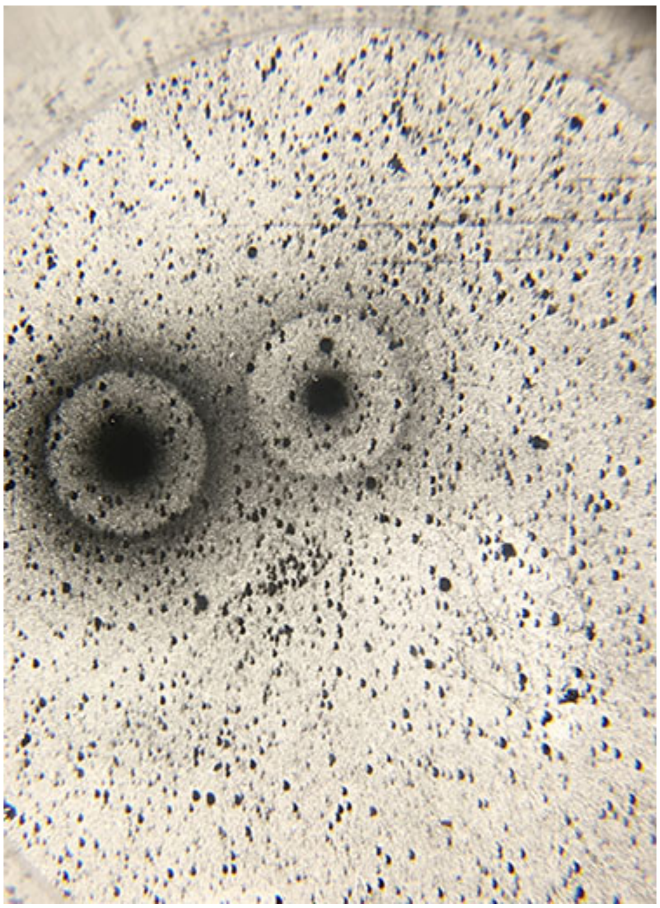
The contemporary art gallery venue was an important factor in making this possible. I felt a freedom to relegate exposition to the background that I would not have felt in a science or history museum. This allowed the objects' quiet visual poetry to be better seen/felt/heard, with a minimum of didactic interference. I also wanted visitors to experience the palpable connection to the human hand in the scientific process: the hand-written labels on well-worn file boxes, the handwriting and drawing styles of individuals, the inked notations on the photographic plates, the wear and tear of handling on the instruments.

Installation view of the Lick Observatory collection

What concerns guided your choice of specific objects and photos?

With the above curatorial concept in mind, I wanted to avoid objects that were outwardly glamorous. Instead I tried to choose objects that were ordinary in their constitution but a bit mysterious, even at first intellectually impenetrable to the layperson. I also chose artifacts that, as stated above, spoke to the hand-made marks of individuals. Multiples, such as the small planetary and spectral plates, or the many file boxes, were also important in illustrating the repetition inherent in so much observational work.

To what extent, if any, did Russ' work influence your selections from the collection?



E.E. Barnard, Milky Way, c.1892-1895, glass plate photo

Not so much, for the most part. The wide-field plates of the Milky Way by E. E. Barnard do have a direct connection to Russell, especially in that one of his drawings included in the show is of a celestial feature discovered and named for Barnard. Also one of the notebooks we included was a particular favorite of Russell's (and mine). There is, too, in Russ' process of mark-making a kind of kinship with the gradual buildup of silver grains on a photographic plate. Russell's visual approach to telescopic observation and recording also traces its lineage to the observers of the late 19th century represented in the exhibit.

