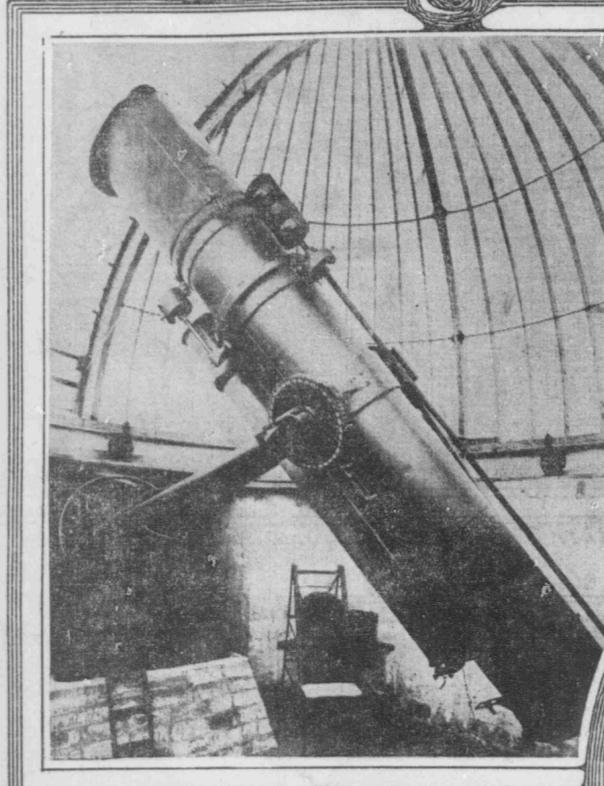


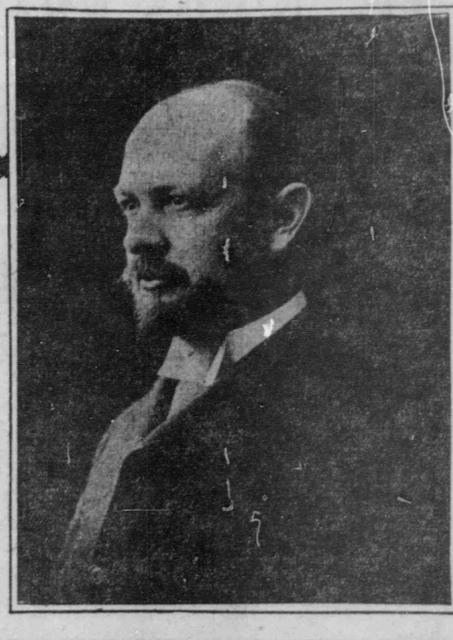
FICKLE PHOEBE

THE DESPAIR OF ASTRONOMERS.

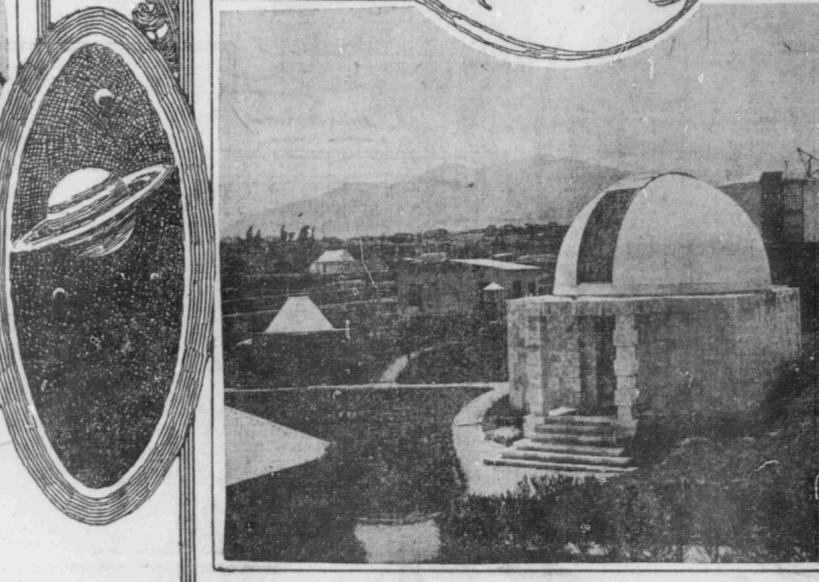
Franklin Bell



The Bruce Telescope, Harvard Observatory Arequipa, Peru



Prof Wm H Pickering of the Harvard Observatory Discoverer of Phoebe



Southern Station of the Harvard Observatory at Arequipa, Peru.

