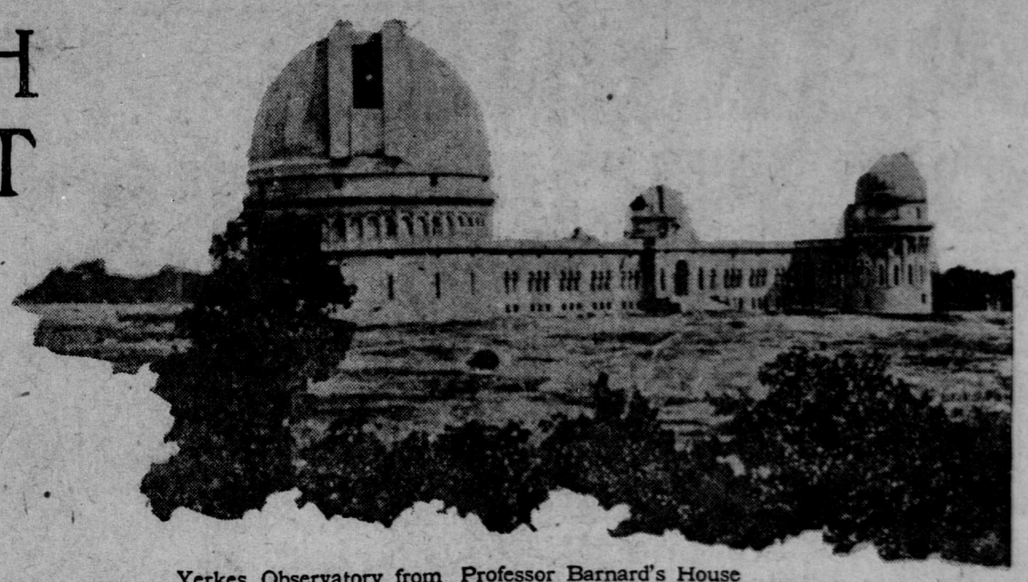
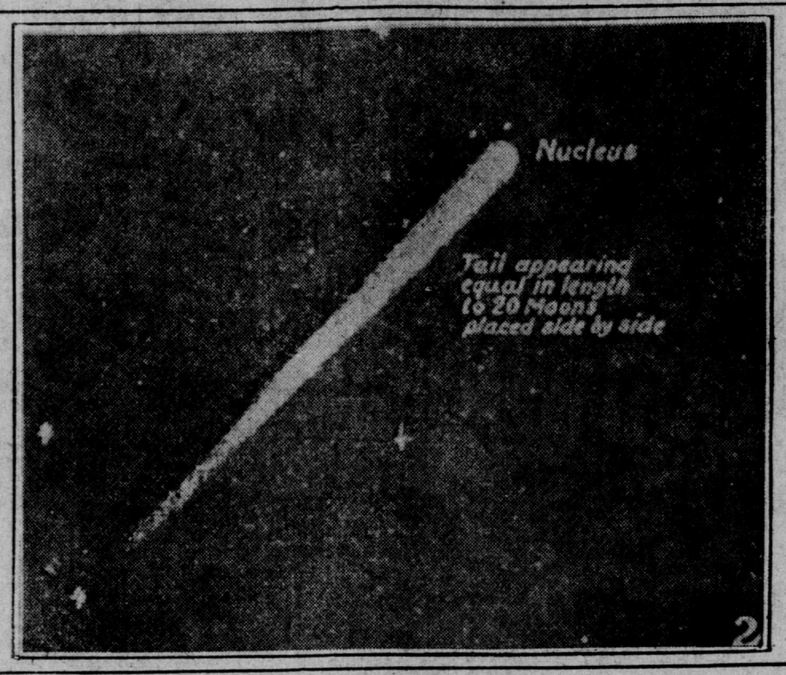
# WHEELING THROUGH THE TAIL OF A COMET

EDMUND HALLEY

## *HALLEY'S Wanderer of the Skies Is Approaching the Earth, Which in May Next Will Pass Through Its Train and Likely Be Swept by Star Dust*



Yerkes Observatory from Professor Barnard's House



**Three Phases of Halley's Comet as It Appeared in 1835**

(1.) As Viewed Through a Powerful Telescope in October, 1835. From a Drawing by the Astronomer Schwabe. (2.) As Seen by the Naked Eye Among the Stars of the Constellation Ophiuchus in October, 1835. From a Drawing by Sir John Herschel. (3.) As It Appeared Through the Telescope in 1835. From a Drawing by Sir John Herschel.

