NEW VARIABLE STARS.—Mr. Stanley Williams announces the discovery of a new variable star in Perseus having the position

$$\left.\begin{array}{l}\text{R.A.} = 3\text{h. } 17\text{m. } 51{\cdot}8\text{os.} \\ \text{Decl.} = +43^\circ\, 39'\, 55''{\cdot}6\end{array}\right\}(1855).$$

The star is B.D. $+43^\circ{\cdot}726$, catalogued as 8·9 magnitude, and is in the same field as Nova Persei with a low power.

The following magnitudes have been determined from photographs obtained with a 4·4-inch portrait lens.

1900.	Dec. 22	...	11·63 Mag.
1901.	Jan. 11	...	11·47
	25	...	10·97
	Feb. 11	...	10·87
	20	...	10·80
	28	...	10.53

The visual magnitude of this star is considerably brighter than the above photographic measures. Espin classes the star R in his "Stars with Remarkable Spectra."

Dr. T. D. Anderson announces a new variable in Andromeda, whose position is

$$\left.\begin{array}{l}\text{R.A.} = \text{oh. } 43{\cdot}5\text{m.} \\ \text{Decl.} = +33^\circ\, 35'\end{array}\right\}(1855).$$

The magnitude of the star has varied as follows:—

1900.	Oct. 5	...	<11·2
1901.	Feb. 16	...	10·7
	March 10	...	10·2.

Astronomische Nachrichten (Bd. 155, No. 3698).

LIGHT CURVE OF ALGOL.—Prof. A. A. Nijland, of Utrecht, contributes an article to the *Astronomische Nachrichten* (Bd. 154, No. 3695), containing the results of a numerous series of determinations of the brightness of Algol during its variation, and gives the light curve deduced therefrom. As shown, the variation is not symmetrical with respect to the minimum, a break occurring on the passage from maximum to minimum.

CHART FOR OBSERVATIONS OF NOVA PERSEI.—The first of a series of charts for use in observations of Nova Persei has been prepared by Father Hagen, of Georgetown College Observatory, and has recently been issued. The publication consists of a map of the region surrounding the Nova, showing stars down to the sixth magnitude, and a catalogue including all the stars shown on the chart, with their actual magnitudes and notes as to any peculiarities. A second series of charts is in preparation, and will be issued shortly.

PHOTOGRAPHY OF THE AURORA.

THE ever-changing form, and the faintness, of the aurora render this phenomenon a difficult subject to the photographer. Many have been the attempts to secure photographs of what have appeared to be brilliant displays, but the results have shown that little or no action had taken place on the photographic film, in spite of the fact that very rapid plates had been used. Herr Tromholt, who made a special study of the photography of the aurora, exposed very rapid plates to what he considered bright auroræ, and even with exposures from 4–7 minutes secured no trace of them. Later, at Christiania, he was more fortunate, and obtained an impression with an exposure of 8·5 minutes. To advance our knowledge of the changes in form of this phenomenon, it is important that photographs should be secured, if possible, in a few seconds, and not minutes. This seems now to be feasible, judging from an interesting account given in the *Meteorologische Zeitschrift* (Heft 6, 1900), by Herr O. Baschin. Herren Brendel and Baschin stayed several months, during the winter of 1891–92, at Bossekop, in Norwegian Lappland, to study the magnetic elements and the aurora.

For the photography of the aurora they employed an apparatus belonging to Herr. O. Jesse, who had used this instrument for photographing luminous night clouds. The objective had a focal length of 210 mm. and 60 mm. aperture; the dimensions of the plates used were 9 × 12 cm., the field photographed covering about 20° to 30°. Schleussner's plates were employed, and what appears to be the most important desideratum, the plates were stained (with erythrosine) and thus rendered more sensitive to the auroral light. For the first experiments the exposures given were comparatively long, namely three minutes, but these were found to be excessive; finally, seven seconds were sufficient to give good pictures. The reproductions accompanying the account of these researches illustrate the results secured with exposures of one minute and seven seconds respectively. The latter is reproduced here and shows very clearly the drapery-structure, although even this, according to Herr Baschin, is overexposed, the structure having a watery

FIG. 1.—Auroral-drapery on February 1, 1892.

and not sharp appearance. With such first results as these, there seems no reason why, with plates stained to be most sensitive to the particular colour of the aurora, and with the most rapid lenses, even shorter exposures of a second or less should not be given.

