The Planets.—Not much new has transpired in regard to the planets that is worthy of special remark. A larger number of the so-called Minor Planets, forming the group between Mars and Jupiter, was discovered in 1868 than in any previous year. That number amounted to eleven, making the whole number of planets in the group 106. The latest four were discovered by Professor Watson, of Ann Arbor, Michigan. Some further use has been made of these minute bodies in physical astronomy, Professor Hansen, of Gotha, having redetermined the mass of Jupiter by means of the perturbations produced by him on the motions of Egeria. The result agrees pretty nearly with previous determinations.

Comets.—In cometary astronomy, something has been added to our knowledge. The periodical comets of Encke (1) and Brorsen have returned according to prediction, and been well observed. A new comet was discovered by Dr. Winnecke on June 13th, and became for a short time just visible to the naked eye. Its orbit was parabolic, so that it is not periodic. The new powerful agent in astronomical research, spectrum analysis, has again been applied to comets with success. Mr. Huggins examined the spectrum of the new comet just mentioned (which is denominated II. 1868), and found a close agreement between it and the spectrum of carbon. It would appear, there identity of orbit which has been proved to exist between some comets and the more remarkable groups of meteors, has led to some speculation on a possible identity or similarity of constitution. The existence of carbon in comets does not militate against this, as that element has also been found in several masses of meteoric matter which have fallen to the earth. Perhaps the fact may even not be without some suggestiveness that the substance in question enters, on the earth, so largely into the composition of organic matter.

Mr. Huggins, and Father Secchi, at Rome, also examined Brorsen's comet with the spectroscope, as they had previously done some others, with the view of ascertaining how far they were either selfluminous or visible by reflected light. The conclusion was that the nucleus alone (with sometimes part of the surrounding nebulous matter), shines with its own proper luminosity, whilst the greater part of the coma and envelopes derive their light from the Sun. Mr. Huggins made formerly a valuable suggestion on this head, viz., that as the comæ and tails appear to be formed of matter thrown off from the nucleus, which gradually condenses afterwards into a cloud-like mass, there must be an intermediate state in which the matter ceases to be self-luminous, but yet retains its gaseous state and reflects but little light. Thus would be explained the existence of the dark spaces which, in some comets, separate the cloud-like envelopes from the nucleus and from each other.

Meteoric Observations.-These now form a branch of astronomy, and one too of high interest. An account of a very valuable paper, by Dr. Weiss, was given in *The Student* for October (p. 199). It refers more particularly to the curious identity of orbit which exists between some comets and meteors, which was first called attention to by Signor Schiaparelli, in the case of the August meteors. This was afterwards shown to be true also of the November meteors, the orbit of which agrees very closely with that of Comet I. 1866, as that of the August meteors does with the orbit of Comet III. 1862. Dr. Weiss's calculations make it probable that the group of meteors seen about April 20th, move in the same orbit with Comet I. 1861; and that another, which has been found to appear about November 28th, has the same path with the comet of Biela, which has been seen only once since its separation into two parts in 1846. He also found that Comet III. 1853, had a remarkable similarity of orbit with a group of meteors seen about August 11th (somewhat later than the Perseides or Principal group of that month, excepting in the element of perihelion distance; and concluded that it was possible he had hit upon a case in which the tail of the Comet extended over the Earth's orbit, and originated a stream of meteors of considerable length in radial, though small in tangential, direction. If comets really are the original bodies, the gradual dispersion of which, through the feeble cohesion of their parts, produces those meteoric rings, the appearances of which have for some years formed so diligent a subject of investigation, it is undoubtedly a very interesting circumstance, and

1. In addition to the observations of Encke's comet, mentioned in our last number, a good series made at Lund, in Sweden, by Professor Möller and his assistant Herr Dunér, between July 28 and August 30, 1868, has been informed by Mr. H Wortham, F. R. A. S., of Royston, Herts, and by Mr. T. W. Backhouse, of Sunderland, that they both obtained a view of the comet on more than one occasion, though they did not make any accurate observations of it.

