

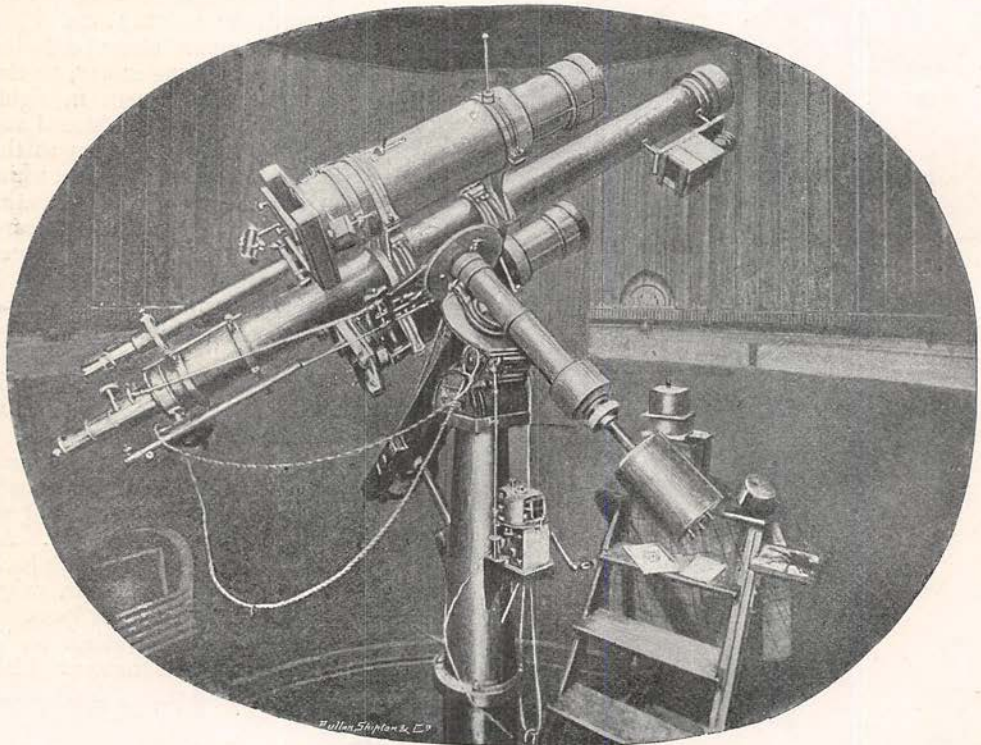
# TRAPPING PLANETS.

BY WALTER GEORGE BELL.



FROM time to time brief paragraphs appear in odd corners of the newspapers announcing that one or two, or perhaps three, new planets have been discovered. To anyone who takes note of these frequent announcements, it might seem that our solar system was getting inconveniently crowded, as indeed it would be were these new-comers of anything

Except the meteorites—the flying stones which, on entering our atmosphere, give rise to the phenomena of shooting-stars—these are the smallest inhabitants of the celestial spaces. Great Britain, if rolled up into a sphere, would make a very respectable minor planet. Or Ireland might be sent off on a career of absolute independence somewhere between Jupiter and Mars, where all these minor planets circulate. Many of them are



DR. MAX WOLF'S OBSERVATORY AT HEIDELBERG.  
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approaching the size of our own earth or the still larger planets which have been known since a dateless antiquity. Already there were 427 of them mapped down to July this year, and doubtless there are some hundreds still waiting to be trapped. In the winter months they are mostly found, for the summer night is too short for the search. They travel round the sun in a path far outside that of the earth, and their bulk altogether is much less than that of the moon.

too small to be visible in a telescope. Their existence was unknown until the dawn of the present century, and they would never have been found in such large numbers but for the invention of photography.

