as follows:—Bessel 3501·6, Leverrier 3529·6, Meyer 3487·45, and Prof. Hall, from the motion of Iapetus, 3481·3 ± 0·54.

Prof. Hall carefully searched for additional satellites moving in the remarkable gaps between Rhea and Titan, and Hyperion and Iapetus, but without result.

STELLAR PARALLAX.—The second Appendix to the Washington Observations for 1883, contains a second memoir by Prof. Asaph Hall, not less interesting and valuable than the above. It will be remembered that Prof. Hall published a volume in 1882, containing determinations of the parallaxes of Vega and 61 Cygni from observations made by himself with the great 26-inch refractor at the Washington Observatory. Prof. Peters, of Clinton, U.S.A., has since pointed out to Prof. Hall that the temperature correction to his observations had been applied with the wrong sign. Prof. Hall has therefore now reduced his observations afresh, and given a new solution of the equations of condition. For 61 Cygni, Prof. Hall now finds a parallax of 0″·270 ± 0 0101 from 101 observations extending from October 24, 1880, to January 26, 1886. This value is notably smaller than he obtained before, viz. 0″·4783, or than most other investigators have deduced. Thus Sir R. S. Ball had found 0″·4756, Auwers 0″·564, and Struve, Woldstedt, and others values closely according. Prof. Hall appears, however, satisfied with his results, and it should be remembered that Dr. C. A. F. Peters obtained 0″·349 for his absolute value of the parallax, the others being only relative parallaxes. Prof. Hall's value for Vega is also rather small, viz. + 0″·134 ± 0·0055 from 128 observations, but agrees very much better with other modern determinations; Brünnow in 1869 from the same comparison-star, but by measures of distance and position, and not of differences of declination only, having obtained $\pi = 0''\cdot212 \pm 0''\cdot0098$. Prof. Hall also attacked the parallax of two other stars, 6 (Bode) Cygni, the parallax of which has recently been determined at Dunsink, being one, and the curious star 40 (o^2) Eridani the other. For the former he finds a negative value, whereas Sir R. S. Ball gave $\pi = + 0''\cdot422 \pm 0''\cdot054$, but only as a "merely provisional" value. The parallax obtained for 40 Eridani, $\pi = + 0''\cdot223 \pm 0''\cdot0202$ is in fairly close agreement with Dr. Gill's, viz. $\pi = 0''\cdot166$. In the early part of this important paper Prof. Hall gives a full discussion, in his usual thorough and painstaking manner, of the value of a revolution of the micrometer-screw employed in the observations.

ASTRONOMICAL PRIZES OF THE ACADEMY OF SCIENCES. The Paris Académie des Sciences have decreed the Lalande Prize to M. O. Backlund for his labours on the motion of Encke's comet; the Valz Prize to M. Bigourdan for his researches on personality in the observation of double stars; and the Damoiseau Prize, for the revision of the theory of the satellites of Jupiter, to M. Souillart, with an *encouragement* to M. Obrecht of a thousand francs from the Damoiseau fund.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 JANUARY 16-22

(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 January 16

Sun rises, 8h. 1m.; souths, 12h. 9m. 58·8s.; sets, 16h. 19m.; decl. on meridian, 20° 56′ S.: Sidereal Time at Sunset, 0h. 2m.

Moon (at Last Quarter) rises, 23h. 47m.*; souths, 5h. 41m.; sets, 11h. 24m.; decl. on meridian, 4° 14′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury ...	7 23	11 13	15 3	23 55 S.
Venus	8 39	12 55	17 11	19 54 S.
Mars	9 4	13 42	18 20	16 24 S.
Jupiter... ...	1 23	6 27	11 31	11 42 S.
Saturn... ...	15 29	23 35	7 41*	22 1 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultations of Stars by the Moon (visible at Greenwich)

Jan.	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
16 ...	65 Virginis ...	6	2 5	3 5	61 193
16 ...	66 Virginis ...	6	2 48	3 57	44 221
16 ...	l^2 Virginis ...	5	7 44	8 35	44 318
16 ...	21 ...	Mars at least distance from the Sun.			
17 ...	3 ...	Jupiter in conjunction with and 3° 40′ south of the Moon.			
17 ...	4 ...	Mercury at greatest distance from the Sun.			

