in diameter gets smaller and smaller as the exposure increment is augmented. M. Dunér discusses the vexed question of the determination of the photographic magnitudes of stars by means of measures made on the negatives, and propounds the following definition :—"The relation between the light of two stars which differ from each other by a photographic magnitude is expressed by the factor with which the time of exposure of a given plate must be multiplied or divided in order to render the diameter of the image of a star on the new *cliché* equal to the image of another star on the given *cliché*." A paper by M. Prosper Henry, on the value of atmospheric refraction for different portions of the spectrum, has previously been noticed (NATURE, vol. xliii. p. 400).

COMET BARNARD-DENNING (*a* 1891).—Prof. Berberich gives the following elements in *Astronomische Nachrichten*, No. 3027, for the comet discovered by Mr. Barnard, of Lick Observatory, on March 29·695, G.M.T. and by Mr. Denning at Bristol on March 30·417 G.M.T.

Mean epoch = 1891 April 27·730 Berlin mean time.

Longitude of perihelion = 178° 14′·30
Longitude of ascending node = 194 13·14 } Mean Eq.
Inclination = 120 30·52
Perihelion distance = 0·40652 earth's mean distance.

On the 18th inst. the comet is in R.A. 1h. 42m. 9s., Decl. + 23° 41′·6, and is therefore not well situated for observation, although it is increasing in brightness.

THE PLANET MERCURY.—At the present time the planet Mercury is in a position most favourable for observation, and will continue so until about the 25th of this month. Appearing as an evening star, it will be found near the western horizon just after sunset, and those who have no optical means at their disposal should look out for it at about 8 o'clock on the 19th or 20th of this month, when it will resemble a star of about the first magnitude, and will be a little to the westward of the Pleiades. Although the planet Mars is also situated near this region, the detection of Mercury can easily be made, by reason of its colour, which is of a far whiter hue than that of the first-mentioned planet. During the latter end of the present month and the first week of May the planet will be almost invisible, being lost in the rays of the sun, and its next appearance will take place as it transits the disk of the sun on the 9th of the same month. At Greenwich the transit will only be partial, as the sun will rise at 16h. 19m. (Greenwich mean time), so that only the internal and external contacts at egress can be observed.

For the benefit of those wishing to observe the planet during the present week, the following extract from the *Nautical Almanac* may be useful :—

	Apparent R.A. Noon.	Apparent Declination. Noon.
	h. m. s.	° ′ ″
April 16 ...	2 50 13·46	... N. 19 2 59·0
,, 17 ...	2 54 42·75	... 19 27 55·9
,, 18 ...	2 58 52·66	... 19 50 6·0
,, 19 ...	3 2 42·52	... 20 9 29·4
,, 20 ...	3 6 11·74	... 20 26 5·4
,, 21 ...	3 9 19·79	... 20 39 54·3
,, 22 ...	3 12 6·27	... 20 50 56·5

NEW ASTEROID (308).—M. Borelly discovered the 308th asteroid on March 31.

THE WHEAT HARVEST IN RELATION TO WEATHER.

THE general law of wheat production in England was stated in the *Times* of August 30, 1881, as follows : "The yield of wheat is proportional to the summer temperature, with the modifying conditions of rainfall, prevalence of cloud, character of the weather at blossoming time and during the harvest, and the state of growth at the commencement of the summer"; and it was added, "The growing influence of a high or low thermometer is established by the observations of many years." To test the law, superior and inferior harvests may be correlated with their summer temperatures and rainfall. For this purpose the meteorological records of the Royal Observatory, Greenwich, will be used. The mean temperature of June, July, and August, and the total rainfall for these months, will be taken for the summer.

I.—*Superior Wheat Harvests.*

Year.	Character.	Temperature.	Rainfall.
		°	inches.
1775	Plentiful	62·0	?
1779	Plentiful	62·3	?
1791	Abundant	59·5	Dry
1818	Most abundant	64·3	1·4
1819	Fine	60·3	4·6
1820	Productive	58·0	8·2
1825	Early and good	62·0	3·3
1826	Remarkably early and very great	64·0	5·1
1827	Good	60·0	2·9
1833 (*a*)	Abundant	59·4	6·7
1834 (*b*)	Early, very productive	62·5	11·3
1835	Good	62·6	4·5
1840	Fine yield	59·8	3·9
1849	Above the average	61·0	3·8
1851	Above the average	61·0	7·2
1854	Extremely good	59·0	5·6
1857	Above the average	63·9	6·0
1858	Above the average	62·5	5·7
1863	Abundant	60·3	6·6
1864	Good	59·6	2·5
1868	Productive	64·4	4·1
1874	Very good	60·9	6·4
1888 (*c*)	Above the average	58·4	13·8
	Mean	61·2	5·68