Saturn's Little Moon Which Travels at a Sixty-Mile-a-Minute Rate Eludes Even the Photographers Who Discovered Her.

THAT fleeting Phoebe, Saturn's ninth and most mysterious satellite, did not actually decide to "sneak all by itself," as recently reported, has been conclusively proved by Prof. Pickering, of Harvard University, the sponsor for this erratic maiden ever since her discovery.

Reports from the Harvard astronomical observatory, at Arequipa, Peru, had it that Phoebe disappeared last July and refused to put in an appearance until August. This rumor was based on the fact that the little satellite did not appear in the photographic plates made at Arequipa during July. But when Prof. Pickering examined these plates recently arrived at Cambridge from Peru, he found the ninth satellite as it should have been. In other words the supposed vacation in July was an error on the part of somebody at Arequipa, where the plates are not and cannot be examined so carefully as they are in the observatory at Cambridge.

This is not the first time Phoebe has eluded astronomers, for her reputation for fickleness has existed ever since Prof. Pickering discovered her five years ago. Immediately after Prof. Pickering announced his important discovery, Phoebe promptly refused to put in an appearance, which conduct would have embarrassed any other astronomical discoverer than the Harvard College observer.

Immediately there were murmurs that perhaps Phoebe was a mistake, or a speck of dust upon the photographic plate. Then for nearly two years Phoebe seemed to be an absentee, but returned in time to make good Prof. Pickering's claim to having found a ninth satellite of the great mysterious yellow planet, Saturn.

Phoebe is a little moon, but is always in the most tremendous hurry, traveling at a speed not far from 100,000 miles a day, or something over sixty miles a minute.

Notwithstanding this great speed, Phoebe is one of the slowest moving of all the heavenly bodies.

Her diameter is something like 200 miles, and the light which shines in reflection from her surface is so faint that Phoebe is put way down in the list for brightness, being of the 18.7 magnitude.

As has been said, Phoebe, who was named by her discoverer, is the ninth satellite of Saturn, and even now there are here and there astronomers just a little bit in doubt as to her existence, and that is, perhaps, not an unreasonable view under the circumstances. In the first place no one has ever seen Phoebe. She is not visible except by means of at least a forty-inch telescope, but when it is desired to know where she is and what she is doing a photograph is taken, and to the skilled and knowing astronomer she is detected on the photographic plate in all the grandeur and splendor of a pinpoint.

Saturn's Satellites.

It is the destiny of Phoebe to remain a photographic moon, as it is the destiny of the remaining moons in Saturn's system to be telescopic satellites, although all the others are considerably larger. Titan, the largest, which was discovered in 1655 by Huygens, has a diameter of 2,590 miles, or nearly half that of the earth. The next largest is Iapetus, discovered in 1671 by Cassini, which has a diameter of 2,000 miles, or about that of our moon. Iapetus for

over two centuries enjoyed the distinction of being the satellite farthest from the planet, revolving at a distance of 2,255,000 miles from the center of Saturn. This distinction has now passed to Phoebe, who whirls around an orbit drawn 7,596,000 miles from Saturn's center, a distance three times greater than that of Iapetus. The nearest satellite to Saturn is Mimas, which has a diameter of 750 miles, and is 117,600 miles from the planet.

The most remarkable thing of all so far discovered about Phoebe is that it travels in a direction opposite to all the other satellites of Saturn. The others make direct revolutions, or from left to right, but Phoebe's revolutions are retrograde, or from right to left. Only one of the planets—Neptune—has a retrograde motion.

Phoebe's orbit is very eccentric, being the most elliptical of any of the orbits of Saturn's moons, and more so than the orbit of any larger planet. The next most elliptical orbit of Saturn's moons is that of Hyperion, which has an ellipticity of .12; the ellipticity of Phoebe's orbit is .22, or nearly twice as great.

The discovery of Phoebe has also dim-

med the glory of Hyperion, discovered in 1848 by Bood, and since regarded as Saturn's tiniest moon. Hyperion is only 500 miles in diameter, and a fairly large telescope is necessary to see him, for he can be seen, which is something in his favor.

Phoebe Discovered by Photography.

The greatest advance in astronomy has been made since the advent of photography, for the photographic plate and the spectroscopic discoveries. The photographic plate has been found far more sensitive than the human eye, and the record made by it has the advantage over direct observation from the fact that it may be studied and measured at leisure. It was while examining some photographic plates made at the Harvard Observatory annex at Arequipa, Peru, in the early part of 1899, that Prof. Pickering discovered Phoebe. At that time there was not sufficient data to determine her orbit accurately. Since that time, however, a sharp look has been kept for the little moon, but batch after batch of photographs taken of Saturn failed to confirm even her existence or to add to the data until recently, when Phoebe once more came

into view—that is, on the photographic plate—and now her career is almost accurately known as that of any other of Saturn's satellites.

