Let anyone read through those three articles, and weigh carefully all the evidence adduced, and the probabilities are that if he has approached the subject with an unbiassed mind he will consider the case fully proved, with a wealth of evidence to spare. But let him next take up half-a-dozen of the newest books on astronomy and turn in each to the chapter on temporary stars. He will find inadequate causes for a stupendous phenomenon seriously discussed, and impact possibly dismissed with scant courtesy as unable to account for the facts observed.

This evidently needs some explanation. Let us, therefore, cull and examine a few such extracts.

But in case any readers have not the original articles by them, let us first give, in as few words as possible, the kernel of the theory, premising that such a statement can give no idea whatever of the number, the importance and the beauty of the deductions that spring from it.

Collisions of celestial bodies almost certainly occur. It would indeed be surprising if they did not.

The collisions are of infinite variety, for every kind of celestial body may take part in them.

A collision between two similar bodies may be of any degree of completenss: from the merest graze to direct impact. The latter must be exceedingly rare in comparison with partial impact, for it can occur only when the bodies have no original proper motions at all, or when their proper motions are entirely in the straight line joining their centres; which are both exceedingly improbable suppositions. In all other cases, when bodies of any kind are drawn together by gravitation they describe conic sections round their common centre of gravity, and if they come near enough they graze one another.

In the case of a grazing impact of suns, the parts coming into collision coalesce, and have their motions of translation in great part changed into molecular motion. The wounded suns generally go on, and form a pair of Variables. The coalesced parts form the third body. This is the real new star. It is as hot as if the whole suns had come into collision, but it has not the same gravitating power If it is small enough in comparison to the suns it is unstable, and is soon dissipated into space. If larger, it forms a permanent planetary nebula. In any case, it is the scene of that wonderful phenomenon Selective Molecular escape, so well explained in the article in June.

Grazing impacts and selective molecular escape seem able to account for the infinite variety of the forms of celestial bodies, and for their continual rejuvenescence. Just as a gas remains to us apparently the same whilst countless billions of impacts take place amongst its molecules, so our universe persists in spite of, or rather by means of, the impacts which give it perpetual youth.

The sequence of events that should follow impacts of all kinds has been worked out in considerable detail, and every year's work in the observatories of the world brings numbers of fresh verifications of these deductions.

Let us now take a temporary star as a test case and see how astronomers account for it A new star appears in the heavens. In a day or two, sometimes in an hour or two, it increases in brightness till it is shining in space with ten thousand times the brilliancy of the sun. It gives a most characteristic spectrum as shown in our April number. In two or three weeks, or months, it sinks back into insignificance, and the final result is frequently a planetary nebula.

Before it can be considered satisfactory, any theory of new stars must account for three things:

1. Their sudden rise.
2. Their sudden decline.
3. The marvellous complexity and variability of the spectrum and the startling changes in constitution which it implies.

The theory we are discussing does all this perfectly, whilst no other theory so far suggested succeeds at all satisfactorily.

That an impact accounts for the first characteristic is evident, for the collision between two stars like our sun would last less than an hour.

The sudden disappearance or decline affords a crucial test. When the third body is taken into account, there is no difficulty whatever. Without it every theory fails.

The wonderful spectrum which has puzzled the astronomers of the world, and has disproved all other theories is not only explained, but was actually foretold by this one.

Let us think for a moment what the spectrum will be like if a new star is formed by two suns grazing one another.

By far the greater part of the heat produced by the collision is concentrated in the third body formed by the coalescence of the parts struck off from the colliding suns. This explosively hot body gives at first a continuous spectrum. But a tremendous outrush of gas from its surface immediately takes place, and the spectrum is crossed by dark lines which are soon followed by bright ones. At first all the elements have equal molecular velocities, and therefore very different temperatures As the temperature becomes equalised, the velocities tend to become inversely proportional to the square roots of the atomic weights. Thus the nucleus becomes surrounded by rapidly expanding concentric shells of gas, hydrogen leading possibly at the rate of 1000 miles a second, helium coming next at half the speed, and the other elements following in order. The velocities of all the lighter elements at least wil be much above the critical velocity, and will, therefore, hardly be reduced by gravitation. As the gases are rushing outwards in all directions, the lines of the spectrum will be widened to bands, the hydrogen bands being twice as broad as those of helium, and nearly five times as broad as those of sodium; and since the nucleus shines through the parts of the shells that are coming towards us, every bright band will be accompanied by a shadow band on the violet side.

As the intensity of the light of the third body wanes, the wounded stars may begin to assert themselves, and the blazing flakes will then give bright lines displaced according to their rates of motion. If the third body is small enough it will be completely dissipated into space, leaving a variable star, which, in course of time, will separate into a pair of variables; the variability, of course continually diminishing. If the third body is larger, the heavier elements in it will be unable to get away and the new star will fade into a planetary nebula and meteoric swarm giving a faint continuous spectrum

Needless to say, this is the sequence observed in temporary stars.

As possible causes of such a phenomenon as this, Flammarion suggests sun spots on a vaster scale, eruptions from the interior furnace, an encounter with a celestial body breaking up a continent on a crusted sun or tremendous meteoric streams meeting in space.

The total inadequacy of all but the last of these is apparent, and if the last were on a sufficiently stupendous scale, how could the light possibly fade so fast?

In Professor Newcomb's book, "The Stars," he discusses at length the spectrum of Nova Aurigae, and shows how utterly inexplicable the phenomena are from his point of view. He does not consider the third body, or everything would be as clear as day. He seems to favour the idea that some foreign body has made an opening in the shell of a star and allowed the interior gases to burst forth, but adds: "What magnitude the outburst might assume it is impossible to say, and cautious thinkers will decline to accept this or any other solution until we have had more experience on the subject."