II.—*Inferior Wheat Harvests.*

Year.	Character.	Temperature.	Rainfall.
		°	inches.
1789	Very deficient	59·7	Wet
1792	Inferior	58·3	Wet
1795	Very defective	57·8	?
1800	Bad	60·7	Wet
1810	Scanty	60·0	?
1811	Very scanty	59·0	?
1812	Very defective	56·0	?
1816	Very great deficiency	55·2	8·4
1817	Deficient	57·4	7·9
1821	Inferior	57·8	7·0
1823	Deficient	57·8	7·1
1828	Bad	60·3	12·0
1829	Inferior	59·0	9·4
1838	Late, unproductive	59·1	7·3
1839	Damaged	59·3	7·6
1848	Very bad	59·5	10·6
1852	Below the average	61·7	11·4
1853	Bad	60·1	11·0
1860	Very deficient	56·7	11·6
1867	Deficient	59·8	10·2
1873 (*d*)	Very deficient	61·7	7·6
1875	Very unsatisfactory	60·3	9·8
1876 (*e*)	Unsatisfactory	62·7	3·7
1877 (*f*)	Unsatisfactory	62·0	6·0
1879	Worst known	58·5	13·3
1880	Deficient	60·6	7·1
1881	Deficient	61·1	7·9
1886 (*g*)	Deficient	61·0	4·1
	Mean	59·4	8·6

(*a*) May was very dry.
(*b*) The winter was very mild ; the spring very dry.
(*c*) The winter and early spring were very cold ; May was very dry, with much sunshine.
(*d*) Frost occurred at blooming-time.
(*e*) and (*f*) The spring was cold.
(*g*) The winter and early spring were very cold ; May was very wet.

It is not easy to understand how to correlate the harvests with any specified meteorological datum, for the harvest itself may vary greatly in different counties. But if it is possible to differentiate the meteorological conditions with reference to the harvest, it is quite impracticable to integrate them, or to consider them all together. We shall not, however, be far wrong if we infer from the preceding simple tabulations that: good harvests of wheat accompany hot and dry summers; bad ones, cold and wet. The yield of wheat in England probably depends much more upon the summer dryness than the high temperature. A mean temperature above the average, and small rainfall during the months of June, July, and August imply much clear sky and bright sunshine. A mean temperature below the average for these months implies prevalence of cloud intercepting sunshine, but does not always or necessarily imply large rainfall. Excessive rainfall generally, unless it is due to local thunderstorms, implies overcast weather. Of course, mischief to the growing crop may be of too early date to admit of good yield from even the most favourable summer weather.

The largest wheat harvests have been in those years in which the sun exerted most power, and when, from midsummer until the full ripening, intermittent glowing heat, with fewest interruptions of cloudy weather, or humidity, was experienced. Of the heavy-yielding wheat years, 1854 was a dry summer, 1857 and 1858 had summers of exceptionally long-continued heat. The large wheat crop of 1863 was connected with a fine dry summer; that of 1864 was related to a prolonged drought from July 4 to August 21. The hot summer of 1868 brought a bulky wheat yield. As regards the abundant harvest of 1874, July was much above its average temperature. Good wheat crops resulted from very fine hot summers in 1846, 1847, 1870; and good wheat crops attended the droughty summers of 1885 and 1887. Bad harvests seem rather to depend upon large summer rainfalls than upon low mean temperatures, as in 1828, 1852, and 1853. The years 1886 and 1888 contradict the law, and would seem to point to the effect of the weather in May, which was of opposite character in these two years. Again, the temperature and rainfall indicate good, not bad, harvests for 1876 and 1877. The good harvest year 1851, and the bad one 1873, were on a par meteorologically; and 1849 and 1876 might exchange places, so far as the weather seems concerned. The hottest and driest summer, 1818, had apparently the best harvest; the wettest, 1879, the worst; the coldest, 1812, a very defective one; and 1860, with its cold and wet summer, had a very deficient harvest.

In estimating the influence of the weather upon the resulting crops, the character of the winter and spring ought to be taken into consideration, for, according to Sir J. B. Lawes, "The great influence upon the subsequent growth of wheat of the weather before the period of active above-ground growth, was clearly illustrated in 'Our Climate and our Wheat Crops,' in the case of the season of 1854. The summer of that year was comparatively cold and sunless, yet the wheat crop was one of the best of the present century. The early winter had been unusually cold, but the remainder and the early spring were warmer than the average, and the season was extremely dry from seed-time to harvest, the mild spring and the dryness obviously compensating for the deficiency of temperature during the summer months." The year 1890, like 1854, had high temperature winter and spring; and, according to Sir J. B. Lawes, "The produce of both seasons clearly illustrates the fact that prevailing high temperature during the period of active growth and even of ripening, are not essential for the production of large crops of wheat."