Phoebe reappeared this year in a series of eleven photographic plates made by Professor Frost between April 15, and June 9, and this time the little one was thoroughly studied. It was found that her period of revolution was 549 1/2 days, or one year and a half, and her distance from Saturn's center was measured accurately. Phoebe at this time is in a more favorable position than before, being nearer to the planet than when discovered.

A million miles is an almost inconceivable distance to the human mind; it is almost impossible to appreciate what it means, yet Phoebe travels one-tenth of that distance in a day, or four times the distance around the earth. In two revolutions around Saturn, which requires three years for the performance, she travels a greater distance than that from the earth to the sun, which is 93,000,000 miles. A distance so great as that becomes merely a term, a figure of speech, for no one can grasp its full significance. This present interest in Phoebe arises from her supposed "vacation" in July.

There is no reason to doubt that the busy little satellite was continuing her giddy whirl just as she should, but at the Arequipa Observatory the photographs failed to show where she was. On June 15 and 20 two exposures of two hours each were made by Professor Bailey, and Phoebe's position was noted. On July 6 and 7 exposures of two hours each, and on July 11 an exposure of three hours failed to show the little satellite.

The plates made in August at Arequipa have not arrived at the Harvard College Observatory, but data which have been sent to Harvard shows that on August 2, 4, 5, 15, and 16 Phoebe permitted herself to be photographed, and her position was noted accurately.

Prof. Young, who has not been an ardent advocate of Phoebe, so late as 1902, in his manual of astronomy, expresses uncertainty of the satellite's existence, and adds that, in any event, she is too small to be seen with any existing telescope. Prof. Barnard, however, with the 60-inch Yerkes instrument, reports that he observed Phoebe visually on August 8, and September 12. The ninth satellite has also been seen at the Lick Observatory. Circular No. 87, of Harvard College Observatory, states that

she can be observed visually with the largest refractors, and that she "can doubtless be photographed with large reflectors." The circular also states that "it is probable that in the future there will be no difficulty in securing a sufficient number of observations, not only to correct the present elements, but to study the large and interesting perturbations to which it is subject."

From this it will be seen that Phoebe improves upon acquaintance. The mystery of her absence from the plates made during July has not yet been cleared up. Prof. Eric Doolittle, of the University of Pennsylvania, suggested that the obscuration of the little moon might have been due to moisture, or to very fine dust in the air. Some photographic plates are more sensitive than others, he suggested, although intended to be uniform, yet he thought it improbable that three different plates would be found to be defective just where it was desired they should be perfect.

Phoebe was discovered with the great Bruce photographic telescope, which has a twenty-four-inch opening, the largest apparatus of its kind in the world. One difficulty in perceiving this coy little moon of Saturn is the fact that Phoebe shows no clear disk; she is only a minute spot of life, as formless as one of those distant suns which we call stars.

In photographing the heavens it has been discovered that the longer the exposure the more stars are found upon the photographic plate when it is developed. In this way millions of stars have been photographed, a large number of stars, nebulae and comets having been discovered which would have forever remained unknown if only visual observations had been made.

As the magnitudes of the stars decrease a much longer time is required to photograph them. Thus a star of the fifteenth magnitude will require the photographic plate to be exposed upon it for an hour before it becomes evident. The brightest stars which will be photographed with a second's exposure. An exposure of four hours, or 14,400 times as long, fails to record stars which will appear when the exposure is five or six hours is used.

Although Phoebe is a delicate thing, and rated as very nearly of the seventh magnitude, her portrait has been taken with the Bruce telescope in two hours, and Prof. Barnard observed her visually with the 60-inch Yerkes telescope. This is a feat which had not been considered possible, although Phoebe is an instrument with an aperture of 23.80 is supposed to be capable of showing a star of the seventh magnitude. It requires a practiced observer to discern the object.

At the Arequipa Observatory they are making photographs of all the stars within range, and some idea of the extraordinary character of the undertaking may be gleaned when it is known that in a few years it is expected to have records of no less than 100,000,000 stars. After the photographs are made the stars of the enormous number catalogued. The great advantage of photography lies in the fact that the images made may be enormous, further enlarged, and it is from these enlargements that some of the most important information about the heavenly bodies has been learned.

AMAZING RECORD OF TWO YEARS OF SLAVERY TO MORPHINE

(Continued from Fourth Page.)

