38,000° C., and inconceivably attenuated as this interplanetary atmosphere would be, the moon would yet come into contact with 600 kilogrammes of it in each minute of time. On a body like the earth, surrounded by an atmosphere, the inevitable result of this unceasing collision with the interplanetary atmosphere would be the stripping away of the terrestrial atmosphere layer by layer. Arriving at results of a similar unacceptable character from the consideration of the action of a diffuse interplanetary gas on the other members of the solar system, M. Hirn decides that matter exists only in a sporadic state in space; only in the state of distinct bodies—stars, satellites, meteorites, and the like. It exists in a state of extreme diffusion only in nebulæ, but elsewhere space is perfectly empty, or, at least, whatever remains cannot suffice to explain the relations of stars to stars.

COMETS 1888 *e* AND *f* (BARNARD, SEPTEMBER 2 AND OCTOBER 30).—The following ephemerides for these objects are in continuation of those given in NATURE of April 4, p. 546, and are for Berlin midnight :—

	Comet 1888 *e*. R.A.	Decl.	Comet 1888 *f*. R.A.	Decl.
	h. m. s.	° ′	h. m. s.	° ′
April 30	23 25 51	1 28·1 N.	9 31 10	37 39·4 N.
May 4	23 23 34	1 41·6	9 33 48	37 35·8
8	23 20 54	1 54·1	9 36 36	37 30·4
12	23 17 50	2 5·5	9 39 38	37 23·7
16	23 14 18	2 15·7	9 42 50	37 15·8
20	23 10 15	2 24·5	9 46 12	37 6·7
24	23 5 37	2 31·6 N.	9 49 43	36 56·8 N.

α URSÆ MAJORIS.—Mr. Burnham reports from the Lick Observatory that he has discovered this star to be a close double. He gives the following measures of the companion :—

			Mag.
1889·142	P = 327°0	D = 0″·96	11
1889·151	= 325·9	= 0·83	11

Mr. Burnham was not able to see the companion with the 12-inch telescope, and concludes that it is too difficult for such an aperture, the difference in magnitude between the two components being so great.

THE WHITE SPOT ON SATURN'S RING.—M. Terby, writing to the *Astronomische Nachrichten*, reports that he has not been able to see the white spot again which he observed on March 6 and 12 (NATURE, vol. xxxix. p. 497). MM. Knorre, Knopf, Lamp, Struve, and Schiaparelli have likewise failed to detect it. On the other hand, Prof. McLeod, of Montreal, and Mr. Brooks, of Smith Observatory, Geneva, U.S.A., both state that they have seen it; and the latter reports it variable. If it be a real spot, and not a mere effect of contrast with the shadow of the planet, it evidently would only occasionally be seen in the place where it was first discovered, but would be observed from time to time in other parts of the ring, for it would be carried round with it in its rotation.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1889 APRIL 28—MAY 4.

(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 April 28

Sun rises, 4h. 39m.; souths, 11h. 57m. 20·7s.; sets, 19h. 16m.: right asc. on meridian, 2h. 23·9m.; decl. 14° 18′ N. Sidereal Time at Sunset, 9h. 44m.

Moon (New on April 30, 2h.) rises, 4h. 36m.; souths, 10h. 54m.; sets, 17h. 25m.: right asc. on meridian, 1h. 20·3m.; decl. 3° 3′ N.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Right asc. and declination on meridian. h. m.	° ′
Mercury..	4 46	12 12	19 38	2 38·6	15 42 N.
Venus.....	4 9	12 7	20 5	2 33·2	20 42 N.
Mars.....	5 8	12 51	20 34	3 17·9	18 30 N.
Jupiter....	0 15	4 11	8 7	18 35·9	22 55 S.
Saturn....	10 59	18 38	2 17*	9 5·7	17 51 N.
Uranus...	17 15	22 43	4 11*	13 11·7	6 54 S.
Neptune..	5 44	13 30	21 16	3 57·3	18 49 N.