The features of the winter 1890–91 make it the most extraordinary winter of the century in England; its effects, therefore, upon agriculture will be watched with more than passing interest. A writer in *Ciel et Terre* propounds the law that cold winters are followed by cold summers, and thereupon predicts that the summer of 1891 will be cold. Now, low summer temperature is usually attended with rainy weather, so the summer may be wet. The Greenwich observations apparently bear out these deductions, but not without exceptions. For instance, the summer of 1847 was warm and dry, after a very cold winter. However, the probabilities seem in favour of a cold and wet summer. Nevertheless, it should be pointed out that, assuming a cold summer and given a cold preceding winter, it follows that the spring and autumn must be either mild or seasonable, otherwise the year altogether will be remarkably deficient in temperature. Protracted winters were followed by cold wet summers and bad harvests in 1811–12, 1813–14, 1815–16, 1859–60, 1878–79; very cold winters by cold and wet summers in 1816, 1820, 1823, 1830, 1836, 1838, 1841, 1845, 1847. There are not wanting weather-wise people who predict that 1891 will be a dry year, on the theory of the sapient meteorologist, taken *per contra*, that rainy weather prolongs itself, that the more rainy weather you have the more you may expect. They argue, 1889 and 1890 were exceptionally dry years, so 1891 may be even drier. Last spring, up to the end of May was curiously rainless, and, from August onward, every month has shown less than the average quantity of rain. December and January had already parched the ground; February made it moistureless. Some rain came on March 7, but the fall for the month was far below the average in all parts of the British Isles except North Scotland. Want of moisture would gravely affect the prospects of the harvest.

In conclusion, one or two inferences remain to be drawn from the foregoing tabulation. Between the mean summer temperature of the superior harvest years and that of the inferior there is only a difference of 1°·8 in favour of the former; but this means so much more heat daily over 92 days. The mean rainfall for the summers of inferior harvest years exceeds that of the superior by 2·9 inches, which means that the wet summers had half as much more rain than the dry ones. Hence, it would seem that rainy summers rule the harvests much more potently than the mean temperatures. This influence seems conformable to the well-known character of rainy summers, in England, as regards sunshine, for they are woefully deficient in that vital element in the growth and maturity of the crops. The wheat yield in England follows the summer rainfall inversely. Good wheat years are those of hot dry summers. Bad wheat years are those of very wet sunless summers.

A JOURNEY IN SOUTH-WEST CHINA.

AT the last meeting of the Royal Geographical Society the paper read was on "Two Journeys to Ta-tsien-lu on the Eastern borders of Tibet," by Mr. A. E. Pratt, whose main object was the collection of natural history specimens. Ta-tsien-lu is a mountain village about 8400 feet above the level of the sea, in the province of Sz-chuen in West China—five days' journey from the borders of Tibet, and ten days' journey south-west from the Roman Catholic missionary station of Mou-pin, where Père David lived for some years, and whence he sent to Europe the valuable collections of mammals and birds which have made his name famous throughout the world. In the year 1889 Mr. Pratt spent three months in this district with Mr. Kricheldorff, making collections in natural history, and again in 1890 about the same time. The first stage of the journey to this remote district was from Shanghai to I-chang. The river Yang-tze is navigated for this distance of 1200 miles by steamers built especially in Britain for the river service, and commanded by English or American captains. Passengers change steamers at Hankow, and the whole journey occupies from ten days to three weeks, according to the state of the river and the time lost in waiting at Hankow for the next boat.

The journey from I-chang to Chung-king is generally made in Chinese house-boats, but Mr. Pratt had a boat specially built. At Chung-king the river (1600 miles from Shanghai), at high water, is considerably over a mile in width. This is a great opium-growing district. At Sui-fu, the great centre of trade for Yunnan, Mr. Pratt left the Yang-tze and entered the Min, one of its largest tributaries. The great industry of this thickly populated district on the banks of the Min is the manufacture of salt. On May 14 the party anchored for the night at a place some fifteen miles below Kia-ting-fu, reaching the city in the course of the afternoon. They left Kia-ting-fu on May 19. Their way lay through a really lovely country, beautifully watered by innumerable streams, reminding Mr. Pratt very much of Hampshire. Here, for the first time, he saw that beautiful orchid, *Dendrobium nobile*, growing wild—a mass of pink bloom. Eight hours' travelling brought them to the town of Omei-hsien, seven miles from Mount Omei, the celebrated sacred hill so well described by M. Colborne Baber. They left Omei-hsien on the 21st, and on their way met many coolies carrying the eggs of the celebrated wax insect down from the