ONCE more Halley's famous comet has been seen through the great 40 inch refractor at the Yerkes observatory by Prof. E. E. Barnard exactly a month from the time he obtained his first glimpse of the celestial wanderer after its absence of 74 years. His observations were made on October 17 and 19, but apparently the comet is gaining in brilliancy, for it was also observed on the morning of October 17 by Professor Wendell of the Harvard observatory with the 15 inch equatorial and by L. Campbell with the 24 inch reflector of the same observatory. It will doubtless soon come within range of smaller telescopes and be visible to the unaided eye in the spring.

As the comet draws nearer to the earth a vague feeling of alarm may be felt by those who regard these celestial visitants with superstitious awe. For them mystery still clings around

"The blazing star,
Threat'ning the world with famine, plague and war;
To princes death; to kingdoms many curses;
To all estates inevitable losses:
To herdsmen rot; to ploughmen hapless seasons;
To sailors storms; to cities civil treasons."

The comet of 1066, one of the earlier returns of Halley's comet, was regarded as a presage of the downfall of Harold of England at the battle of Hastings. In the Bayeux tapestry, on which Matilda of Flanders had drawn all the most memorable episodes in the eventful career of her husband, William the Conqueror, the comet appears in one of the corners with the inscription, "Isti Mirantur Stellam," which proves that it was considered a veritable marvel. It is said even to be traditionally reported that one of the jewels of the British crown was taken from the tail of this comet.

Although comets are no longer regarded with superstitious awe as in olden times, yet they are apt to cause unnecessary alarm. For instance, even in our present enlightened day a letter was recently inserted in the Observatory, addressed to the editor by an alarmed Britisher, who feared the present appearance of Halley's comet might be an ill omen in connection with the possible invasion of England by the Germans. Some alarm has also been aroused by the statement that in all probability the earth will pass through the train of the comet on the morning of May 19, 1910, and that on that occasion the head of the comet will be about only 12,000,000 or 13,000,000 miles distant.

### Swept by Star Dust

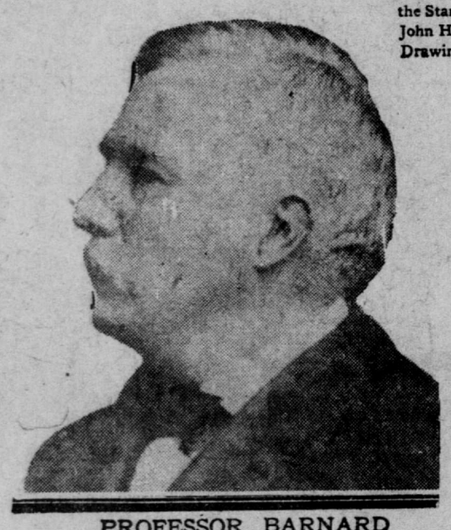
According to the calculations of Frank E. Seagrave, an astronomer of Providence, R. I., he finds by computations as delicate as trigonometry and the micrometer can make them that on May 19 the comet will cross the plane of the earth's path. It is likely that the earth will be enveloped in the train of the comet and for a short period our planet may be swept by star dust.

"There need be no scare over the approaching event, however," Mr. Seagrave reassures us. "Nothing will happen. The end of the world will not come. It will be nothing more than we passed through on June 3, 1861, when the earth cut through the comet of that year. The nearest it could ever come to the earth would be 6,235,000 miles."