The modern process adopted for their capture may be concisely explained. The astronomer lays his trap by pointing his telescope, with a camera attached, to some portion of the heavens lying in the zodiac. He has taken the precaution beforehand to



see that his telescope is provided with a driving-clock which shall accurately keep it pointed to the same group of stars as they pass—or rather seem to pass—across the sky. Then if he had confidence in the accuracy of his clock and the freedom of the night from clouds—which, however, he never has—he might comfortably go off to bed. The plate is exposed for a varying period, it may be as little as two hours or as much as five hours, during which time the light from each separate star is burning out its image on the sensitive film.

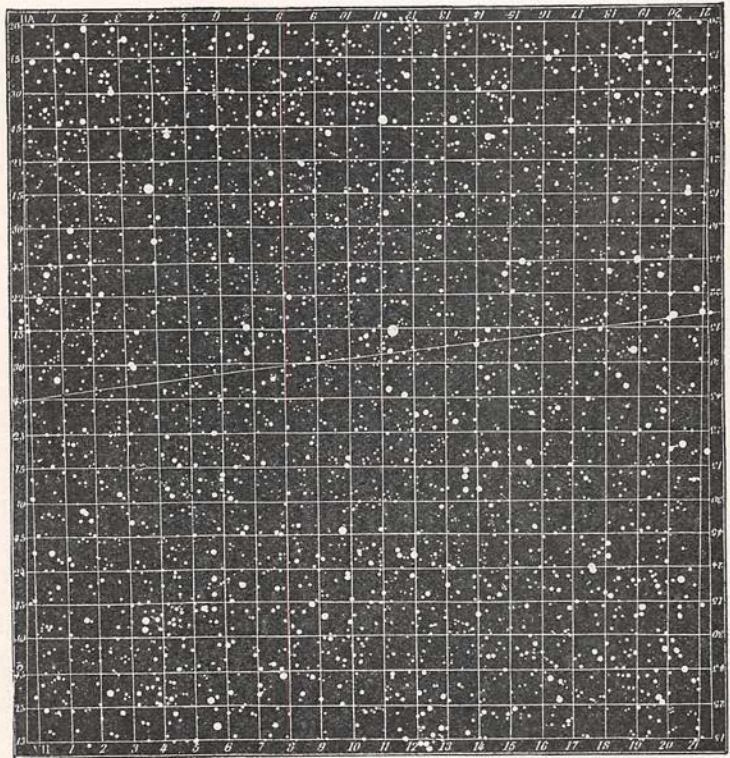
Before the first indication of sunrise on the eastern horizon the astronomer takes out his plate, develops it, and forthwith subjects it to a careful scrutiny. Success or failure depends on the accuracy of the driving-clock. The "fixed stars," down to the very faintest, will (in a positive print) have come out as clear, round, white specks on a dark background. If a planet unknown to the astronomer has also been photographing itself on the plate, it will not be fixed, but will have moved during the hours of exposure, and its motion will be marked by a slender white track across the plate. Some of these tracks may be from planets already known; but whenever a new track is found the astronomer knows that his night's work has not been fruitless, and that he is to go down to fame as the discoverer of a new planet.

The photographic process is only five years old, but already nearly half as many planets have been found by its agency as were known before. It has entirely displaced the old system of telescopic search and comparison with star-charts. A reduction of a star-chart showing a minute portion of the heavens lying in the zodiac, as seen through a telescope, is printed on this page. A glance at it will suggest the immense labour which is involved in a comparison each night of the positions of all the hundreds of stars

marked on such a chart to see if any new-comer has appeared among them.

It may be explained that the zodiac is searched for minor planets in preference to other portions of the heavens because each planet in its journey round the sun must pass twice through this region, and the chances of discovery are consequently greater.

Dr. Max Wolf, of Heidelberg, discovered the first asteroid—a name given to these small planets by Sir William Herschel—by



AN ECLIPTIC STAR-CHART.

the photographic process on the night of December 22, 1891, and he is still one of the most renowned planet-catchers of our time. His apparatus is shown on p. 564. It consists of a telescope surrounded by three telescope-cameras, all moving together on a single mounting. At the end of the short tubes the cameras are attached. The central, and longer tube, is used visually to detect any errors in the motion of the driving-clock. Lines of spider-web—the finest thread it is possible to obtain—are stretched across the field of view behind the magnifying eyepiece, and the relative position of any



prominent star to these lines shows whether the clock is working accurately or not.

