longed to a radiant in Cassiopeia, and possibly to the same system which furnished the fireballs of April 10, 1874, and April 9, 1876, with radiants at 19°+57° and 17°+57° respectively, according to Von Niessl. A fireball seen on May 30, 1877, had a radiant at 20°+58°, which is virtually the same position as the others. I would be glad to hear of any additional observations of the large meteor of April 15, 1893, or of any of the meteors seen at Bristol on the nights of April 18, 20, and 21 last, and referred to in the first of the foregoing tables.

W. F. DENNING.

Smithsonian Institution Documents.

I DO not know whether your numerous readers realise that many of the public documents published by the United States Government and the Smithsonian Institution can be obtained by direct personal application to the author, at least as long as copies remain undistributed.

The volume entitled "Mechanics of the Atmosphere," recently published by the Smithsonian Institution, was compiled in the confident hope of stimulating the study of this difficult subject by English-speaking scholars throughout the world; further volumes will follow if it becomes evident that this hope is being realised. This collection of translations appeals especially to the mathematical physicist, and I should be pleased to hear from any one who desires to study or teach this subject.

CLEVELAND ABBE.

Weather Bureau, Washington, April 15.

THE GENESIS OF NOVA AURIGÆ.

IT is a common belief that everything is created for a beneficial purpose, and a commoner one that the chief purpose is the delectation of mankind. Without occupying the stilted position involved in the acceptation of such an idea, it can be said that all things that are made are useful for the extension of knowledge. Viewed from this standpoint, the universe is a field containing an infinite number of facts which have to be reaped and garnered before they can be threshed. In the case of the new star that appeared in Auriga last year, a rich harvest of facts has been gathered in. Astronomers from their watch-towers have scanned the celestial visitor through optic-glasses; estimated its glory; measured its place; photographed it, and caused it to weave its pattern in the spectroscope. But it is not enough to make observations and store them up in musty libraries without the proper understanding of their import. At all events, the greatest possible good should be wrung from the facts, and an attempt should be made to discriminate the theory that best explains them. For this reason the subject of Nova Aurigæ is here resuscitated. Theories galore have been propounded to account for that star's genesis, and the most important are described in this note, so that every one can judge for himself the explanation which sufficiently satisfies the phenomena.

Before the advent of the new star of 1866 the general opinion was that such objects represented new creations. Spectroscopic observations then caused a revulsion of that idea, and we find Dr. Huggins suggesting in an italicised expression, that "*the star became suddenly enrapt in burning hydrogen*" ("Spectrum Analysis," p. 28, Huggins, 1866). To quote more fully, "In consequence it may be of some great convulsion, of the precise nature of which it would be idle to speculate, enormous quantities of gas were set free. A large part of this gas consisted of hydrogen, which was burning about the star in combination with some other element. This flaming gas emitted the light represented by the spectrum of bright lines. The greatly increased brightness of the spectrum of the other part of the star's light may show that this fierce gaseous conflagration had heated to a more vivid incandescence the matter of the photosphere. As the free hydrogen became exhausted the flames gradually abated, the photosphere became less vivid, and the star waned down to its former brightness." More or less modified forms of this theory of a fiery cataclysm were afterwards put forward, to account for the formation of Nova Cygni in 1876. Mr. Lockyer, however, advanced the idea that the outburst was due to cosmical collisions (NATURE, vol. xvi. p. 413). In his words, "We are driven from the idea that these phenomena are produced by the incandescence of large masses of matter because, if they were so produced, the running down of brilliancy would be exceedingly slow. Let us consider the case, then, on the supposition of small masses of matter. Where are we to find them? The answer is easy: in those small meteoric masses which an ever-increasing mass of evidence tends to show occupy all the realms of space." Practically all the theories with regard to the origin of new stars are modifications of one or the other of these; either an internal convulsion, or an external collision, is hypotheticated. Let us see how each will stand the test put upon it by Nova Aurigæ.

The discovery by Mr. Lockyer that the bright lines in the spectrum of the new star were accompanied by dark lines on their more refrangible sides seemed at once to be a striking confirmation of his views. The interpretation naturally put upon such a composite appearance was that two discrete masses were engaged in producing the body's light; one, having a spectrum of dark lines, was rushing towards the earth, while the bright-line star or nebula was running away. As Mr. Lockyer remarked in a paper communicated to the Royal Society on February 7, 1892, "the spectrum of Nova Aurigæ would suggest that a moderately dense swarm [of meteorites] is now moving towards the earth with a great velocity, and is disturbed by a sparser one which is receding. The great agitations set up in the dense swarm would produce the dark-line spectrum, while the sparser swarm would give the bright lines." In spite of its simplicity, however, and its ability to account for the observed facts, the meteoritic theory did not commend itself to the minds of some astronomers. Dr. Huggins clung to the idea that the outburst was the result of eruptions similar in kind to those upon the sun, but the acquisition of knowledge of the light changes of stars forced him to withdraw the original suggestion that the luminosity of a Nova is produced by chemical combustion (*Fortnightly Review*, June 1892, p. 827), in fact, to relinquish entirely the crude conception of a burning world propounded in 1866. In its place Dr. Huggins put the view that Nova Aurigæ owed its birth to the near approach of two gaseous bodies. "But," he admits (*Ibid.* p. 825), "a casual near approach of two bodies of great size would be a greatly less improbable event than an actual collision. The phenomena of the new star scarcely permit us to suppose even a partial collision, though if the bodies were diffused enough, or the approach close enough, there may have been possibly some mutual interpenetration and mingling of the rare gases near their boundaries."

"An explanation which would better accord with what we know of the behaviour of the Nova may, perhaps, be found in a view put forward many years ago by Klinkerfues, and recently developed by Wilsing, that under such circumstances of near approach enormous tidal disturbances would be set up, amounting, it may be, to partial deformation in the case of a gaseous body, and producing sufficiently great changes of pressure in the interior of the bodies to give rise to enormous eruptions of the hotter matter from within, immensely greater but similar in kind to solar eruptions." Serious objections to the Klinkerfues-Wilsing hypothesis are pointed out by Herr Seelinger (*Astr. Nach.*, No. 3118, and NATURE,