

air,  $P$  the net wind-pressure on the wing-plane,  $G$  the pull of gravity, the bird's weight, and  $F$  the frictional resistance<sup>1</sup> encountered by the bird in moving through the air, we have indicated a solution of the problem of support and of propulsion, propulsion in a direction opposite to that of the horizontal component of the wind's velocity.

As the trail of smoke marks the direction of the wind with respect to the moving ship, the bird must, in order to sail with the same velocity and direction as the ship, have a motion relative to the air equal and opposite to the motion of the smoke relative to the ship. Accordingly, the bird's axis is kept parallel to, and opposite to, the course of the smoke as indicated by its trail from the funnel.

With a head-wind, though there must be an up-current near the bow, this current must be much more narrowly local, and therefore less advantageous for the bird's use in sailing, than the up-current produced by a wind abeam.

It would appear that the gulls when sailing are not directly seeking food, but are merely resting, loafing for the time being, with ears intent, however, for any indication of a find by their more industrious brothers astern.

Having shown this discussion to a number of well-known physicists aboard the *Arabic*, I find no opposition to the theory proposed for the facts as noted, but a very general doubt as to whether gulls do not sometimes sail on the leeward side of a ship or too far astern to get the benefit of the upward air current from the windward side. When I ask seafaring men about the matter, they at first say confidently that the birds sail on either side of the ship, but after a little consideration they waver in this statement and admit that they have never taken particular note of the facts in the case. Accordingly I have thought it worth while to write this letter, in the hope that its publication in *NATURE*, if room be found for it, may stimulate further observation of an interesting phenomenon and perhaps prevent some inventors from wasting their time and money in vain attempts to accomplish motorless flight.

The westward course from Queenstown may be an especially favourable place for studying the question here raised. Four years ago I made there some observations which, so far as I can now recall them, agreed in essential particulars with those which I have made recently, but I did not at that time see the full significance of the facts noted.

EDWIN H. HALL.

Cambridge, Mass., September 20.

#### Errors of the Computed Times of Solar Eclipse Phenomena.

THE final reports of two of the observers of the total solar eclipse of April 28, 1911, have recently been published, giving detailed accounts of their experiences at Vavau, Tonga Islands. Father Cortie's report appears in *Proceedings, R.S.*, No. A595; that of Dr. W. J. S. Lockyer in a publication of the Solar Physics Committee. In reading these reports I have been much struck by the circumstance that both writers appear to have been taken aback by the (to them) unexpected effect of the errors of the lunar tables on the computed times of the various phases of the eclipse. But I wish to point out that they were not left without warning. In *Monthly Notices, R.A.S.*, vol. lxxix., p. 31, I stated that with the existing errors of the lunar tables the times of the contacts in this eclipse as there

<sup>1</sup> Perhaps  $F$  should be taken in the direction of  $D$ , but uncertainty here does not affect the main argument.

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given would be several seconds too late. And as a means of estimating the true times I gave the intervals from the instant when the cusps subtended an angle of specified value at the sun's centre to the commencement of totality. The shift of the moon's actual position relatively to its tabular place would, of course, alter the predicted duration of the eclipse. At the time of publication of my paper (November, 1908), it was not possible to give definite information as to the magnitude of the errors in question, as Newcomb's latest corrections were not then available. But, so far as appears from these reports, the intending observers did not make any further inquiries on the subject before proceeding to draw up their definite programmes of observation. In the circumstances this, surely, would have been a wise precaution.

A. M. W. DOWNING.

September 27.

WITH regard to Dr. Downing's remarks, I was aware from his published statement that the predicted time of totality would probably be "several seconds too late," but little thought that the error would amount to so much as *twenty seconds* of time. The precaution was naturally taken to observe closely the diminishing cusp and to arrange to give the necessary time signals from the cusp data mentioned by Dr. Downing in the above letter. Unfortunately, however, while the cusp was visible nearly up to second contact, the image of it on the screen had been oscillating so violently (due to air tremors) that the officer in charge had previously decided to give the necessary signals at the computed times from the chronometer. (See page 17 of my report for details of the actual procedure.) It is true that no inquiry was made by me to find out what error might be expected, but it was assumed that if such a large error had been approximately known it would have been published. It would be advantageous if the present director of the Nautical Almanac could find his way to make generally known the approximate values of such errors a short time previous to the setting out of eclipse expeditions.

The facts that Father Cortie's camp was in the same clearing as that of my party and that he made use of my time signals explain why he experienced the same error.

WILLIAM J. S. LOCKYER.

Solar Physics Observatory, October 1.

#### A Flower-sanctuary.

It seems to me that Sir Edward Fry takes a rather narrow view of the by-law under discussion; for surely it may be held that the removal of any of the special Cheddar plants, in such quantities as to leave a blank where there was formerly a mass of colour, would constitute a "disfigurement" or "damage" within the meaning of the enactment: and I suggest that any bench of magistrates anxious to preserve the beauty of the gorge should find no difficulty in convicting under the by-law. If, however, it be held that the existing by-law is inadequate, it seems clear that county councils have full power to enact far more stringent and specialised by-laws.

I remember that on the commons under the jurisdiction of the London County Council there used to be—and doubtless still are—notices forbidding anyone, under a penalty of five pounds, to pluck even a single blossom of any wild flower; and I think that Sir Edward Fry will find on St. Vincent's Rocks, at Clifton, notices announcing a similar penalty against anyone who shall gather the rare *Arabis stricta*: at any rate, there were such notices a few years ago,