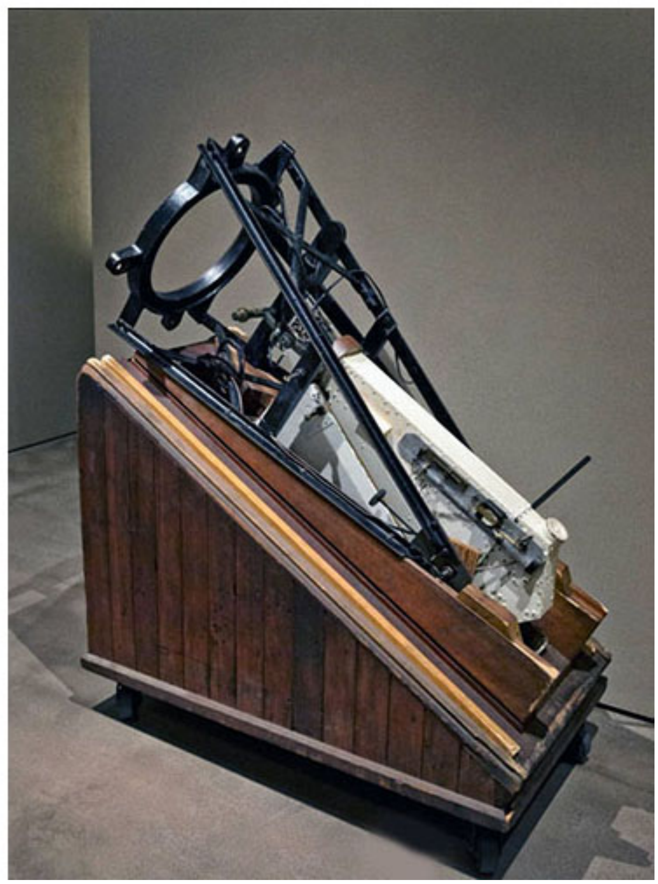
I take it the collection is much larger than what's at SJICA? How much greater? Can the public visit?

Correct. The collection is large. For example, we displayed about 25 logbooks; the archive contains about 2,000. Even more striking is the number of photographic plates in the collection. Photography was the dominant means of light detection in astronomy for decades. I don't have an exact count, but I estimate that there are on the order of 150,000 photographic plates in the archive. I also don't have a precise count of the number of scientific objects (i.e., instruments, tools, optics, etc.) in the collection, but it is in the several thousands (of course some are far more complex than others, but almost all have some story to tell).

Unfortunately, the public cannot see the collection, except for the few things we have on display in our visitors' center. This is primarily due to lack of space, lack of money, and lack of human resources. I would love to see the collection properly catalogued and properly housed, with generous display space and a curatorial staff to preserve, interpret, and tell the stories the objects illustrate through rotating exhibitions, online, and in publications. But with present resources that's not an option. If such resources were to materialize, my inclination would be to find a space in San Jose or another Bay Area city that could house and display these treasures, where the greatest number of people could see, enjoy, and learn from them.

There's a big emphasis on the logbooks and on spectrograms. What are spectrograms are and why they were so important? Are they *still* important? Or have they been replaced by other methods?