"Better eat" sufficiently to make him quiet. He continued his war dance, and threatened the purloiner with immediate arrest for misappropriation of property. He uttered this threat in the peculiar high, strident voice of a thorough "fiend," and could not be pacified until an attendant came and gave him a "shot" from the official gun.

Today that sanatorium furnishes book marks as well as clothing for its patients.

Roll Call for Injections.

The great event of the day with us was the first roll call for injections. This was at 9 o'clock in the morning. Needless to say, everyone was promptly in line, and if the attendant whose duty it was to administer to each "fiend" his allotted dose was even a few seconds late there was a scene truly terrifying to the newcomer. The line went frantic, and was ready to tear the "gun man" into little bits. There was always a melee among those trying to be first to receive a shot, but the little syringe quieted each "fiend" wonderfully, and from a sort of battleground the hallway became the abode of peace—a place that endured until the approach of the time for the next "shot." This was at 11:30 o'clock. There was another line-up at 1:30, and the last one came at 9 o'clock at night, the scheme being to work each patient's dose down gradually until he might be able to live quietly without the drug.

We had meals at three-hour intervals, though few of us cared much for food. There was anything to be had in the eating line that a man could wish for, and individual whims were carefully attended to, but with most of the "dope" the food would not "tax down," and the ridding process was very painful.

As soon as a man began to eat he was decidedly on the mend.

As far as I could see there was little difference between the man who had been using morphine for years and the one who had been a victim for months only. One seemed just about as hard to cure as the other, even when the doses each had been in the habit of taking varied greatly in quantity. I wondered at that, and so did the doctors.

One man I talked with often had been taking tablets for fifteen years without knowing what they were made of. A physician had given him a prescription for "little flat pills," as he called them, to enable him to sleep, and he had taken one tablet a night for these fifteen years regularly until, happening to be without tablets one when on a visit to Chicago, he went to a physician for a prescription for his sleeplessness, which had returned. He then learned to his amazement that he was a "dope fiend." Immediately he went to the sanatorium, and, being a man of great determination, he pulled through. Now he is normal and an AI advertisement for the sanatorium.

I stayed at this place under treatment for ten weeks, and was wretched the whole time except for the hour or two after each injection. During the last ten days, though I had injections regularly, they were innocent of morphine, so "Doc" said, and he told me I was cured. Then I left, as others had from time to time with an "Au revoir" or "Auf wiedersehen." And I did meet most of these "cured" ones again at other sanatoriums.

A Discovery in a Dream.

Among those whom I met was a young man whose parents discovered him to be a victim of the drug in a way that savors of second sight. He had taken

to the drug in the first instance under just the same conditions that I had. He was careful in its use, and for a long time no one suspected him. One night, however, his mother called at his door after he had retired. She was terribly excited—could hardly speak, in fact, but she managed to say that she knew her son had become a slave to morphine.

"I know it," she declared. "I know it, certainly. It is useless for you to deny it. Oh, my boy! My boy!"

He did deny it nevertheless, for he found that her only reason for accusing him was that she had dreamed she saw him taking the drug. So vigorously did he protest that he had well-nigh convinced her when, just as she was leaving his room, she caught sight of a thin, bright line on the floor. She stooped and picked up a hypodermic needle. There was another scene more trying than the first, and it was long before the boy could persuade his mother to retire. She withdrew eventually, however, altogether wretched, and when my friend judged she had had time to fall asleep the doctor's cunning showed itself. He dressed and hurried to the house of a physician whom he knew well, and who had been to see him the day before. He told this friend exactly what had happened, and said:

"Now, doctor, I want you to drop around when mother and sister will be home, and after you have been there a while begin to look around the room a little anxiously so that the folks will notice you. Probably mother will ask what you are looking for. If she doesn't I will. Then you say that when you were in yesterday you think you dropped a hypodermic needle and you have come to find it before any one should get it into his or her foot."

The doctor did this, and the ruse was quite a success. Nothing more was

said of morphine for several weeks. My friend by that time had gone from home, and after the manner of "dope" he had not sent word to anyone as to his whereabouts. He was in Cincinnati, where he chanced to slip into a hotel that he had never been inside of before. Just as he went in he heard a bellboy cry his name. That was surprising, but he was fairly started when he called the boy to him and learned that some one was asking for him on the telephone, and that this person was his father.

"Come home by the next train," said the boy.

"Why, father, what has happened?" he asked.

"Never mind. Come!"