Regarding the actual experience concerning the comet of 1861 Sir Robert S. Ball recounts it as follows in his usual entertaining way:

"In the year 1861 a fine comet appeared. It is not so well remembered at its merits deserve, because it happened, unfortunately for its own renown, to appear just three years after the celebrated comet of 1858, which was one of the most gorgeous of its kind in modern times. But in 1861 we had a novel experience.

"On a Sunday evening in midsummer of that year we dashed into the comet, or rather it dashed into us. We were not, it is true, in collision with its densest part; it was only the end of the tail which we encountered. There were, fortunately, no very disastrous consequences. Indeed, most of us never knew that anything had happened at all, and the rest only learned of the accident long after it was all over. For a couple of hours that night it would seem that we were actually in the tail of the comet, but so far as I know no one was injured or experienced any alarming inconvenience. Indeed, I have heard of only one disaster arising from the collision. A clergyman tells us that in midsummer he was always able in ordinary years to read his sermon without artificial light. On this particular occasion, however, the sky was overcast with a peculiar glow, while the ordinary light was so much interfered with that the sexton had to provide a pair of candles to enable the clergyman to read his sermon. The expense of those candles was, I believe, the only loss to the earth in consequence of its collision with the comet of 1861."



PROFESSOR BARNARD
Photo by Calvert Bros.

**Passage of the Earth and Moon Through the Train of a Comet June 30, 1861**

Flammarion's "Popular Astronomy."
Permission of D. Appleton & Co.

### Year of Comets

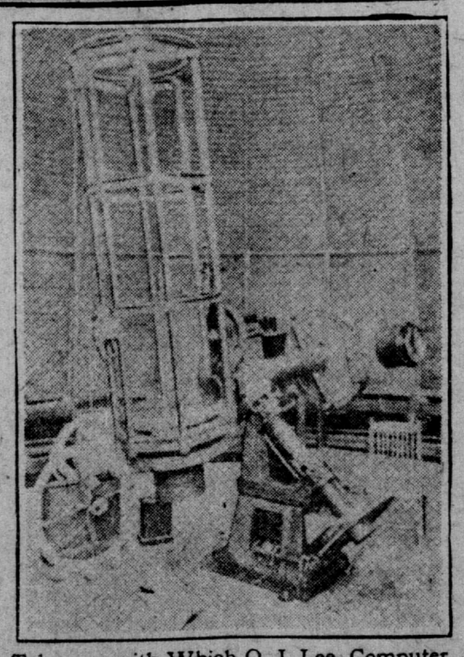
Nevertheless, despite our escape from harm in 1861 and the reassuring statements of such an authority as Prof. S. W. Burnham of Yerkes observatory, who tells us we need not feel alarmed, for the comet "is not going to hurt anybody on this earth," yet in all probability there are many who will doubtless cast suspicious glances in its direction when it is bright enough to shine resplendent in the evening sky next spring, if not sooner. At present it is no use trying to see the celestial wanderer except by means of a telescope, as it is too faint as yet to be seen otherwise.

As it draws nearer, however, and increases in brightness, adorning itself with a glittering train when it approaches the neighborhood of the sun, it will prove a source of keen delight to those who can regard it from the true standpoint of scientific knowledge, but to the uninformed it may doubtless prove truly alarming. When the comet appears with its

Ten million cubic miles of head,
Ten billion leagues of tail

the first question the uninitiated will probably ask will be, "What great calamity does this mean?"

The greater number of inquirers will be more occupied, however, with the physical effects likely to result than with the supernatural form of the apparition. Do you think we shall have a cold or dry winter, or must we anticipate foggy weather, rains or inundations? Does it announce an abundant harvest, as was remarked in connection with the comet of 1811, resulting in the excellent quality of the so called "comet wine" of that year?



Telescope with Which O. J. Lee, Computer at the Yerkes Observatory, Photograped Halley's Comet September 16, 17, 24 and 26

Of meteorological phenomena attributed to comets because their causes have remained unknown mention must be made of dry fogs, such as those of 1783, 1822, 1831 and 1834. The appearance of this singular phenomenon in 1783, accompanied by its long duration—for it was visible more than a month—has been accounted for as resulting from the immersion of our planet in a comet's train.

