was confirmed on the former of these dates by each of three photographs. Two more stars have been found having a similar periodicity—β Aurigæ and *b* Ophiuchi. The hydrogen lines of ζ Ursæ Majoris appear to be broader when the K line is double than when it is single. Several other lines are also seen double when the K line is double. Measures of the plates gave a mean separation of 0·246 millionths of a millimetre for a line whose wave-length is 448·1, when the separation of the K line, whose wave-length is 393·7, was 0·199.

The explanation of this phenomenon proposed by Prof. Pickering is that the brighter component of this star is itself a double star having components nearly equal in brightness, but too close to have been separated as yet visually, and some interesting results have been worked out which appear to support this hypothesis.—*American Journal of Science*, January 1890.

SPECTROSCOPIC OBSERVATIONS OF ALGOL.—A note on the motion of this star in line of sight has previously appeared (NATURE, vol. xli. p. 164). The detailed investigation of the six photographs taken at Potsdam is given by Prof. Vogel in *Astronomische Nachrichten*, No. 2947, from which the following is taken. Motion towards the earth is represented by a minus sign, and a motion of recession by a plus sign; both are expressed in geographical miles per second :—

Potsdam mean time.		Distance from minimum.		Motion in line of sight.
	h.	h.		
1888, Dec. 4,	6·6 ...	11·4 after.	...	−5·0
1889, Jan. 6,	5·7 ...	22·4 before.	...	+6·9
,, 9,	5·5 ...	19·4 before.	...	+7·5
Nov. 13,	9·3 ...	13·3 after.	...	−5·6
,, 23,	9·0 ...	22·3 before.	...	+6·2
,, 26,	8·5 ...	19·6 before.	...	+6·8

From these results it will be seen that, before minimum, Algol has an average motion of recession of 6·8 geographical miles per second, but after minimum it approaches the earth with an average velocity of 5·3 geographical miles per second. A reduction of the measures by the method of least squares shows the velocities per second to be—

Before the minimum, +5·3 geographical miles,
After the minimum, −6·2 ,,

which give an average motion of recession or approach = 5·7 miles. The entire system is found to be moving towards the earth with a velocity of 0·5 geographical miles per second.

GEOGRAPHICAL NOTES.

AT a meeting of the South Australian branch of the Royal Geographical Society, on November 1, 1889, Mr. Tietkens gave an account of his recent explorations in Central Australia. His expedition was despatched by the Central Australian Exploring and Prospecting Association, and consisted of a party of five persons, including a black tracker and a native boy. At one point of his journey, when the party came within sight of "an imposing range," Mr. Tietkens hoped to find a watercourse flowing from its slopes to Lake Amadeus. He was disappointed. No watercourse worth mentioning was discovered, nor any spring or place where water could collect. Mr. Tietkens discovered several ranges of hills, to which he gave names. One of the pleasantest places found by him he called Gill's Creek, after the hon. treasurer of the South Australian branch of the Royal Geographical Society. Here a stream flows from a range of hills through a gorge or glen of sandstone formation. "This," he says, "was a most beautiful spot, where a few days could be spent profitably, so the camels were unloaded, and Billy and myself went up the creek to explore its wonders. We found that the creek separated into three distinct channels. Following the principal one, we found the creek to be running through a glen with perpendicular cliffs 80 or 100 feet high on each side, and fully three miles in length. We returned to our charmingly situated camp late in the afternoon. . . . The water will not be found to be always running, but in the glen at the head of the creek, and which I have named after my sister Emily, large deep pools will be found, four or five chains long, 10 and 15 feet deep, and so shaded by rocks from the sun that they cannot be looked upon as otherwise than permanent." After the reading of the paper Mr. G. W. Goyder, Surveyor-General, expressing gratitude to Mr. Tietkens, said that although as an effort to increase the extent of Australian mineral and pastoral resources Mr. Tietken's expedition might have been a comparative failure, yet the route which he had travelled might serve as a most useful base for after-comers. His journey showed that no large large river, as had been hoped, flowed into Lake Amadeus, and only gave another proof that the interior of Australia consists of a series of low mountains with shallow basins, which in wet seasons form lakes and in dry seasons evaporate.

MESSRS. GEORGE PHILIP AND SON have issued an excellent map showing all Stanley's explorations in Africa from 1868 to 1889. Each expedition is distinctly marked in colour, and dated on the map; and a condensed account of the explorer's travels and discoveries is provided by Mr. E. G. Ravenstein.

THE SOURCES OF NITROGEN IN SOILS.[1]

THE number of this half-yearly Journal, issued last April, contains nineteen valuable contributions, covering a considerable portion of the large subject of agriculture. Many of them are of purely practical import, such as the report upon the previous year's prize farm competition, on implements exhibited at the Nottingham meeting, and on the Exhibition of thoroughbred stallions of February last. Among the articles of special scientific interest may be named "The History of a Field newly laid down to Permanent Grass," by Sir J. B. Lawes, F.R.S.; "Grass Experiments at Woburn," by W. Carruthers, F.R.S.; "The Composition of Milk on English Dairy Farms," by Dr. Paul Veith, and the Annual Reports of the scientific staff of the Society. The Journal contains 380 closely-printed pages, is well illustrated, and replete with tables and statistics. Among such a mass of information, all of which possesses important economic value, it is by no means easy to make a selection for special notice. The changes within the soil, in the formation of a meadow by Sir John Lawes, are, however, worthy of close attention at a time when grazing and stock-feeding appears to be the most popular remedy for the agricultural depression under which the country has so long suffered. These observations are also important scientifically, as they throw light upon the interesting question as to the sources of nitrogen in all soils. The gradual improvement of grass land, from the period when it is first laid down until it assumes the character of old pasture, is a well-known agricultural fact. The gradual increase in the amount of nitrogen per acre in the meadow selected by Sir John Lawes throws light upon this practical observation, and is recorded as follows:—"There can be no doubt that there has been a considerable accumulation of nitrogen in the surface soil during the formation of the meadow (1856 to 1888), amounting in fact to an average of nearly 52 pounds per acre per annum over the last twenty-three years. The question arises, Whence has this nitrogen been derived?" This is, as is well known, a controverted point. The balance in favour of this acccumulation of nitrogen within the soil is still large, even after every source of nitrogen in fertilizers employed, foods fed upon the land by live stock, rainfall, and from every other possible source is taken into account. Therefore, Sir John comes to the conclusion that the gain of nitrogen in the surface soil must have had its source either in the subsoil, the atmosphere, or both. There is much experimental evidence pointing to the conclusion that at any rate some deep-rooted leguminous plants derive a considerable quantity of nitrogen from the subsoil. Reasoning upon the question as to how far the whole of the accumulated nitrogen in the surface soil has been derived by deeply-searching roots from the subsoil, Sir John says, "On this point we think it may safely be concluded, from the results of the experiments of Boussingault and of those made at Rothamsted, many years ago, that our agricultural plants do not themselves directly assimilate the free nitrogen of the air by their leaves. But in recent years the question has assumed quite a new aspect. It now is, Whether the free nitrogen of the atmosphere is brought into combination within the soil under the influence of micro-organisms, or other low forms, and so serving indirectly as a source of nitrogen to plants of a higher order? Thus Hellreigel and Wilfarth have found, in experiments with various leguminous plants, that if a

[1] "The Journal of the Royal Agricultural Society of England," April 1889. (John Murray, Albemarle Street.)