

The Discovery of Pluto: Generally Unknown Aspects of the Story

Clyde Tombaugh (1906–1997)

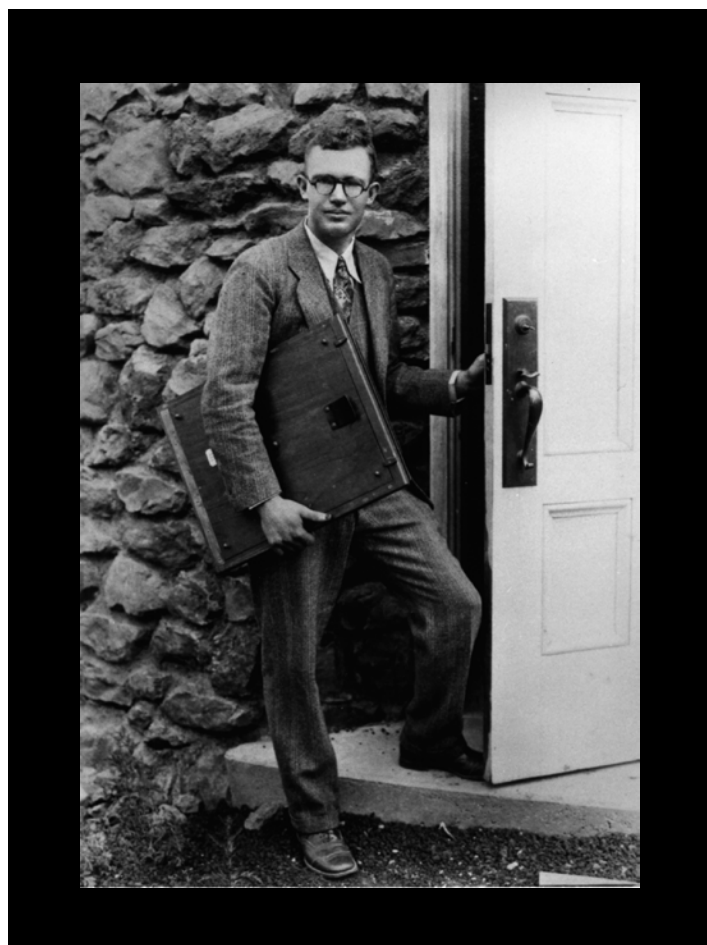
[excerpts from a longer article written for the ASP's Mercury magazine in 1986]

Editor's Introduction

As many of our long-time members know, the ASP has been sharing news of astronomical developments with the public since its founding in 1889. *Astronomy Beat* is only the latest of the various ASP publications through which noted astronomers have explained their research. From time to time, we will reprint one of the classic “behind-the-scenes” articles from our archives that discuss work which still resonates today. Our first such “classic” is the story of how Pluto was found by Clyde Tombaugh, a young Kansas farm boy, at the Lowell Observatory in Flagstaff, Arizona, as told by him 56 years after his discovery.

How I Came to Flagstaff

I was born on a farm near Streator, Illinois in 1906. In 1922, our family moved to a large wheat farm in western Kansas, where I had clearer skies. I used a Sears Roebuck 2 ¼ inch telescope hundreds of times on the Moon and planets...I wanted a more powerful telescope, so I started grinding mirrors. The third one was a 9-inch of excellent quality, which yielded sharp images under a high magnifying power of 400 diameters. In the fall of 1928, I made many sketches of Jupiter and Mars at the eyepiece of the 9-inch. I made exact copies of them and sent them to the Lowell Observatory, at Flagstaff, Arizona, for their comment. Unknown to me



Young Tombaugh with one of the photographic plates used in his search
(Lowell Observatory)

at the time, astronomer Vesto M. Slipher was looking for a good amateur astronomer who might be trained to take long-exposure photographs with their new 13-inch



Clyde Tombaugh posing later in life at the blink comparator he used
(Lowell Observatory)

astrograph [a telescope specially built to continue the search for a 9th planet which had been one of the observatory's founder's life ambitions.]

Percival Lowell founded the Lowell Observatory on a volcanic mesa just west of Flagstaff, Arizona, in 1894. His main purpose was to study the planet Mars. Lowell became fascinated by the so-called "canals" on Mars... and published scores of papers and several books... supporting the view of the artificiality of the canals. Such views stirred the ire of Lowell's astronomical peers.

As Carl Lampland told me, Lowell wanted desperately to improve his credibility among other astronomers. So, Lowell thought, if he could predict the location of a ninth planet, beyond Neptune, and then find it, it would surely improve his status. [At the faintness this planet was predicted to be,] there are millions of points of light in the sky and the task is to find one that shifts its position relative to the background stars... Such a search required photography to "freeze" all of the light images with an hour exposure. Then one must obtain a duplicate photographic record a few nights later. The real stars show no change in position during such a short interval, but a trans-Neptunian planet will show a small shift in position, and thus betray its planetary nature. [An instrument called a *blink comparator* can be used to flash the two photographs on a screen in rapid alternation, to make it easier to see

the point of light that has moved.)]