It must not be thought that when a track is found on the photographic plate the discovery of a new planet is complete. At least three positions of the planet on successive photographs must be obtained before its path can be ascertained. The most laborious part of the work has yet to come. Calculation now commences to ascertain if the planet is really a new discovery, or is not merely a planet which has already been mapped and named, and moving round the sun, has arrived at a new position. Tables of the motions of the known planets are kept, and many sheets of paper have to be filled with very many intricate figures before the

several additions to the family. Two of his plates he has kindly sent me, with permission to reproduce them. They have not before been published. The one shown on this page—taken on the night of March 7, 1894—is of special interest, as it is the actual photograph by which a new planet, provisionally numbered 388, was discovered.

A little explanation of the plate is necessary. In the first place, the white rings and figures now shown formed no part of the original plate exposed at the end of the telescope. They were added, after the necessary calculations had been made, to identify each of the planets which has left its trace on the plate, for one planet mark is exactly like any other, and it is only by following their movements that their identity is established. Within each ring is seen a little white line, the mark of the planet, showing the direction in which it has moved, while the clear round images of the fixed stars testify to their being stationary. For purposes of reproduction it has been necessary to exaggerate this planet mark, but it will be understood that in the original glass negative it is faint and slight, and needs a hand-glass to be easily distinguished. Three other planets besides the new-comer are marked on this photograph.

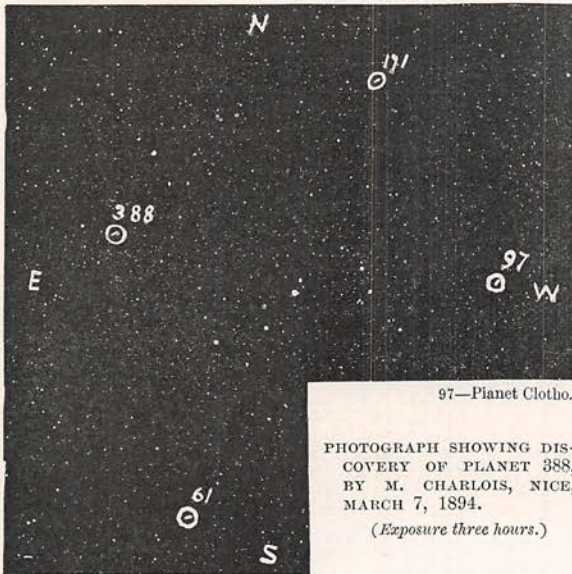
Plate II, exposed by M. Charlois on the night of December 8, 1895, contains photographs of the planets Elvira, Harmonia, Isis, and a planet discovered by M. Charlois, and known by the number 317. Both plates were taken at the great observatory at Nice, which was founded by the munificence of M. Bischoffsheim, and is one of the finest and best equipped astronomical

observatories on the Continent.

Of late years England has done little in the detection of new planets, their pursuit being left chiefly to Continental astronomers. There is at Berlin a sort of astronomical exchange to which records of new planets are sent, and here calculations of their orbits are worked out. Before the adoption of the photographic method however, Dr. Hind—who died some eighteen months ago—Mr. Graham and Mr. Pogson, among English astronomers, had each made discoveries in this difficult field of research.

What, it may be asked, is known about these tiny planets? What can be known about a mere speck on a photographic plate? In that case certainly not much. But not

171—Planet Ophelia.



97—Planet Clotho.

388—New Planet.

61—Planet Erato.

astronomer has confidence to announce his discovery.

Often it happens that weeks or months after a planet has been announced, and a provisional number given to it, another astronomer, working perhaps in another hemisphere of the world, finds by careful calculation that the supposed new addition to the family is after all only a well-known planet rediscovered.