A step in the right direction has, however, been made, and the time is not far off when it will be as possible to project the ever-changing form of the aurora upon a screen as it is to exhibit in this way the phenomenon of an eclipse of the sun.

THE MISSISSIPPI RIVER.

THE Mississippi river, extending over a length of 2550 miles, has been placed by the United States Government under the charge of a Commission, whose duties include the making of a detailed survey of the channel from the headwaters to the Gulf of Mexico; a topographical survey showing the natural and artificial features lying within a mile of the river; a system of triangulation with base lines along the stream; longitudinal and cross sections of the channels; observations and records as to floods; and, for the assistance of future surveys, the placing, at intervals of three miles, of permanent marks, consisting of four stone or vitrified tile monuments placed in a line normal to the stream, two on each bank, about half a mile apart. The Commission has also the charge of the works carried out for regulating and deepening the channel.

Mr. J. A. Ockerson, who is a member of this Commission, and who, in the year 1899, made a survey of the headwaters of the Mississippi, contributed a paper on the subject to the *Proceedings* of the International Congress on Navigation held at Paris last year,[1] from which the principal part of the information here given has been obtained.

[1] "The Mississippi River: Some of its Physical Characteristics and Measures employed for the Regulation and Control of the Stream." By J. A. Ockerson, member of the U.S. Mississippi Commission Eighth Navigation Congress on Navigation. Recorded in English and French. (Paris 1900.

The Mississippi is one of the largest rivers in the world. It penetrates the heart of the most fertile portion of the United States for a distance of 2550 miles, and has 15,000 miles of navigable tributaries. Its headwaters rise amidst the pine-clad hills of northern Minnesota, where the long winters reach almost a polar cold, and winds its way through the varying conditions of climate of ten great States to the semi-tropical lowlands of southern Louisiana, finally losing itself in the Gulf of Mexico. Its drainage area, of over 1¼ million square miles, covers nearly half of the United States, and is equal to the whole of Europe exclusive of Russia. The region which it drains has no equal in any part of the world for fertility of soil and natural resources, such as vegetable products, timber, coal and minerals of various kinds. On its surface are borne immense cargoes of grain, coal and lumber gathered from the resources of a vast district and despatched across seas to all parts of the world. In its upper reaches it affords power to innumerable saw-mills and flour-mills and manufacturing industries.

The source of this great river has long been the subject of controversy. The earliest white explorers who first visited the country where the Mississippi rises were the French fur traders, but the earliest authentic account of the exploration of its source is that of William Morrison, who visited the district in 1804. The next explorer who recorded the results of his survey was R. H. Schoolcraft, in 1832, who located the head-waters in Lake Itasca. In 1872 the *New York Herald* sent a representative to visit the source of the river, with instructions to navigate the stream thence to the Gulf of Mexico. Again, in 1879, the *Louisville Courier Journal* sent an expedition to Itasca Lake. It was not, however, until 1889 that the first thorough exploration of the basin was made under the direction of the Minnesota Historical Society.

The State of Minnesota has set aside a reservation of 35 square miles, covering the basin of Lake Itasca, thus preserving for ever sacred the source of the father of rivers in the "Itasca State Park."

Unlike the origin of most large rivers which commence as mountain torrents, the Mississippi leaves its source with a width of 30 feet and a depth of 5 feet, and starts on its journey at an altitude of 1560 feet above sea-level. Commercial navigation reaches to within 25 miles of the lake, and thousands of sawn logs are floated down the stream every summer. At about 60 miles from the source the Government have constructed reservoirs, capable of holding 93,746 million cubic feet of water, for the purpose of regulating the supply of water to the channel and maintaining a navigable depth in summer. Near St. Anthony, about 500 miles from the source, are rapids which have been made use of obtaining water-power for working saw and flour mills and other manufacturing industries. Steamboat navigation commences near the junction of the Minnesota river, where the river has fallen 870 feet, 548 miles from the source.

