the volume [*a'*]. Then the wave-lengths, λ, of the lines in the spectrum of A, which belong to *a*, are to the wave-lengths, λ', of the lines in the spectrum of C, which belong to *a'*, as [*a*] is to [*a'*]. If there be no condensation the lines are the same as to their position, since the volume remains constant, though their relative intensities may vary greatly; the compounds of hydrogen with chlorine, bromine, and iodine may be cited as examples. Assuming this principle, the spectra of hydrogen and water vapour offer some very interesting relationships. Thus, the wave-lengths of the second spectrum of hydrogen, which seems to belong to a molecule, H', of a more complicated structure, when divided by 2 give the wave-lengths of the lines of water vapour, the volume of the free molecule H' being double that which hydrogen occupies in water vapour. The wave-lengths of the elementary spectrum of hydrogen can be arranged into two groups, *a* and *b*, which give the lines of the water vapour spectrum when they are respectively multiplied by $\frac{19}{20}$ and by $\frac{4}{5}$. From this Prof. Grünwald concludes that hydrogen is composed of the combination of four volumes of the element *a* with one of the element *b*. The first element, *a*, should be the lightest of all the gases, and much lighter than hydrogen; and since it should therefore probably enter largely into the constitution of the corona, Prof. Grünwald gives it the name of "coronium." The D_3 or "helium" line is found in the spectrum of the second element, *b*; and the Professor therefore gives *b* the title "helium." The correspondences between the wave-lengths calculated by Prof. Grünwald for the elements *a* and *b* and those of lines actually observed in the spectrum of the sun are certainly striking. Following out the same method, the Professor finds the chemical formula of oxygen as follows—

$$O = H'O' = H'[b_4O''_5] = H'[b_4(b_4c_5)_5].$$

The line of the corona, 1474 K, should belong to the element "coronium," and would correspond—$5316 \times \frac{2}{3} = 3544$—to a line, as yet unknown, of the elementary spectrum of hydrogen, with wave-length 3544. Prof. Grünwald had hoped that the late eclipse would have afforded an opportunity of searching for this line. It is clear that the dissociation of hydrogen in the sun is a necessary consequence of this theory, since its two constituent elements will thus both be in the free state in the solar atmosphere.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 *SEPTEMBER* 25—*OCTOBER* 1.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on September 25

Sun rises, 5h. 52m.; souths, 11h. 51m. 42·7s.; sets, 17h. 51m.; decl. on meridian, 0° 50′ S.: Sidereal Time at Sunset, 18h. 8m.

Moon (one day after First Quarter) rises, 14h. 54m.; souths, 19h. 14m.; sets, 23h. 36m.; decl. on meridian, 19° 26′ S.

Planet.		Rises. h. m.		Souths. h. m.		Sets. h. m.		Decl. on meridian. ° ′
Mercury	...	6 57	...	12 34	...	18 11	...	5 6 S.
Venus ...	...	5 43	...	11 16	...	16 49	...	6 1 S.
Mars ...	...	1 38	...	9 9	...	16 40	...	16 30 N.
Jupiter...	...	9 7	...	14 3	...	18 59	...	12 56 S.
Saturn...	...	0 20	...	8 10	...	16 0	...	19 30 N.

Occultations of Stars by the Moon (visible at Greenwich).

Sept.		Star.		Mag.		Disap. h. m.		Reap. h. m.		Corresponding angles from vertex to right for inverted image. ° °
25	...	*f* Sagittarii	...	5	...	23 27	...	0 30*	...	125 330
26	...	B.A.C. 7053	...	5½	...	17 35	...	18 55	...	73 270
26	...	*o* Capricorni	...	5½	...	17 36	...	18 55	...	73 269
27	...	*υ* Capricorni	...	5½	...	0 1	...	0 48	...	93 7
28	...	42 Aquarii	...	6	...	22 14	...	23 1	...	65 1

* Occurs on the following morning.

Meteor-Showers.

		R.A.		Decl.		
Near δ Aurigæ ...	...	78°	...	57° N.	...	Swift.
From Lynx	...	105	...	51 N.	...	Very swift.

Variable Stars.