* Indicates that the setting is that of the following morning.

April.	h.	
29	23	Venus in conjunction with and 10° 15′ north of the Moon.
30	12	Mercury in conjunction with and 5° 8′ north of the Moon.
May.		
1	2	Venus in inferior conjunction with the Sun.
1	3	Mars in conjunction with and 4° 21′ north of the Moon.
1	21	Mercury at least distance from the Sun.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei ...	0 52·5	81 17 N.	May 1,	2 12	*m*
U Monocerotis ...	7 25·5	9 33 S.	,, 3,		*m*
δ Libræ ...	14 55·1	8 5 S.	Apr. 30,	0 17	*m*
U Ophiuchi...	17 10·9	1 20 N.	May 1,	1 44	*m*
			,, 1,	21 52	*m*
β Lyræ... ...	18 46·0	33 14 N.	,, 2,	0 0	*M*
U Aquilæ ...	19 23·4	7 16 S.	,, 4,	0 0	*M*
η Aquilæ ...	19 46·8	0 43 N.	,, 1,	20 0	*M*
S Sagittæ ...	19 51·0	16 20 N.	,, 3,	22 0	*m*
R Sagittæ ...	20 9·0	16 23 N.	,, 3,		*m*
T Vulpeculæ ...	20 46·8	27 50 N.	,, 3,	2 0	*m*
			,, 4,	4 0	*M*
δ Cephei ...	22 25·1	57 51 N.	Apr. 28,	4 0	*m*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
Near ζ Ursæ Majoris	206	57° N.	Slow; bright.
,, α Serpentis ...	234	10 N.	Swift.
,, υ Herculis ...	239	46 N.	May 1. Swift; short.
,, η Aquarii ...	337	2 S.	Swift; very long.

THE CORROSION AND FOULING OF STEEL AND IRON SHIPS.[1]

THE difficulty of obtaining adequate experimental data, and the fact that nearly everyone who has worked at the subject has had a composition of his own to bring before the public, has so hampered and restrained the free discussion and interchange of ideas on this most important question, that at the present time we have made but scant progress beyond the point reached twenty years ago, and my object in bringing this paper before you is more to excite you to discussion, and to show you the known facts of the case, than to tell you of any very new or startling discoveries.

Corrosion generally precedes fouling on exposed metal surfaces, and it is therefore this portion of the subject that will be considered first, together with the means which have been taken to prevent it and to protect the plates of our vessels from decay.

In a paper which I had the honour to bring before you two years ago, I pointed out that in all processes of rusting carbonic acid gas and moisture played an important part, the iron uniting with the carbonic acid and oxygen of the water to form ferrous carbonate whilst the hydrogen was set free, and that the ferrous carbonate then took up oxygen dissolved in the water, or present in the atmosphere as the case may be, and was decomposed into ferric oxide (rust) and carbonic acid, which being liberated in actual contact with the moist surface of the iron carried on the process of "rusting."

This view of the case was confirmed by a paper read by Prof. Crum Brown before the Iron and Steel Institute, at Edinburgh, last autumn, and is generally accepted as the true explanation of the corrosion taking place on iron or steel surfaces exposed to moist air or fresh water; but the rusting of the metal in sea water has by many chemists been ascribed to a more complex action, in which the salt present plays an important part by first forming oxychloride of iron.

This preliminary stage of corrosion in sea water is, I am inclined to think, a myth. When iron filings or turnings are exposed to the action of sea water, hydrogen gas is evolved, and ferrous oxide and carbonate are formed, and this changes, as in air or fresh water, into ferric oxide, by taking up dissolved oxygen present in the water. At no time have I been able to

[1] A Paper read at the thirtieth session of the Institution of Naval Architects, by Prof. V. B. Lewes, F.C.S., F.I.C., Royal Naval College Associate, on April 12, 1889.