We may well decline to accept this solution, but why should we reject another if it gives a complete explanation of the facts?

In the "Story of the Heavens," Sir Robert Bale, whilst discussing Nova Cygni says: "We know no cause which would account for such a phenomenon more simply than a gigantic collision." "Two or three days (or less) for the rise, two or three weeks for the fall. Yet even two or three weeks was a short time in which to extinguish so mighty a conflagration. It is comparatively easy to suggest an explanation of the sudden outbreak; it is not equally easy to understand how it can have been subdued in a few weeks. A good sized iron casting in one of our foundries takes nearly as much time to cool as sufficed to abate the celestial fires in Nova Cygni."

Of course it didn't cool It was dissipated into space.

In "The Earth's Beginning," Sir Robert Ball discusses Nova Persei without mentioning the possibility of the third body. He points out that the heat developed by a collision might be much more than sufficient to raise the masses of the two colliding bodies to a state of incandescence, and then adds: "A collision affords the simplest explanation of the sudden outbreak of the star, and also accounts for the remarkable spectrum which the star exhibits."

A collision as Ball pictures it certainly does account for the sudden outbreak, but it completely fails to account for the rapid disappearance, and without the third body it would certainly not account for the peculiarities of the spectrum.

In Bryant's "History of Astronomy," 1907, he says: "The original idea that the appearance of these "temporary stars" must be attributed to a collision between two more or less solid bodies, or one solid body and a fairly condensed nebula, is gradually being abandoned since of the several successive different phases shown in the spectrum of a Nova until it reaches the stage of a faint star again, there is not one that necessarily denotes instability."

Now here again, is not the whole trouble in interpreting the spectrum caused through omitting to notice that the third body is the new star, and that the two original ones take quite a minor part in producing the spectrum.

Miss Agnes M. Clerke, in "Problems in Astrophysics," discusses at length the phenomena observed in all the new stars of recent times. Every page contains striking confirmation of the predictions made long ago from a consideration of the sequence of events that should follow a partial impact. She describes very fully the spectrum of Nova Aurigae (1892), which really affords a most convincing proof of the grazing impact theory. It is incredible that all its peculiarities, which astonished the astronomers of the world, could have been foretold without a clear conception of what was really taking place. But she tries to account for the spectrum without considering the two essentials, the third body and selective molecular escape, and says, "The collision theory collapsed under the weight of the facts it had to carry." The very next year Nova Normae appeared; its spectrum was virtually a replica of that of Nova Aurigae.

Miss Clerke says: "There was then nothing casual about its production. The spectral displacements and the augmented refrangibility of the dark lines belonged to the essence of the phenomenon. The appearance of Nova Normae then disposed of what was left of the encountering star theory." In reality it piled proof on proof. "Nova Carinae, 1895, disclosed precisely the same arrangement of coupled lines, the dark set above the bright." And so it has gone on ever since. A grazing impact followed by selective molecular escape is the only hypothesis that explains the observed facts, and this all-powerful double key to the mystery is the very one she does not try. In discussing Nova Persei, which afforded the most complete confirmation of all, as it was discovered at an earlier stage, she says: "The sodium band actually moved upwards; the emitting molecules quickened their vibrations through some unknown kind of influence." But why is the influence unknown? The light sodium molecules must necessarily have their velocities increased by the heat they take from the heavier elements during the equalisation of temperature that follows the collision.

But not having the "open sesame" Miss Clerke misses the solution, and sums up as follows: "On the whole the most promising theory of their occurrence is that stars in the Milky Way occasionally get entangled in the diffused nebulosities with which that region abounds, and blaze through the resistance offered to their motion, just as meteors kindle to brief splendour in shooting athwart our cloud of "circumfluous air."

Fancy a star heated in this manner till it glows with ten thousand times the brilliancy of the sun cooling in a month or two. If this is the most promising theory, what shall we say of the others?

One of the latest and most interesting speculations on the origin of the universe is that given by Arrhenius in "Worlds in the Making." It approaches nearer to Bickerton's theory than any previous one. In the preface Arrhenius writes: "My guiding principle in this exposition of cosmogonic problems has been the conviction that the universe in its essence has always been what it is now" This is the same idea as Bickerton's "Immortality of the Cosmos." Arrhenius adopts the collision of suns as the true explanation of new and variable stars, and on the assumption that dark suns are 100 times as numerous as luminous ones, calculates the probable interval up to the next collision of our sun as something like a thousand billion years. He discusses at length the probable sequence of events in such a collision, and tries to account for the observed facts. But his reasoning in several particulars fails to bring conviction, as he does not consider the formation of the third body, and does not definitely accept selective molecular escape. His explanation of the sudden disappearance of the star amounts almost to saying that it is hidden by its own dust. His words are: "But what has meanwhile become of the new star? Spectrum analysis tells us that it has been converted into a stellar nebula like other new stars. The continuous light of the central body has more and more been weakened by the surrounding masses of dust."

In accounting then, for the phenomena of temporary stars, Professor Bickerton's theory appears more successful than any other. We might, with similar results, compare his method of treating variable stars, double stars, planetary nebulae, spiral nebulae or, in fact, any of the details of the scenery of the heavens, but space forbids. Let us, therefore, confine our attention to one more point—the structure of our own Galaxy. Professor Bickerton appears to have been the first to suggest, as he did a quarter of a century ago, that our visible universe owes its form to the interaction of two great cosmic sys-