one from which we may look for further increase in our knowledge of their constitution. But the subject is still in its infancy, and there can be no doubt that comets are bodies of widely different conformation, since any matter existing in space which comes within the sphere ot the Sun's attraction, must necessarily be drawn into an orbit of some kind (permanent only if elliptic) round him. No perfectly satisfactory theory of the tails, by which they are frequently accompanied has yet been brought forward. Too little, moreover, is known of the actual position and curvature of form of these to expect any positive manifestation of their existence, as shown in other phenomena. Dr. Weiss is of opinion that it deserves more attention than has yet

Dr. Weiss is of opinion that it deserves more attention than has yet been given to it, that the meteors belonging to different streams possess, to a great extent, distinct peculiarities of colour, appearance of train when such exists, and other particulars. Thus, the meteors belonging to the Perseides constantly increase in apparent brightness as they pass along their path in the sky, being most conspicuous at the time of their disappearance. On the other hand, those which appear about the same time of the year (mentioned just now as possibly due to the tail of the Comet III. 1853), and radiate from the neighbour hood of the pole-star, have a whitish colour, a much less intense light, and exhibit no change in apparent brightness during their course, moving indeed for the most part with such velocity as to leave the impression of mere phosphoric lines.

He goes on to show that the actual height at which meteors appear and disappear is connected with the velocity of their motion, being greatest for those which move fastest. An instance of this is furnished by the well-known August and November showers (the Perseides and Leonides), the latter of which move much more rapidly, and are seen at greater elevations, than the former. Dr. Weiss thinks that it is desirable to ascertain for every known group of meteors, as far as possible, the mean height of appearance and disappearance. At present this can only be done with any certainty in the case of the Perseides, which are first seen at an elevation of about seventy miles, and vanish from sight when about fifty-five miles in height.

The observation of shooting-stars has been well continued during 1868, but all the results are not yet known. Those of last November gave a very brilliant display, even in many parts of Europe. It was most conspicuous about six o'clock on the morning of the 14th, which being several hours after we expected to be in the middle of the stream, proves that its thickness and extent is greater than had been supposed. It was well seen at Rome by Secchi, and at Madrid by Águilar, and partly also by some observers in this country and elsewhere. A very interesting account of the display, as seen in Canada by Mr. Elvins, and Professor Kingston, at Toronto, was contributed by the former gentleman to the last number of THE STUDENT (p. 467.). The discussion of the observations will doubtless lead to improved knowledge of the constitution of the ring of meteors composing the socalled Leonides.

The Fixed Stars and Nebulæ.—In the wide field of stellar astronomy, observers have been, during 1868, by no means idle. But, partly by reason of the vastness of the field, it is only at distant intervals that results appear which materially affect the extent of our knowledge. A few special points may be just named, whilst the reader is reminded that material is being constantly accumulated which will doubtless hereafter be productive of abundant fruit. Dr. Schmidt, at Athens, and Professor Schonfeld, at Mannheim, have been vigorously following up the subject of variable stars. It is now one of great extent, as well as interest, and its continued prosecution exceedingly desirable. Constant and diligent observation will probably here, as in so many other fields of study, lead in time to a clearer understanding of the true nature and causes of the phenomena seen.

We may mention here that Mr. Birmingham, of Milbrook, who was, we believe, the first to detect the extraordinary outburst of light in a small star in Corona in 1866, discovered also a similar one, but somewhat less conspicuous, in Ursa Major last year. The small star known as 83 Ursæ Majoris, which is barely visible to the naked eye, was seen by him on the night of August 6th, equal in brightness to d of that constellation, or of the third magnitude. It afterwards gradually faded away again to its ordinary size. So far as we know, Mr. Birmingham was the only observer of this remarkable fact, which affords another instance that naked-eye observing is even still sometimes not unproductive.

unproductive. Professor D'Arrest, of Copenhagen, has been prosecuting his nebula observations with his magnificent refractor. We mentioned, in the April (1868) number of THE STUDENT (p. 213), his additional interesting observations of the great nebula in Orion (now known to be gaseous in constitution) and its connections.

We gave also an account, in the number for May (p. 234), of a reinvestigation, by Dr. Schur, of Berlin, of the orbit of the double star 70 Ophiuchi, which appeared to reconcile all the observations better