It is not impossible for our globe, as we have seen, to traverse the gigantic trains of certain comets nor to penetrate to a certain depth the vaporous atmosphere of some among them. Apart from these encounters we may suppose that cometary matter may be introduced into our atmosphere by the power of attraction. Pursuing its course in the same region as the planets, projecting its substance far beyond its own sphere of attraction, a comet can scarcely fail to abandon fragments of its tail, which the mass of the earth, for example, may afterward appropriate. At any rate, such was the opinion of Arago with regard to the dry fog of 1783.

This fog had not the qualities of an ordinary fog. It was not damp and moist like the clammy fogs of London. The general color of the air was that of a dull, dirty blue; distant objects were enveloped in a blue, misty haze and at the distance of a league were indistinguishable. The sun, without brilliancy and obscured by mist both at its rising and setting, could be looked at without dazzling the eyes at noonday. A singular circumstance mentioned by Arago in connection with this fog was the fact that it seemed to possess a certain phosphoric property, a light of its own. "I find, at least in the accounts of some observers," he remarks, "that it diffused, even at midnight, a light which they compared to that of the moon at its full and which sufficed to make objects distinctly visible at a distance of more than 200 yards."

### The Dust and Ashes

Was the earth plunged in the tail of a comet or had it met with the fragments of a cometary appendage abandoned in space? But why, then, was the comet itself not visible? Could the dust and ashes projected to a distance and scattered far and wide have been the cause of this phenomenon? Some scientists assumed, in order to explain the dry fog of 1783, that it was caused by the diffusion of volcanic cinders, as in the more recent case of the eruption of Krakatoa in August, 1883. The descriptions of extraordinary optical phenomena, such as wonderful ruddy glows at sunset and sunrise, or strange hues in which the sun and the moon were occasionally tinted, were collected from numerous places all over the world.

Everywhere remarkable appearances were noted in the sky that winter, from Lake Superior to Tierra del Fuego, from the gulf of Guinea to China, from Panama to Australia. Strange halos were often seen, occasionally blue or green moons, and the sun was glorified by a corona that had its origin in our atmosphere. Wherever there were inhabitants with sufficient intelligence to note the unusual reports were received of extraordinary manifestations witnessed in the heavens.

When we reflect that an explosion on an insignificant islet in the straits of Sunda has sufficed to adorn the sunsets of every country on earth, what may we not expect at a result of our passage for a short period through the train of Halley's comet? Will it be in the nature of a peculiar glow in the sky, as in the year 1861, or a rain of fire, celestial fireworks outrivaling the marvels recorded at the magnificent display of meteors in the year 1833, when the shooting stars were said to have fallen as thickly as snowflakes?

According to the ephemeries of Halley's comet, as calculated by A. D. C. Crommelin and D. Smart, the position of the comet on May 19 will be right ascension 6 hours 30 minutes 16 seconds and declination 13 degrees 38 minutes. The comet will then be in the neighborhood of the constellation Gemini, and as the sun sets at 14 minutes after 7 o'clock and the comet between 8:30 and 9 o'clock the probability is that the splendor of the comet will fade in the twilight. There will be, however, a fine opportunity to observe the comet, under the most favorable conditions possible, at the total eclipse of the sun, which takes place May 8, 1910. On that occasion, when the blinding glare of the sun is hidden for a few moments by the dark globe of the moon coming between the sun and the earth, it may be possible to see Halley's comet during totality. If so it should provide a magnificent spectacle, for this is the most favorable of all conditions for seeing a comet.

### View of the Comet

What is the cause of the doubt about this event? It is due simply to the fact that the track of eclipse runs across the ocean and only touches the northeastern extremity of Tasmania.