I could not have sent in my drawings at a better time. ... V.M. Slipher promptly answered my letter, asking questions about my schooling, interests, and physical health. With this, I suspected more than just polite interest. I immediately answered his letter. Within a week, I received another letter from Slipher, asking if I would be interested in operating a new photographic telescope in a cold unheated dome throughout the night. If so, would I be interested in coming to Flagstaff on a 3-month trail basis? I could not have been more eager to accept such a proposition.

Another letter arrived, suggesting that I come to Flagstaff about the middle of January, 1929. So I made ready for travel to Arizona, packing my math, physics, and astronomy books in my heavy suitcase. I boarded the Santa Fe train at Larned, Kansas, with not enough money in my wallet for a return ticket. After 28 hours in a chair car, I arrived at Flagstaff.. and V.M. Slipher was there at the depot to meet me...

The next day, I was taken out to the new 13-inch telescope dome... Completion of the telescope was behind schedule, so I was assigned various odd jobs — shoveling snow, stoking the large furnace with pine logs, and showing visitors astronomical pictures...

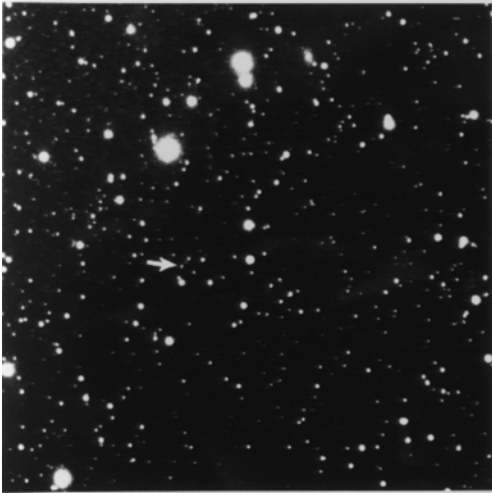
Getting Started

[When the telescope was finally ready in mid-February,] I assisted V.M. Slipher in the dome... The first few exposures were on 11 by 14 inch plates. [In those days, astronomical photographs were taken on glass plates to which photographic chemicals had been applied.] The field was so good that Slipher decided to use 14 by 17 inch plates. To get the best possible image on plates that large, they had to be bent into slightly concave form. Slipher had three special plate holders made in the shop... There were thumbscrews on the back for each corner and one for the center... Slipher had a testing table made with a long

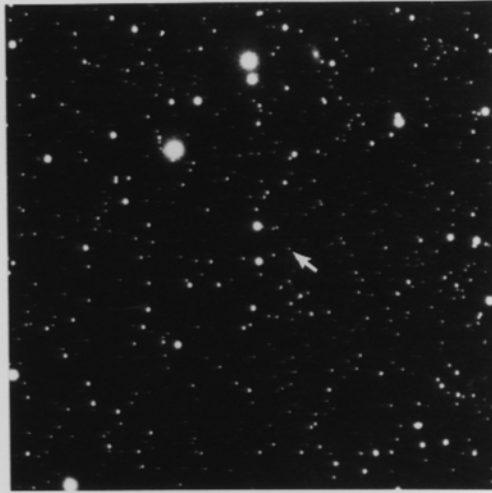


Vesto M. Slipher (Lowell Observatory)

DISCOVERY OF THE PLANET PLUTO



January 23, 1930



January 29, 1930

Two of the images used in the discovery of Pluto; Pluto is marked with arrows (*Lowell Observatory*)

amplifying arm to measure accurately the curvature of each plate in the plate holder before it went to the telescope. All parts of the plate had to be within $1/200th$ of an inch of the focal surface of the instrument!

The smallest star images were about $1/30th$ of a millimeter in diameter. If the star images are not exactly the same size and shape on both plates of a pair, the plates are “unblinkable” for a thorough examination. ... To take exposures as long as an hour [to gather enough light to record faint objects], we used a brighter “guide star” in the field that we kept centered in our eyepiece. V.M. Slipher soon had me do the guiding on the plate exposures. After watching my performance for a few nights, he finally said to me, “You are doing all right; you are on your own,” and he stopped coming out to the dome.

In early April of 1929, the regular plate-taking of the Planet X search got under way. Slipher picked the guide stars from a Norton star atlas. He wanted me to do the regions in [the constellation of] Gemini — Lowell’s preferred place for his Planet X — in spite of the fact that they were now low in the western sky... After I had obtained three pairs of large plates spanning Gemini, the two Sliphers [Vesto and Earl Slipher were brothers and both astronomers] started blinking them in an effort to find Planet X quickly.

