produced. Cosmic flint and steel have met and struck a spark of marvellous brilliancy. The idea of the formation of this body is all-important and basic, the correlation has been called "The Theory of the Third Body."

We know that some hundred million stars can be photographed in the Milky Way. These suns must be of all ages—young, mature, and old. Some are dead; there are possibly more dead than living. The suns are travelling in two great streams in opposite directions. They attract each other as they pass, so that collisions are likely to occur. Suns are more likely to graze than meet fair. As they approach one another they get up the incredible speed of hundreds of miles a second, hence clearly the graze does not stop the stars. The coalesced third body possesses many wonderful properties; it spins, it sorts its atoms, and it is abnormally hot; it has many times more energy than it can retain, therefore it explodes. Thus a graze of suns produces three bodies: two revolving torn suns or variable stars, and a third explosively hot body which is a temporary star. This star appears suddenly, expands for a time, and is finally dissipated into atomic dust.

At the time of its greatest luminosity the star is thousands of times as brilliant as the sun. Nearly all the energy of the graze is confined to this third body. The conception of the formation of a third body belongs to the science of mechanics; it is a problem in engineering and not of ordinary astronomy. Hence the men who study the stars have missed the idea, and, although they have spent a great amount of thought on collisions, it appears that the idea of the third body has never been debated, as no mention of it can be found in astronomical literature. The amazing set of agencies that are at work in the third body, due to its abnormal energy, the unbalanced momentum of its parts, the varying velocity of its different chemical elements renders its formation an event of surpassing importance. The light elements move so fast as to fly completely away—they go to lay the foundations of new cosmic systems, those of moderate weight form great gas shells called planetary nebulae; and the heavy atoms and metals combine with oxygen and form meteoric swarms. The greater the mass of the grazing suns the higher the temperature of the third body. The smaller the ratio that is cut off the more quickly and more completely is the new star dissipated. No matter how small the ratio cut off, the temperature of the new body is just as high as though the whole of the mass of the stars had collided. The temperature of a given element increases as the mass of the colliding suns is greater. Thus Nova Persei (the great new star of 1901) was a very small graze. Perhaps less than one-twentieth was torn from two very massive dead suns, whilst the new star in the Chariot was probably a graze of as much as one-fifth of two dead suns of small mass.

Possibly that most wonderful of all temporary stars, the Pilgrim, was a deep graze of very massive suns. We read that in November 1572 Tycho Brahe, who was studying the stars in his Danish home, was astonished to behold a new star of extraordinary brilliancy in the constellation Cassiopeia. It must have appeared quite suddenly, for Tycho believed it was not visible an hour before he noticed it. When first seen it was very brilliant; it soon became more brilliant than Sirius, rivalled Jupiter, was even brighter than Venus at quadrature, and became so bright it could be seen at noonday. It was fixed in space at true stellar distance, and was therefore the most brilliant body of the entire heavens. Probably it gave off over a hundred thousand times as much light as the sun. Then in short time it began to diminish in intensity, in a few months it was only a star of the second magnitude, and in seventeen months had faded completely away. Fully twenty such sudden appearances of stars are recorded, some within the last few years, but except the new star of the new century these were not prominent objects, telescopes being needed to observe them properly. Yet so marvellously have photography and the spectroscope added to the power of the telescope that these points of light have given us stellar information which the brilliant visitants of the past never afforded us. All observation tells the same story of sudden appearance, temporary increase of brilliancy, rapid and often complete disappearance. A new star is a giant sun that has been suddenly born, a body of surpassing brilliance and inconceivable size torn from two colliding dead suns.

The basic idea of the theory of partial impact is thus simple. It is that two grazing suns strike off a cosmic spark of great brilliancy; the suns travel past one another, each with a fiery scar, a pair of variable stars. These two variables will frequently be wedded by the attraction of the new third body, and the pair will become a permanent double star. Such is the simplicity of the basic conception, whilst on the other hand, so complex are the conflicting forces set at work by the graze that the resulting phenomena seem to have no end. Numerous branches of chemistry, of thermo-dynamics, spectroscopy, and other advanced portions of physics and mechanics are laid under contribution. Ordinary mathematics seem incompetent to solve the problems, and new graphics of gravitation have had to be designed to deal with the subject, and partial impact of suns is only the first step of the whole correlation. Some elementary atoms are hundreds of times the mass of others yet at the same temperature each possesses the same energy. What they lack in mass they make up in motion, so that a light atom like hydrogen has incredibly greater chance to escape than has the atom of lead. The stupendously hot third body is a vast blazing bonfire that is expanding a million miles an hour whilst the light atoms are sometimes observed to move a thousand miles an hour. Thus these light atoms escape the surface and form vast ensphering shells, the atoms actually flying away into the empty parts of space, there to lay the foundations of other cosmic systems.