Variable Stars

Star	R.A. h. m.	Decl. ° ′			h. m.	
U Cephei	0 52·3	81 16 N.	... Jan.	16, 23	2	*m*
			,,	21 22	40	*m*
Algol	3 0·8	40 31 N.	... ,,	16, 2	41	*m*
		and at intervals of		2 20	48	
λ Tauri	3 54·4	12 10 N.	... Jan.	16, 22	48	*m*
			,,	20, 21	41	*m*
δ Libræ	14 54·9	8 4 S.	... ,,	20, 2	42	*m*
U Coronæ	15 13·6	32 4 N.	... ,,	20, 21	39	*m*
W Herculis... ...	16 31·2	37 34 N.	... ,,	18,		*m*
U Ophiuchi... ...	17 10·8	1 20 N.	... ,,	20, 2	44	*m*
		and at intervals of		20	8	
β Lyræ...	18 45·9	33 14 N.	... Jan.	22, 21	0	m_2
δ Cephei	22 25·0	57 50 N.	... ,,	18, 23	0	*M*

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

Meteor-Showers

Near γ Orionis, R.A. 72°, Decl. 4° N. From Coma Berenices, R.A. 181°, Decl. 35° N.; swift streak-bearing meteors. Near χ Cygni, R.A. 295°, Decl. 53° N.; somewhat slow meteors.

GEOGRAPHICAL NOTES

THE opinions of Dr. Junker, who is now in Cairo, as to the best route by which to reach Emin Pasha do not help us much. Indeed, Dr. Junker does not commit himself further than to suggest that by the shortest route, through Masai Land, there would be difficulties as to food. Not more, we are inclined to think, than by any other route. Mr. Thomson passed through the country at an exceptionally bad time, when the cattle of the Masai were dying by hundreds from disease. The country is one of the richest game regions in Africa, and by any route an expedition must, as far as possible, be independent of local supplies. For an expedition of hundreds of men to attempt to cross the Victoria Nyanza in boats would be extremely hazardous. Meantime it is evident both from what Dr. Junker says and from the letter of Mr. Ashe, who has just returned from Uganda, that Emin Pasha is in an exceedingly perilous condition, and that every week's delay risks his life and the lives of those who are with him, for he has no ammunition. We hear, on good authority, that Mr. Stanley has decided to go by the Masai Land route; if so, it seems a pity that the only white man who has explored this route will not be in the expedition.

IT is said that great administrative changes are about to be made in Russian Central Asia. According to the St. Petersburg Correspondent of the *Times*, the whole system of arbitrary military mixed with native government, formerly considered necessary for high political purposes of further conquest, is to be gradually modified and almost abolished by the introduction of Russian civil administration and justice, and the subordination of the various departments to the Ministers in St. Petersburg. There is a proposal that Turkestan and the new Transcaspian province should be amalgamated, the reason alleged being that they will be closely connected by the Transcaspian railway, which, after passing through Bokhara, will terminate at Tashkend. The Transcaspian province will therefore, it is considered, be nearer to Turkestan than to the Caucasus. The scheme is said to have been suggested by General Rosenbach, the Governor-General at Tashkend. It is opposed by General Shepeleff, Director of the Chancery of the Governor-General of the Caucasus, who is of opinion that it would be highly inconvenient to remove the Transcaspian further from the control of the central Government, and that, if alterations are considered necessary, it would be better to make the newly-acquired territory an independent province.