An indefatigable worker in the search for these tiny worlds is M. Charlois, of Nice, who has used both the telescope and the camera with equal success. Forty new planets attending the sun had been discovered by him before 1893, and no year has since passed in which he has not made



all the asteroids are so insignificant. Vesta, the brightest, though not the largest of the number, is, under favourable circumstances, just visible to the naked eye, and many have appreciable discs when viewed through a sufficiently powerful telescope. Each is just as much a separate world, making a periodical revolution round the sun, as this world on which we live. All investigations which have been made have been insufficient, however, to prove the existence of any atmosphere, though in some few cases it has been suspected, and without air or water they can be little else than barren, arid rocks, at a temperature much lower than anything we experience on earth.

Ceres, largest of all this group of little worlds, is believed to have a diameter not exceeding 485 miles, Pallas 304 miles, Vesta 243 miles, and Juno only 118 miles. As the asteroids, even when nearest the earth, are viewed at a distance, in rough figures, of 150,000,000 miles, these measures can only be taken approximately, but they indicate the extremely small size of these bodies. Probably a healthy vigorous man would, in a day's walk, go right round the equator of some of the smaller photographic planets. One curious effect of the low gravitation on their surface would be that a jump of a mile would be an easy feat to a being endowed with our physical powers.

Many are the theories as to their origin. It was noticed towards the close of last century that while the planets Mercury, Venus, the Earth and Mars maintained a sort of regular progression in their distances from the sun, between Mars and the giant planet Jupiter there was a large gap left untenanted, and the harmony of the sun's family seemed to require that this should be filled up. Search was consequently made for a hypothetical planet, which it was supposed had been overlooked by astronomers owing to its small size; but where one planet was expected hundreds have been found. A startling but still most plausible theory was first suggested, that these small planets were fragments of one large planet which, through its internal heat, had exploded. And in them was seen the fate that might possibly be in store for our own earth.

It required to establish the truth of this theory that all the fragments in their journeys round the sun should return to the

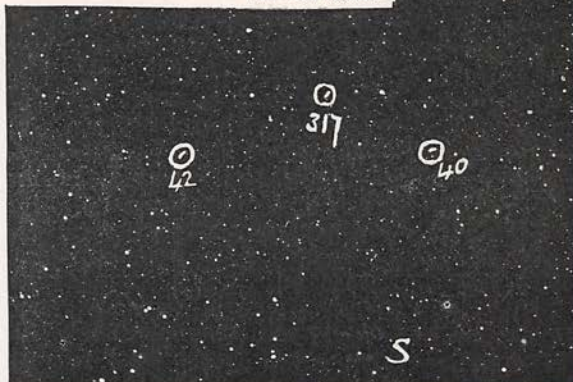
point at which the explosion took place. In the case of the first three of the minor planets discovered, such a point of meeting seemed actually to have been found, and a great explosion in the skies untold ages ago came to be accepted as the most probable explanation. This received support from appearances detected by some keen-sighted observers, which led them to believe that the asteroids were not all circular, but jagged and irregular, as if violently torn asunder. But as more discoveries added new members to the numerous family, it was found that they passed wide of this point, and so the famous theory became itself exploded.

On the whole, it seems most likely that the material out of which a compact world like our own earth might have been created, separated into small detached

277—Planet Elvira.



317—New Planet.



42—Planet Isis.

40—Planet Harmonia.

PLATE II.—PHOTOGRAPH SHOWING DISCOVERY OF PLANET 317, BY M. CHARLOIS, NICE, DECEMBER 8, 1895.

(Exposure three hours.)

masses before the time for cohesion arrived. Midway in the development of the solar system a breakdown, or at any rate a change of plan occurred, but how it originated we can only speculate.

Which will be exhausted first, the patience of astronomers or the supply of minor planets? All the known minor planets are confined to the space between the orbits of Mars and Jupiter, and their paths are so interlaced that, if we imagine them to be material rings, a finger placed in one would lift up the lot. An astronomer has now to make himself sure of the accurate paths of 427 planets before he can venture to announce to the world that he has discovered the 428th.