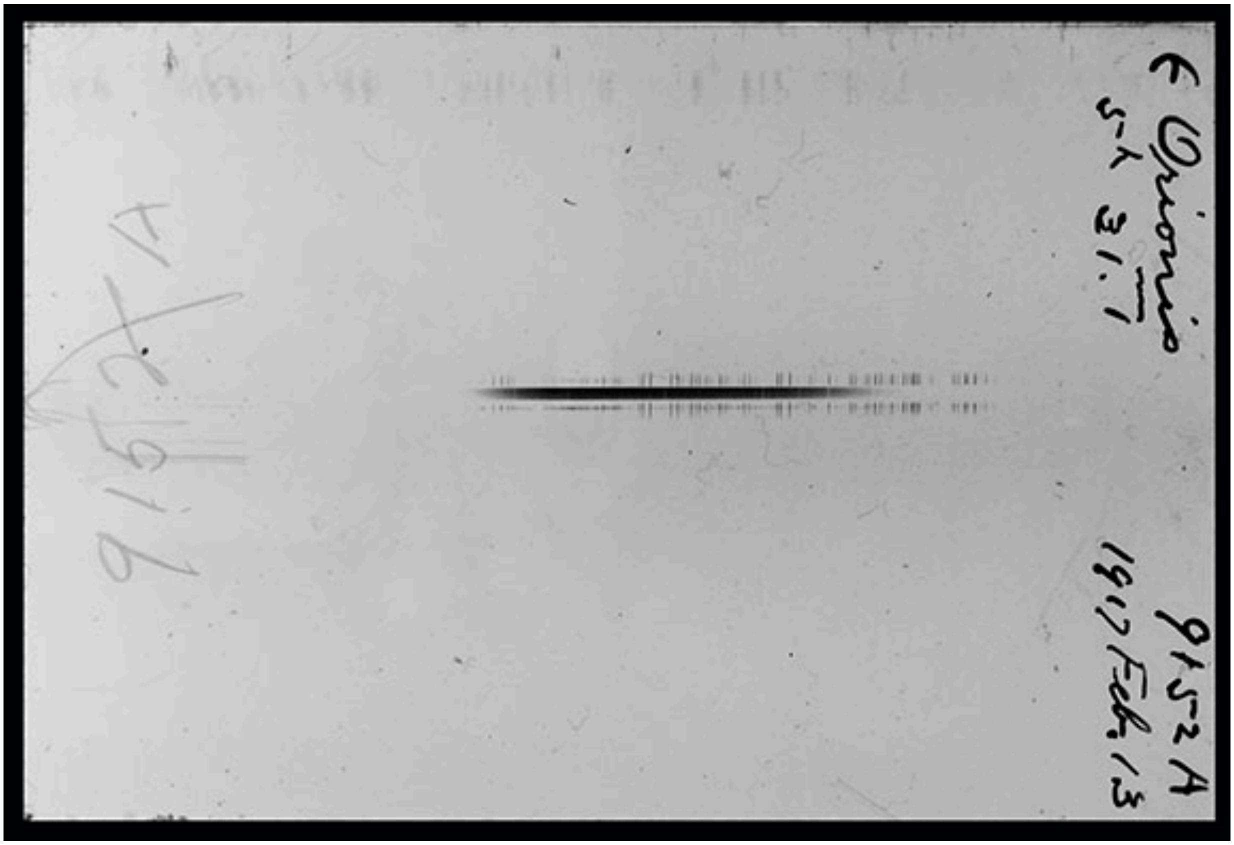
Unlike other observational scientists, astronomers cannot experiment directly with their objects of interest, but must rely on what they can see from a distance, that is, the information conveyed to them in starlight. Until the invention of spectroscopy—and the advances in physics it made possible in the laboratory—astronomy was confined to the observation and measurement of the positions, motions, and relative brightnesses of stars. It did not seem possible at the time to know anything about the true physical nature of the stars and other celestial objects.



New Mills Spectrograph, 1902, brass, steel, optics, electronics, used for making photographic spectrograms

Light, however, has hidden within it a wealth of physical information about its sources. Spectroscopy, by spreading light into its constituent colors (wavelengths), unlocks those secrets, revealing in spectra keys the chemical constitution of distant luminous objects, their velocities, their temperatures, clues to their masses, a whole new system of classification, and the path to unraveling the nature and evolution of stars and galaxies. Spectroscopy was the catalyst that transformed classical astronomy into the new science of astrophysics at the end of the 19th century. Spectroscopy remains today the single most powerful tool in an astronomer's kit.

It is hardly possible to overstate the importance of spectroscopy, then and now. But bear in mind that, while its arrival revolutionized astronomy, refining spectrographic techniques to extract ever-more precise data from a beam of light, has been going on for decades and continues today.



Spectrographic photo, glass plate image, 1917

The photos themselves look like ragged zips (to borrow terminology from Barnett Newman). How does one extract data from them?