"A hardy mariner," to quote Prof. H. H. Turner's remarks on the subject in an address given before the British Association for the Advancement of Science at its meeting at Dublin on Friday, September 4, 1908, "who should care to take up a suitable position on May 8, 1910, and was favored with a cloudless sky would be sure of a magnificent view of the comet during totality. But an astronomer who wishes to set up an instrument on terra firma must be in Tasmania, and there it seems possible that the comet may have set below his horizon before totality is reached."

Nevertheless, the prospect is so fascinating that the writer is now making arrangements to journey to Tasmania next spring for the express purpose of witnessing this wondrous sight. Three times she has been enabled to observe the marvelous glory of the corona at the total eclipses of the sun which occurred in 1896, 1900 and 1905, but to see Halley's comet near the sun on a similar occasion in all its glory is simply irresistible.

According to the ephemeris of A. D. C. Crommelin and D. Smart the comet must be looked for in the constellation Taurus during the month of November, this constellation being near the well known group of stars Orion. On November 20 it will pass very close to the bright star Aldebaran, the leading brilliant in the constellation Taurus. During January the comet will pass through the constellation Aries and Pisces, and on March 21 will pass near Algenib, in the constellation Pegasus. After about April it will be a matter of some uncertainty how long it will be possible to see the comet as it approaches the neighborhood of the sun. It will certainly cease to be visible much longer in the evening, but will reappear in the morning early in May, still in the northern hemisphere, and still in Pisces, where it will be until about May 14. After that the comet will pass into the southern hemisphere and remain there until it disappears altogether, which may be in June or July.

The comet will be nearest to the earth—that is, about 12,000,000 miles, and therefore at its maximum brilliancy—about May 18, but the moonlight will to some extent spoil the view of the comet, so that, all things considered, the best view will be on May 21. After leaving the constellation Pisces, about May 14, the comet's path will be through Aries, Taurus, Gemini, the head of Orion, Canis Minor, Hydra, Sextans, the feet of Leo and Virgo, where it will probably be last seen, but the long days and short nights and the full moon on May 22, with no true night at all during many weeks, will seriously interfere with cometary observations.

After the comet has whirled around the sun, having attained by that time its maximum speed of 1,878 miles a minute, it will begin its return journey to the regions beyond the outermost planet, Neptune, not returning for another 74 or 75 years. On its way it will pass near a number of bright stars, which will be visible to observers living in the southern hemisphere, at the cape, in Australia or in New Zealand and can be seen by them for a long time. The bright stars along the pathway, shining like beacon lights, marking the celestial milestones of the comet's track, will be Aldebaran, in Taurus; Betelgeuze, in Orion; Gamma Geminorum and Procyon, in the constellation of Canis Minor.

## *The Efficient Human Engine*

THE human organism is a machine of very high efficiency, according to the latest researches on the action of foods, made at the University of Sheffield, England, by Professor Macdonald, and at Wesleyan university, Middleton, Conn., by Professors Atwater and Benedict. This means that an unusually large proportion of the chemical energy contained in our food is transformed within the body into the mechanical energy of muscular movement. A good steam engine utilizes about 13 per cent of the heat energy in its furnace. Explosion motors do better. A gas or gasoline engine turns into useful work about 20 per cent of the energy possessed by the working substance. The human body does still better, utilizing about 21 per cent of the energy that is put into it. Thus the efficiency of the human machine, despite the fact that its mental functions are almost continuously in action and that quantities of energy are used up within the body to operate the internal organs, is nearly twice as great as that of a steam engine and a little higher than that of an internal combustion engine. This, too, is a normal performance, which is greatly exceeded in special cases. An athlete, according to Professor Atwater's experiments, may have an efficiency as high as 36 per cent. What this means we may realize when we recollect that no heat engine, even if ideally perfect, can utilize more than a fraction of the energy used in running it, and that the size of this fraction is proportional to the extent of temperature within which the engine works—in a steam engine, for instance, to the difference between the temperature of the boiler and that of the condenser. Now, the human machine works between limits of temperature that are very close together, so that its high efficiency is remarkable.