They took turns working at it for about a week. Two of the plate regions had about 300,000 star images each.

To pick [out] one tiny image that shifted position...is an awesome task...

V.M. Slipher was in a serious predicament. They had all done a superb job in designing and constructing the excellent [telescope]. Slipher had stuck his neck out to the Observatory Trustee, [who] had stuck his neck out to his Uncle Lawrence Lowell, who had furnished the money... It was imperative that they find Planet X...He instructed me to continue photographing the Zodiac eastward...I pushed the photographing through Cancer, Leo, Virgo and Libra, reaching Scorpius

and western Sagittarius by the end of the June lunation. I had taken nearly 100 plates.

The Discovery

After doing the blinking of Gemini in May, I think Slipher was demoralized. Of course, he wanted to be the one who found Planet X. Undoubtedly, he realized that the task greatly exceeded the time he could devote to it. At the end of June, [he] came to my office and said they wanted me to start blinking the pairs of plates. I shuddered at the thought of having to examine all those hundreds of thousands of star images... What did this new assignment mean? I thought “Are they throwing in the towel?” I had no college education and relatively little observatory experience. Perhaps my vigorous and vigilant dedication to making excellent [photographic] plates raised their confidence in me?

[When] the rainy summer monsoon season ceased about the middle of September...I started photographing in the Zodiac belt again...The number of stars greatly increased as I approached the Milky Way, which slowed down the blinking coverage. I realized then that the Sliphers had blinked those 1929 plates of Gemini much too fast, so I decided to re-photograph Gemini...On 21 January, I set the telescope on Delta Geminorum (a 3rd magnitude star), [but], after 10 minutes a fierce northeast wind came up...On the

nights of the 23rd and 29th, I re-photographed [that] region...

On Feb 18th, [while the Moon was too bright for observing], I decided [to blink] the Delta Geminorum plates. Upon starting a new strip to the east of star Delta...I suddenly spied a 15th magnitude image... "That's it," I exclaimed to myself... I saw the images almost instantly in a 1 by 2 cm field containing about 300 stars... I had never encountered a planet suspect so promising in all during all the fall months of blinking... I removed one of the plates and placed the 21 January plate [the one taken during miserable weather] on the comparator. Sure enough, there was the swollen image of Planet X exactly where it should be... For three quarters of an hour, I was the only person in the world who knew exactly the position of Planet X.

Carl Lampland was sitting at his desk across the hall. He heard the clicking noise of the blink comparator suddenly stop and then a long silence. He thus suspected that I had run onto something and was nearly dying of suspense (he told me later). I called him in to view the new planet images and I explained that the shift was right for a trans-Neptunian planet.

Then I went down the hall to V. M. Slipher's office... Slipher was sitting at his desk, working with some papers. I boldly strode into his office. "Dr. Slipher, I have found your Planet X," I said. He rose up from his chair, as if propelled by a spring, with a facial expression of excitement, but reservation in his voice. ...He was on his way to the blink comparator room so quickly, I had to step lively to keep up with him.

Lampland surrendered the comparator to Slipher, commenting, "It looks pretty good." The air was tense with excitement as I interchanged the plates... Finally, Dr. Slipher said to me, "Re-photograph the region as soon as possible." I looked out of the window... it was pretty much overcast. "Doesn't look very promising for tonight," I said, "but I will sit up for it throughout the night." Lastly, Dr. Slipher charged, "Don't tell anyone about the discovery. It could be very hot news. We need to keep it secret for a few weeks to study the object."

I drove downtown to eat my dinner in a café and perform my usual duty of picking up the observatory mail at the Post Office. After dinner, I noted the sky was heavily overcast. I was extremely excited and had to calm myself down. So I went to the Orpheum

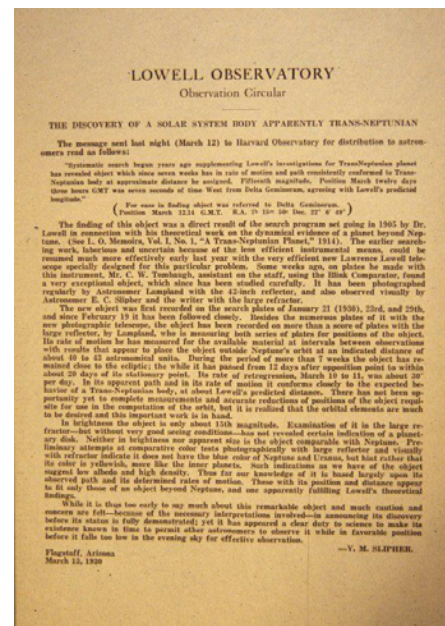
Theater to see Gary Cooper in "The Virginian." I can never forget that night. After the gun fight, my knees were shaking more than ever... After the show, I waited... frequently going outdoors to view the sky. I gave up a little after midnight because the third quarter Moon was due to rise...