That was all there was to it. Not a word of explanation. My friend was in a funk. He did not know what might not have happened. Perhaps his mother was dying, or his sister. Full of forebodings he took the train for home as his father had directed. The distance was several hundred miles. His father met him at the station. With the old gentleman were two husky men. All four got into a closed carriage, and my friend soon learned that he was off for a sanatorium. It seems that the very day before his mother, who was with his father in the library at home, had suddenly exclaimed:

"George is in Cincinnati in the hotel, and he has been taking morphine. Some one is with him. We must get him home at once if we would save him!"

Then she told of her dream, of the finding of the needle and of the doctor's visit the following day. So earnest was she that she prevailed upon her husband to ring up the hotel she had named, and the result was as related.

On his way to the sanatorium my

friend contrived to rid himself of his syringe, his phial of distilled water and his tube of morphine tablets. No one is cleverer than a dope when it comes to that sort of work. Of course, he was searched carefully when he reached his destination, and of course he protested innocently. He had not been a slave long enough at that time to show the outward signs that are certain evidences of the habit, but he was detained nevertheless for "observation." Then came a display of nerve. Nearly frantic as he was from the desire for the drug, he declined it angrily when an attendant offered it to him, saying: "What do you take me for? Are you trying to make a 'fiend' of me? I wouldn't touch the stuff. Do you think I have no sense?" and more to the same effect. So well did he play the part of injured innocence that, after forty-eight hours of close watching, the head of the sanatorium reported that there was no evidence whatever of morphine habit, and that he should discharge the youngster.

The first thing the youngster did on being set free was to go to a drug-gist's and put as much "dope" into his system as he could stand.

This incident is remarkable not only for its strangeness, but because it shows the cunning of the "dope." He is capable of almost any game when the stake is "dope."

The Agony of No "Dope."

What it means to be without morphine when one has been accustomed to it is known to those only who have been through the experience, and they cannot tell. The words of all the world's vocabularies would be inadequate. Perhaps a mathematical formula might suggest it. Let "x" equal terror, "y" horror, and "z" agony and remorse.

Then if we raised x, y and z to the ninth power the sum might equal the sensations of a dopeless dope fiend.

(X⁹ plus Y⁹ plus Z⁹ equals D. D. F.)

I had the full of these sensations once when going from Albany to New York. I was X, Y, Z, and all the other letters. It came about in this way. I had gone into the lavatory and had shot some dope into my thigh. The dose I took used the last tablet in one of the two tubes I had bought that morning. When I had cleaned my "gun" and was ready to return to my seat in the car, I packed up the empty tube and put some dope into my pocket, but the tube that was still full I threw out of the window! By and by I needed another phial to prepare my dose. Then I saw that the phial was empty. For a moment I could merely look at it in vacant helplessness. There is no way of describing how I felt. I could not have been more desolate had I suddenly awakened in the darkness of that illimitable space beyond the worlds, alone in the midst of unending nothingness. As soon as I understood that I had thrown away the tube that was full, and that was the empty one which I had kept, I felt it seemed as though it would follow after the tablets I had tossed out through the window.

My first conscious act was to go to the buffet and drink half a tumbler of brandy. Then I called the porter and asked him to go through the train for a physician. After several minutes—or years, as it appeared to me—he returned saying that there was not a doctor on board. I explained the cause of my distress, but he could do nothing; indeed, he added to my misery if that were

possible by saying that there were only two stops, and those of five minutes each, between us and New York city, where it was imperative I should be early the next morning. It meant some thousands of dollars to me not to be there on time.

I ordered a bottle of absinthe, and drank it as fast as I could pour it out. It was like so much water. When I reached Poughkeepsie I cursed the train. I sprinted like a Comanche running for his life until I reached a drug store, half a mile away. I had just breath enough left to say:

"Morphine tablets! Quick!" and I followed the clerk back behind the counter and shot myself in the thigh before he knew quite what had happened.

"You wanted that pretty badly. I guess," said he.

"You could have had a hundred dollars a tablet," I replied.

"At that rate my dose would have cost \$1,200, for I had injected a grain and a half."

I went over to a hotel after that and spent the time until the first morning train went in shooting dope into my arm. I lay in bed with all the lights turned on and "shot" myself frequently.

What bliss it was to feel the "dope" and watch the spot it made around where it went in—a round, white spot as large, perhaps, as a silver dollar, and through which I could see a reticulation of fine veins redden as the morphine took effect. Then I would enhance this sensation mentally by thinking of the hideous misery while on the train only a few hours before.

It was not long after this experience that my family sent me away to a sanatorium that did cure me, to the surprise of everyone who knew me, and I have stayed cured.