ACCORDING to the *Novoe Vremya*, the trading caravan lately despatched by the Central Asian Commercial Company Koudrine has passed through Kashgar and entered Tibet. This company is likely to play an important part in Central Asia. It has established permanent agencies at Merv and Askabad and in the Persian cities of Kutchan and Meshed, and now it proposes to do the like in Tibet. It has received from the Ameer of

Bokhara a large tract of land on the banks of the Amu-daria, near the Chardjui station of the Transcaspian Railway, for the cultivation of cotton. In the Transcaspian there seems to be a great district suitable for cotton-growing, and there is a general opinion among the commercial classes of Russia that the development of this industry ought to be steadily encouraged by the Government.

THE *Bollettino* of the Italian Geographical Society for November contains an account of a second expedition by Signor E. Modigliani to Nias, which has proved much more successful than his first visit to that island, reported in NATURE, November 16, 1886, p. 60. His primary object was to discover and ascend the Mount Matsua, 600 metres high, seen by Von Rosenberg from the west coast, and figured on his map as the culminating point of the island. But, although no trace could be found of this mountain, the hitherto unexplored south-western district was traversed from Serombu on the west to Lagundi Bay on the south coast. This district was carefully surveyed, and the explorer succeeded in making rich zoological, botanical, and ethnological collections, most of which have been forwarded to the Natural History Museum of Genoa. They include no less than twenty-six human skulls (fifteen of which were obtained at Hili Horo in exchange for a rifle), about 120 birds, 2000 butterflies, 1500 other insects, monkeys, fishes, reptiles, and plants. The journey was made during the summer of 1886, Signor Modigliani's last communication being dated August 10, and forwarded to Europe from Gunung Sitoli, in the north of Nias, where he was then stationed with the intention of continuing his scientific researches in the island.

ON Tuesday evening last Captain Cameron delivered at the London Institution a lecture on "Urua: its People, Government, and Religion." In closing his lecture Captain Cameron said that Urua would shortly come into great prominence, for lately some of the officers of the Congo Free State had followed the river due east, across the great bend of the Congo, showing that it was a navigable river, and that if followed up it would lead to Kasongo's capital. They were frequently hearing of the London Missionary Society's agents pushing up the new great tributary of the Congo on the south, so there could be little doubt that in a short time the Somami would be followed up to Urua, and that traders, missionaries, and others would soon come into the great kingdom of Urua, where there was a great work before them. However, they would have to bear in mind that they would not have to do with a little chief ruling over 200 or 300 natives, but with a powerful monarch who ruled absolutely over his people, and who would allow of no agreement which had not been approved by him. It was to be hoped that, as Stanley had been successful before, he might be successful in his expedition for the relief of Emin Pasha, and also that those who went into Urua would bring civilisation and peace, and be able to do away with the horrors of the slave trade which obtained there owing to the Portuguese and the Arabs. Urua was rich in many kinds of minerals and other products, and the people were a fine race. When the Europeans came into constant contact with them, if they were wisely managed, there would be a great future for them.

WAR AND BALLOONING[1]