A little above the junction with the Ohio, about 1400 miles down, the water becomes heavily charged with sediment and the country is subject to be flooded. The extreme range between high and low water at St. Louis is 37 feet. The slope of the water here falls six inches in a mile. Sand bars are numerous, and although the discharge amounts to 35,000 cubic feet a second in dry seasons there is not frequently more than four feet over the bars. Works are being carried out along this length for regulating the width of the channel and dredging away the bars so as to secure a better navigable depth. Where the banks are subject to excessive erosion they are protected by mattresses of woven willows, and the banks graded by hydraulic action. A description and illustration of this work was given in NATURE of December 19, 1896. Along this reach the river is exceedingly crooked. Between Arkansas and Greenville the distance along the river is 40 miles, the air line being only 15 miles. It also has great width, the banks, which are from 30 to 40 feet high, being in places two miles apart. The maintenance of these "levées" or banks is of vital importance to the surrounding country, as a breach would result in the inundation of 50,000 square miles of rich alluvial land.

One of the greatest difficulties which the management and the navigation has to contend with is the immense amount of drift-wood carried down in floods. This wood, if not cleared away, gets caught in the bends and accumulates, forming with the alluvial matter an effective barrier to the flow of the water and a source of danger to the banks. For the removal of this drift-wood special vessels, called snag-boats, are employed, which patrol the river and remove the snags.

Dredgers of large type, and provided with very powerful machinery, are in constant employment for removing sand bars and shoals. The type now almost universally in use for this purpose are worked by centrifugal pumps, which raise the sand and in some cases deliver it over the banks. Where the material is hard, cutters are provided at the end of the suction pipes of the pumps, which loosen the clay or hard material sufficiently to allow of its being sucked into the pipes. One of the most recent of these machines is capable of raising more than 4000 cubic yards of material an hour, and is fitted with electric light, machine shops, and all appliances necessary to repair the machinery and keep it in going order.

For the lower part of its course the river winds its way through a vast delta, twisting and turning by numerous bends until it extends its length to nearly double the point to point length of the delta. This delta is 500 miles long, and from 30 to 40 miles in width, covering an area of 400,000 square miles. It is composed of material transported by the current and deposited in the estuary, which at one time extended from the original outfall to the Gulf of Mexico. The river is still pouring solid matter into the Gulf, where it is spread out in a fan-like shape over a coast-line of 150 miles and is filling it up at the rate of 362 million tons a year. Some idea of the vastness of the silent operations of nature may be conceived when the fact is considered that this solid matter consists of the wearing away of the land through which the river flows, and that some of it must have been transported a distance of over 3000 miles; and that if the whole of it had to be carried in boats for half the total distance at the lowest rate at which heavy material is carried on the inland waterways of America, or, say, for one-tenth of a penny per ton per mile, the annual cost of transport would amount to no less a sum than 238 millions of pounds.

The channel in the lower reach is narrow, not exceeding half an mile in width, the depth in places exceeding 200 feet, and everywhere sufficient to float large sea-going craft as far as the junction of the Red river, a distance of more than 300 miles.

On this length is situated the city of New Orleans, 110 miles above the Gulf of Mexico. Ships of all nations reach this port. Its wharves extend over fifteen miles of river front, and are crowded with vessels of every description. Grain and cotton form the chief item of export.

As the river approaches the Gulf it is split up into three principal channels. The smaller of these has been improved by training walls made of mattresses and stone, which extend over the bar out into the deep water of the Gulf for more than two miles. This work was undertaken by Captain Eads, under contract with the Government to provide, for a certain sum of money, a depth of twenty-six feet at low water and to keep and maintain this depth for a period which has now expired.

The description of this mighty river above given will surely warrant its being called the "Father of Waters."

W. H. WHEELER.

HISTORY AND PROGRESS OF AERIAL LOCOMOTION.[1]

WHILE history contains no records of any past age in which men rode bicycles, the question of aërial locomotion has occupied the thoughts of man from the days of the Egyptians, to whom we are indebted for a representation of a man with wings considerably resembling the gliding machine on which Mr. Pilcher lost his life. Passing by the legend of Daedalus, whose invention of sailing ships led to the tradition that he attached wings to himself, we find in history numerous records, some such as that of Dante of Perugia or the chronicle of Busbequius, referring to gliding experiments which may not improbably have been authentic, others describing machines by which men have tried to raise themselves by their own exertions, but without success, as exemplified by Besnier, the Marquis de Bacqueville, Jacob Deghen, while a far larger number have been handed down to us of designs of fantastic machines for navigating the air, of a purely visionary character. In the latter category we must include in past times the grotesque figures

[1] Abstract of a Discourse delivered at the Royal Institution on Friday, February 8, by Prof. G. H. Bryan, F.R.S.