The following night, the sky was fairly clear, and I took a new plate... I expected the planet's image to be 10 to 11 millimeters farther west. Sure enough, there it was, just where it should be... The following night, [after making a finding chart,] Lampland, Slipher and I walked to the 24-inch refractor for a visual look... Soon [Slipher] picked it up. "I've got it," he said, "but I don't see any disk," with sadness in his voice. What a thrill it was to me, and I realized that we were looking farther out in the solar system than anyone had ever looked before. It was also disappointing — the planet was a very faint, unimportant looking... star-like point.

The Follow-up and Announcement

Pluto was 2.5 magnitudes (or ten times) fainter than Lowell had predicted. E.C. Slipher [the other Slipher brother], who had been out of town serving as senator in the Arizona State Legislature, returned to the Observatory from Phoenix. He proceeded to make some tests to put a limit on the size of Pluto's disk. He made little holes of various sizes in a box and looked at them at different levels of illumination. The box was placed on top of the Monte Vista hotel downtown and the 24-inch refractor was turned down upon it for study... Slipher concluded that Pluto's disk could subtend an angle as large as one-half second of arc and still not exhibit a perceptible disk.

The discovery disrupted all of the current programs



The Lowell Observation Circular on the discovery of Pluto.

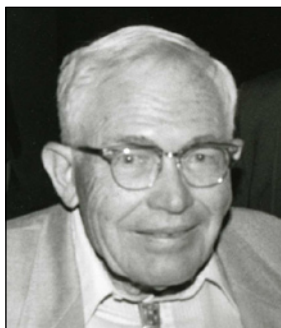
in progress at the Lowell Observatory... Extensive preparations were made for the day of the announcement, such as precise measurements of daily positions, calculations of its characteristics, preparation of a special "Observation Circular", and so on. I assisted Mrs. White, the secretary, with the folding of hundreds of circulars and running the addressograph machine for the envelopes. The staff decided on 13 March for the date of announcement, the 149th anniversary of the discovery of Uranus by Herschel, and [what would have been] Percival Lowell's 75th birthday...

With the announcement of the discovery, pandemonium broke loose. The intense public interest greatly exceeded Lowell Observatory's expectations. Hundreds of telegrams and letters poured in, most of them consisting of congratulations and suggesting names for the new planet. Newspaper reporters and photographers swarmed over Mars Hill [the site of the observatory.] Some magazine writers demanded exclusive story rights, to the extent of being rude.

V. M. Slipher quite freely kept us informed from day to day on the events, problems, and controversies that ensued after the announcement of the discovery. For most of 1930, Pluto dominated the astronomical news all over the world... But [for me] the thrill of finding Pluto that February day... was certainly a once-in-a-lifetime experience which I shall never forget.

About the Author

After discovering Pluto, Clyde Tombaugh went to the University of Kansas and earned a BA degree in 1936. He then returned to the Lowell Observatory, and continued his photography and blinking. He later estimated that he had sat at the blink comparator for about 7,000 hours during his career. He eventually earned a Master's Degree from the University of Kansas and helped found the Astronomy Department at New Mexico State University. He published papers and articles on a range of astronomical topics in the publications of the Astronomical Society of the Pacific, and spoke at several of the Society's meetings. In 1985 he and astronaut Loren Acton chaired the ASP's An-



nual Fund. Tombaugh passed away in 1997; in a fitting memorial, some of his ashes are on their way to Pluto aboard the New Horizons spacecraft.

Resources for Further Information:

Levy, David *Clyde Tombaugh: Discoverer of Planet Pluto*. 1991, University of Arizona Press.

Stern, Alan & Mitton, Jacqueline *Pluto and Charon*. 1998, Wiley.

Tombaugh, Clyde & Moore, Patrick *Out of the Darkness: The Planet Pluto*. 1980, Stackpole Books.

Falk, D. "More than a One-Hit Wonder" in *Astronomy*, Feb. 2006, p.41.

Tombaugh, C. "The Discovery of Pluto" in *Mercury*, May/June 1986, p. 66, and Jul./Aug. 1986, p. 98. (The full version of the story.)

Biographical outline at New Mexico State:

http://archives.nmsu.edu/exhibits/tombaugh_website/bio.html

Clyde Tombaugh website by Jeff Foust:

<http://www.klx.com/clyde/> ♦

Astronomy Beat is a service exclusively for members of the Astronomical Society of the Pacific. For more information about becoming a member, visit www.astrosociety.org/membership.html.

One copy of this article may be downloaded on any single computer and/or printed for your personal, non-commercial use. No part of any article may be reproduced in any form, sold, or used in commercial products without written permission from the ASP.

The Astronomical Society of the Pacific increases the understanding and appreciation of astronomy by engaging scientists, educators, enthusiasts and the public to advance science and science literacy.