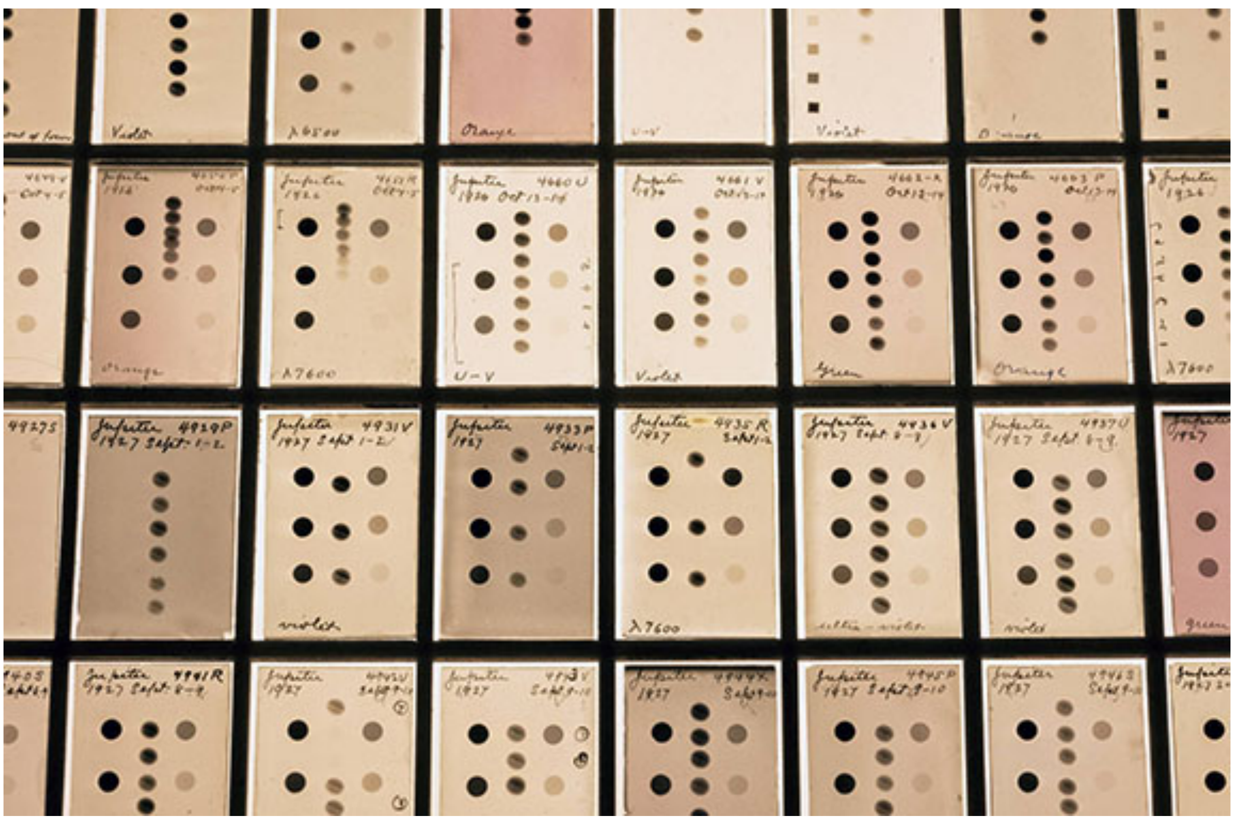
I assume here you mean the spectrographic photos.

Yes.

The answers to this question fill many shelves, but in a nutshell, chemical elements and molecules leave distinct signatures in the light they emit or absorb. These take the form of features in their spectra consisting of unique patterns of light and dark at different wavelengths. The patterns and their behaviors under certain conditions are known from laboratory and theoretical physics. Their interpretation in astronomical spectra begins with microscopic measurement of these features, leading to their identification by comparison with a known spectrum from a man-made source, exposed on the same plate. The exact positions, shapes, and magnitudes of the features contain the sought-after information. In the era represented in the exhibit, all this was done by eye and hand. These days it is all done by computers. But the fundamental techniques are the same.

Ultimately, how do all these measurements aid discovery? Is it a process of comparing measurements over time?

Man, you ask tough questions! Again, this is very complex and takes many forms. It is important also to remember that discovery is almost always cumulative, each increment of new understanding having been built on what came before. Perhaps the best way to answer is with a few examples from Lick Observatory (bearing in mind that their are many more and many variations on each).



