

LETTERS TO THE EDITOR.

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Surface Deformation and the Tides.

FOUR years ago I installed in a cellar beneath the Victoria Club, at Ryde, an astronomical level. It was oriented at right angles to the shore-line, only a few yards distant. At the time of high water I found, contrary to my expectation, that the strand, rather than sinking, rose upwards. This I attributed to the tide backing up underground drainage beneath the land, which in consequence bulged upwards. Sir George Darwin, however, makes the suggestion that my observations might be explained on the assumption that the load of water in the English Channel on the south of the Isle of Wight might reverse the effect of a smaller body of water in the Solent on the north side.

I was enabled to make a second attempt to measure the

the steepness of the bounding shores is increased. The buildings in towns along sea-boards twice a day are tilted seawards. When the tide flows out these movements are reversed. The deflection of the pendulum by tidal load and attraction, although greater than might be expected, is, however, very small. At Bidston it is about 0.2", or 1 inch in sixteen miles.

JOHN MILNE.

Shide, Isle of Wight, January 24.

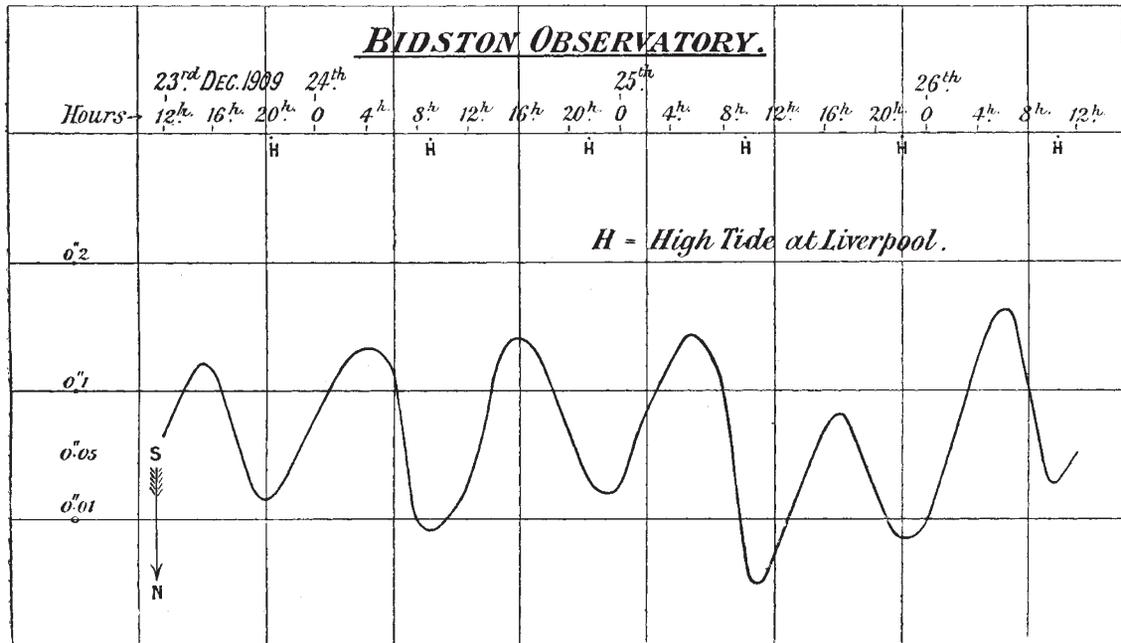
A Possible Identification of Comet 1909e.

HERR EBELL has recently determined approximate elliptic elements for this comet.

These elements bear some resemblance to those of comet 1890 VII. Spitaler, which has a period of 6.373 ± 0.01 years, and has not been seen again.

Comet Spitaler had a perihelion distance of 1.8 and an aphelion distance of 5.1. It passes near no other planets than Mars and Jupiter. The small mass of Mars makes the perturbations by that planet of little account.

As comet Spitaler's period is half that of Jupiter, it only approaches Jupiter at alternate aphelion passages. It did



The movement of a Horizontal Pendulum at Bidston, December 23-6, 1909. The bob moves to the North with a rising tide. Scale $\frac{1}{16}$ in. = 0.1 second of arc.

changing slope along a coast in consequence of tidal influences through the kind cooperation of Mr. W. E. Plummer, the director of the Bidston Observatory. This observatory is situated near Birkenhead, about one and a half miles from the sea. The instrument is a slightly modified form of a British Association type of seismograph. It consists of a horizontal boom, 2 feet in length, carrying a weight of 6 lb. At the outer end of the boom there is an extremely light lever, which multiplies the movement of the boom eight times. This, which is a peculiar feature of the apparatus, was designed by my assistant, Mr. Shinobu Hirota. The outer end of this pointer moves above a surface of bromide paper driven by clockwork. A displacement of the image shown on the paper through a distance of 1 mm. corresponds to the displacement which would be obtained were the stand of the pendulum tilted through an angle of 0.08". The objects of this installation are two-fold, first, to record tidal effects, and, secondly, to pick up minute movements which other types of seismograph seldom record. The accompanying figure shows the tidal effect, which varies with the height of the water, the ebb, and the flow.

At high tide the bed of the Irish Sea is depressed, and

not approach Jupiter at its aphelion after its appearance in 1890, but it did approach Jupiter on the following aphelion passage, 1899-1900.

The comet's motion is direct, and it therefore remains in proximity to Jupiter for a considerable time. Its closest approach took place about 1899 November 8, when its distance was about 0.6 and its eccentric anomaly 160°. For more than a year it remained within a distance 0.8 of Jupiter, and the perturbations must have been considerable. If we carry Ebell's orbit backwards, we see that comet 1909e was also near Jupiter in 1899-1900, and there is, therefore, a fair probability of the two comets being the same.

If Ebell's elements were definitive, this identification would have to be given up, for a rough calculation shows that the changes of elements are not in the right direction or of the right magnitude. Ebell's elements, however, merely represent the first attempt to get elliptic elements instead of parabolic elements. They depend on three places only, the first and last being six weeks apart. Herr Ebell himself tells us that the residuals for a fourth observation in the middle of the above-mentioned six weeks amount to a minute of arc, so that it is quite conceivable that the