THE object which stimulated the practical invention of the balloon was its use in war. I say practical invention, because in theory the balloon was invented before the experiment of Montgolfier. Theory is ever the soil of practice. The idea of the balloon has its starting-point in the principle of the pressure of fluids elucidated by Archimedes, of Syracuse, 200 years before the Christian era. The discovery of hydrogen gas by Mr. Henry Cavendish, in 1760, led Joseph Black, the Professor of Chemistry at the University of Edinburgh, to suggest in one of his lectures that a weight might be lifted from the ground by attaching to it a sphere of hydrogen gas. A fruitful idea once expressed is rarely lost, however casual its first expression. Some years later, Tiberius Cavallo, an Italian merchant, remembered the remark of Dr. Black, and, in 1782, tested its truth by experiment. He first manufactured some paper bags, which he filled with hydrogen gas: to his disappointment, the subtle gas escaped through the pores of the paper. He then collected the gas in soapy water, and the bubble of gas ascended. A soap-bubble filled with hydrogen was therefore the first balloon. The experiment seems to have been repeated by Cavallo at one of the meetings of the Royal Society, and described in the Transactions of that Society; but neither Cavallo nor his colleague pursued the experiment further, and there was still to be found the peculiar kind of energy that would transform the laboratory experiment into a practical reality. Books are indeed the carriers of thought. It is probably due to a work of Priestley, in which were described those discoveries of Cavallo, and which was translated into French, that Montgolfier, the paper-maker of Annonay, was fired to perform an experiment that is historical. He, as most of you know, filled a paper bag with heated air, the consequence being that the bag rose to the ceiling of the room. Montgolfier was not content with such trifling efforts: a patriotic motive stimulated him to attain greater results—the desire to make the invention of use to France in her wars; and the paper bag of 40 cubic feet capacity was succeeded by one of 680 cubic feet; this, again, by one of 23,000 cubic feet. Montgolfier seemed on the high-road to a brilliant success. There was, however, another brain actively employed in eclipsing the fame of Montgolfier—that of Charles, the Parisian, who realised that heated air would never become a satisfactory method of filling balloons, heated air being three-fourths the weight of the air at the ordinary temperature. He therefore took up the experiments with hydrogen gas where Cavallo had left off. Hydrogen gas being thirteen times lighter than air, its superiority in filling balloons was, to his mind, indisputable. He succeeded in making a material gas-proof, and consequently produced the first practical gas-balloon.

From the efforts of Montgolfier and Charles began the history of ballooning. I do not propose to discuss its general history this evening, with its startling incidents of adventure, nor to enumerate the good service the balloon has rendered to science in the hands of such men as Benedict de Saussure, Robertson, and Glaisher, but to make a few remarks upon its use as an adjunct of war.

By many persons, those who advocate its use in war are looked upon as enthusiasts. With many persons, an enthusiast is synonymous with a fanatic. Now, I agree that enthusiasm is sometimes expended on improper subject-matter—on wild incoherent schemes; but give enthusiasm proper subject-matter, truth, and coherency, and it becomes a noble thing; it is, in fact, the life-blood of science and art. It is, in other words, earnestness of purpose. I think the use of balloons in war is worthy of this earnestness of purpose.

I have to bring before your notice this evening, in particular, a somewhat new departure in balloons, in which electricity is so combined with a captive balloon as to render it valuable for signalling-purposes. Before I describe this special use for balloons in war, which I have had the honour of introducing to the English Government, and for which I hold patents in the principal foreign countries, I will say a few words concerning the general use of balloons in time of war.

The way in which balloons have been chiefly utilised in war is for taking observations of the enemy. In such cases the balloons are captive. As early as 1793 the French Government adopted the use of captive balloons. Such balloons were employed with great success in those wars which the French Goverment carried on soon after the French Revolution. There was a regular company formed, called "Aërostiers," and it seems to me that more practical work with captive balloons was done in actual war at this period than has been accomplished since. It was Napoleon who put an end to their career of usefulness in France, and who closed the Aëronautical School at Meudon.

It is this use of captive balloons for observations that has lately been revived by the English Government, and experiments are frequently carried on at Chatham under a Committee of the Royal Engineers. Notably amongst those who have been prominent in the revival of balloons for war purposes we may mention the names of Major Templer, Major Elsdale, and Lieut. Mackenzie, and the country, I think, has reason to thank these officers for the really good work they have done with the means at their disposal. At the Inventions Exhibition there was an exhibit of balloons in the War Department. Perhaps the more important feature of that exhibit was a balloon made of gold-beater-skin, such as was used in the war in Egypt. Gold-beater-skin is an admirable substance for forming balloons on account of its lightness and capacity of holding gas.

The free balloon has its use in war as well as the captive one.

[1] A Lecture delivered by Mr. Eric S. Bruce, M.A. Oxon., at the London Institution, on December 28, 1886.