W.H. Wright and others, Photos of Jupiter and Saturn, 1920s, glass plate photos

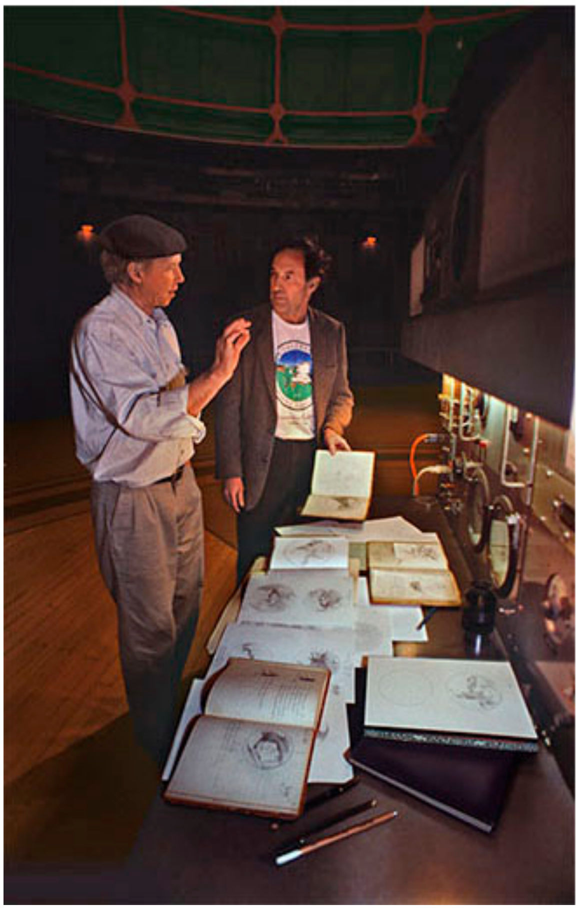
1. The Lick Radial Velocity Program (1896-1928): On the mountain we have hundreds of hand-written books containing numerical measurements of spectrographic plates, and their algorithmic reductions to meaningful

results, all deriving from a 30-year project to measure the radial velocities (velocities along the line of sight) of thousands of stars. The 132 file boxes in the exhibit contain the numerical evidence for those velocities and the final results of each observation, filed by star. Taken together, statistical analysis of these stellar motions established the Sun's own motion within the galaxy, the motions of the stars around us and, as a sort of byproduct, the discovery of many new binary (double star) systems. This knowledge, in turn, laid the groundwork for further study and discovery, such as star clustering, galaxy dynamics, and stellar masses from binary systems.

2. The Search for Extrasolar Planets (early 1980s to the present): This work required spectroscopic precision greater than any attainable at the outset of the project, so years were spent refining techniques of observation and reduction (these refinements are ongoing). The refined techniques were first applied to a sample of several hundred stars, which, on the basis of earlier knowledge, were thought to be good candidates for having planets. These stars were then observed at intervals of a few days, weeks, or months over long periods. It was hoped that the monitoring of a star's spectrum over time would reveal tiny, regular changes that would be the telltale signs of an unseen planetary companion. The results have been spectacular, but the process is long, and difficult, and hugely meticulous.

E. S. Holden, A. L. Colton and others, Moon at different phases, 1893 and 1895, glass plate photos

3. The Berkeley Supernova Search (early 1990s to the present): Massive stars end their comparatively short lives in big explosions. The study of these supernovae at Lick involves both direct imaging (i.e. taking direct pictures of the sky) and spectroscopy. The first stage involves the discovery of new supernovae by monitoring external galaxies on a nightly basis with a dedicated telescope and digital camera. When one is discovered, follow-up spectra are made with larger telescopes to determine the type of supernova (they come in different flavors). This in itself leads to greater knowledge of these explosive processes, but also plays an important role in establishing distances in the universe, which has led to startling discoveries. Again, the results are news-making, but process is repetitive and painstaking.



Misch speaking at Lick about astronomers' logbooks

Of course, not all programs are so long term, but even shorter term ones are complex and typically involve lots of planning, a number of people, and many observations. Nor do all produce wholly new or spectacular results. Many programs serve refine existing knowledge, some just don't pan out. But all are built on earlier knowledge.