Star.		R.A. h. m.		Decl. ° ′				h. m.	
U Cephei	...	0 52·3	...	81 16 N.	...	Sept.	28,	5 34	*m*
R Ceti ...	...	2 20·3	...	0 41 S.	...	,,	28,		*M*
Algol ...	...	3 0·8	...	40 31 N.	...	Oct.	1,	4 1	*m*
λ Tauri...	...	3 54·4	...	12 10 N.	...	Sept.	26,	22 36	*m*
						,,	30,	21 28	*m*
R Boötis	...	14 32·2	...	27 14 N.	...	,,	28,		*M*
δ Libræ	...	14 54·9	...	8 4 S.	...	,,	26,	3 13	*m*
U Coronæ	...	15 13·6	...	32 4 N.	...	,,	29,	21 59	*m*
R Scorpii	...	16 10·9	...	22 40 S.	...	,,	28,		*M*
U Ophiuchi...	...	17 10·8	...	1 20 N.	...	,,	26,	4 37	*m*
				and at intervals of				20 8	
X Sagittarii...	...	17 40·5	...	27 47 S.	...	Sept.	28,	23 0	*m*
						Oct.	1,	20 0	*M*
W Sagittarii	...	17 57·8	...	29 35 S.	...	,,	1,	19 0	*m*
β Lyræ...	...	18 45·9	...	33 14 N.	...	Sept.	25,	4 0	m_2
R Lyræ	...	18 51·9	...	43 48 N.	...	Oct.	1,		*m*
S Vulpeculæ	...	19 43·8	...	27 0 N.	...	Sept.	30,		*M*
η Aquilæ	...	19 46·7	...	0 43 N.	...	,,	26,	3 0	*m*
S Sagittæ	...	19 50·9	...	16 20 N.	...	,,	25,	3 0	*m*
						,,	28,	3 0	*M*
R Vulpeculæ	...	20 59·4	...	23 22 N.	...	,,	30,		*m*
δ Cephei	...	22 25·0	...	57 50 N.	...	,,	28,	5 0	*M*
						Oct.	1,	23 0	*m*

M signifies maximum; *m* minimum; m_2 secondary minimum.

THE UNWRITTEN CHAPTER ON GOLF.[1]

THERE are two ways of dealing with a difficulty—the metaphysical and the scientific way. The first is very simple and expeditious—it consists merely in giving the Unknown a name whereby it may be classified and categorized. Thenceforward the Unknown is regarded as having become part of knowledge. The scientific man goes further, and endeavours to find what lies concealed under the name. If it were possible for a metaphysician to be a golfer, he might perhaps occasionally notice that his ball, instead of moving forward in a vertical plane (like the generality of projectiles, such as brickbats and cricket-balls), skewed away gradually to the right. If he did notice it, his methods would naturally lead him to content himself with his caddie's remark—"Ye heeled that yin," or, "Ye jist slicet it" (we here suppose the metaphysician to be right-handed, as the sequel will show). But a scientific man is not to be put off with such flimsy verbiage as this. He *must* know more. What is "heeling," what is "slicing," and why would either operation (if it could be thoroughly carried out) send a ball as if to cover-point, thence to long slip, and finally behind back-stop? These, as Falstaff said, are "questions to be asked."

As the most excellent set of teeth, if but one incisor be wanting, gives pain rather than pleasure to the beholder; so is it with the works of the magnificent Clark, the sardonic Hutchinson, and the abstruse Simpson. These profess to treat of golf in theory as well as in practice. But in each a chapter is wanting, that which ought to deal with "slicing," "heeling," "toeing," "topping," &c., not as metaphysical abstractions enshrined in homely though unpleasant words, but as orderly (or disorderly) events due to physical causes and capable of receiving a physical explanation. Mayhap, with the aid of scissors and paste, some keen votary of the glorious game will employ this humble newspaper column to stop, however imperfectly and temporarily, the glaring gap which yawns in the work of every one of its exponents! If so, this scrap will not have been written in vain. It may even, in the dim future, lead some athletic pundit to elaborate *The Unwritten Chapter*.

Every one has heard of the uncertain flight of the projectile from Brown Bess, or from the old smooth-bore 32-pounders, and of the introduction of rifling to insure steadiness. Now, all that rifling secures is that the ball shall rotate about an axis nearly in its line of flight, instead of rotating (as the old smooth-bore projectiles did) about an axis whose direction is determined by one or more of a number of trivial circumstances whose effects cannot be calculated, barely even foreseen. Thus it appears that every deviation of a spherical projectile from its line of flight (excluding, of course, that due to gravity) is produced by rotation about an axis perpendicular to the line of flight.

[1] From *The Scotsman*, August 31, 1887.