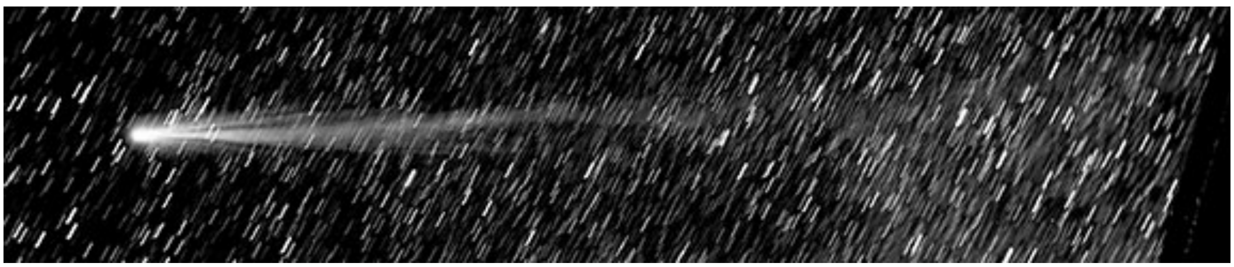
Note: Examples 2 and 3 are modern ones, and are largely made possible through automated observing and reduction.

Is this type of data collection emblematic of what the *real* work of astronomy? (As opposed to flash-bang revelations seen through telescopes, which I am told, are NOT the way discovery *actually* happens.

Yes.

Is the drudgework of the astronomer sitting at a computer terminal markedly different than what it was a century ago? From my conversation with Russ, it seemed that lot's changed technologically, but the data sets are still very much the same, still a lot of number crunching.

Russell is correct in that science is a largely mensural enterprise, so the gathering of data and its reduction to numbers is as fundamental today as a century ago. But the work of the astronomer has, especially in the last couple of decades, begun to be very different. The actual observing is more and more done by instrument specialists employed by the observatory, or by robotic telescopes. Virtually all data are now digital and thus numerical from the start; number crunching is now done entirely by computer. Much of the drudgery has shifted away from the telescope and now lies, I think, in writing programs to reduce and analyze data.



Tony Misch, Animation of the 1908 Comet Morehouse, 2003, made from positive scans of 29 of A. Estelle Glancy's glass plate photos

I really enjoyed your animations, particularly the one involving the comet. I'm guessing you maybe had Muybridge in mind when you created it. Perhaps also Georges Méliès' *A Trip to the Moon*?

Thanks. I did think about Muybridge when making the Transit of Venus animation. The plates (though not originally intended as an animation) were made only three years after Muybridge began photographing at the Stanford Ranch, which happens to lie within sight of Mt. Hamilton. I think as such, it's one of the earliest events to be photographically animated, albeit long after the fact.

What are all the white streaks, the marks that make it look like the comet is moving through a hailstorm?

They're distant stars. A "normal" astro-photograph, in which stars look like points, is made by slowly tracking the camera at the rate of the Earth's rotation in order to keep it pointed at the same stars for the length of the exposure. But in this case, the stars are streaked because comets move with respect to the background stars. In order to get a sharp shot of the comet, the observer kept her camera pointed precisely at it during the 1-2-hour exposures, thus the stars look streaked. The photos used for the animation were taken over a period of almost three months, during which the comet moved across the sky, being seen against a nightly changing background.

Any additional thoughts you'd like to communicate that I haven't asked about?

I'm very pleased with the exhibit and grateful for the good reception its enjoyed, but I'd like to mention one way in which I feel that the exhibit did not achieve my vision for it.

The archive and collections rooms on Mt. Hamilton have a sort of Wunderkammer feel that gives a very special coloring to the artifacts. I would have wished to reproduce that feeling in the gallery. I tried to do so by reproducing the style of furnishings in the archive, and I think that though the fixtures add a good deal to the atmosphere of the exhibit, but it fell short of my hopes in that respect. There's an art-gallery sparseness to it that definitely alters the objects. But perhaps that's not a bad thing.

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David M. Roth, Squarecylinder's editor and publisher, conducted this interview with Tony Misch via email on January 14, 2017.