Atoms not moving so fast may form vast shells of gas known as planetary nebulae, whilst the slow-moving heavy atoms may not escape at all, but form rotating meteoric swarms. These swarms, if small, may become comets, and, if stupendously large, may after countless ages become the beautiful star clusters that form such magnificent objects when seen through our modern giant telescopes. Thus, this one apparently destructive event—the tearing collisions of two dead suns—is full of most wonderful constructive power. This one event must produce a temporary star and two variable stars. It must dissipate matter; it may form ensphering gas shells, or planetary nebulae; it may originate meteoric swarms, comets, or star clusters. This basic part of the theory of the third body is considered by some experts to be absolutely demonstrated. The light curve—the variations of light with time—corresponds exactly with the deduced physical phenomena. New stars give a wonderful and characteristic spectrum of beautiful many-coloured shaded blaze bands so characteristic that many new stars have been discovered by their peculiar spectra. Quite recently, within six weeks, these abnormal characteristic spectra have enabled three new stars to be discovered, yet these spectra, which are quite inexplicable on any other theory, can actually be deduced from the theory of the third body. Of course, the theory suggests that where new stars have appeared we should sometimes see variable stars left. In 1670 Antheim saw a temporary star, and there, in the very place, now exists a star that is actually variable and another suspected of variability. Variable stars are some times in pairs, as we should expect them to be; indeed, so many are so that some law must have paired them. Double stars are often variable and actually sometimes doubly variable. Both variable and double stars are associated with nebulous matter, as we should expect. Planetary nebulae are frequently sphere in sphere and often have a nebulous star, double star, or meteoric swarm at their centre.

Thus there is no single type of evidence of the accuracy of this part of the theory, but the facts have been found that have been looked for. The evidence has accumulated until a Cambridge Wrangler, Mr. Gifford, who won the Herschel Scholarship, says: "That in 1878 the facts on which the impact theory relied were few, though sufficiently striking; now they are innumerable. It has had many of its predictions verified by subsequent discoveries, in a manner as striking as the fulfilment of the predictions of Mendelieff, based on the periodic law." Whilst Professor Rutherford says: "The theory of cosmical impact of Professor Bickerton is, in my opinion, the only satisfactory way of accounting for the remarkable phenomena observed at the time of the appearance of a new star. . . The theory is a genuine contribution to science." He also called it an excellent working hypothesis. It is as a working hypothesis it should be used, to guide research. Some astronomers have believed that if this theory had been used as a working hypothesis from its inception thirty years ago astronomy would years ago have been where it is now. There seem to be but few branches of astronomy upon which it does not throw light.

Impacts may take place between every class of body and system in the universe. Star clusters may collide with giant suns, with nebulae, or with other star clusters; dead suns with vivid stars; each of these may collide with the most varied systems. The graze may be slight or deep, or the collision may be complete. Each and every one of these varieties of impact have their representative in the universe. Even cosmic systems of the order of our galactic universe may collide. The configuration of our own universe is of such a character as to render it certain that it is made up of two systems that ages ago began to interpenetrate and collide. By collision a great central furnace was formed that grew for countless ages. The millions of stars and systems closed in about the circumference of this vast fire until the pressure was so enormous it blew out the polar cap of nebulae. Then by the flight of its atoms it burnt itself out. The lessened attraction then allowed the vast double spiral of stars of the Milky Way to extend itself to its present dimensions. The two majestic streams of stars in stately procession, quite recently discovered, show the residual motion of the two original cosmic systems that went to the building of our universe, each star being held in leash by the attraction of the mighty whole. Is not the vast centre of light in the great spiral nebulae, in Andromeda, just such a central furnace, even now blazing? May not the two "Clouds of Magellan" be systems on the road to collision and rebirth?

Still the subject is not exhausted. Complex inter-acting agencies may be traced on and on until the whole scheme of creation is unfolded. We then realise the cycle of the eternal heavens, in which we have no evidence of a beginning or promise of an end—a cosmic whole, infinite and immortal. This, then, is the scope of the partial impact theory of evolution. It finds astronomy a chaos of facts and converts it into a classical system. If finds no generally accepted theory of the genesis of a single body or system in the universe, and leaves but few untold. The interpretation of spectograms will tell the chemical physicist the result of the great experiments Nature is making in those wondrous laboratories—the stars and glowing nebulae of the heavens. The scores on scores of new principles deduced throw light on many branches of chemistry, physics, and mechanics, especially on spectroscopy. When all these principles are known and used technology must advance by leaps and bounds, whilst the substitution of the theory of an immortal cosmos for the dismal doctrine of eternal death will kill the prevailing pessimism of the present and replace it with an optimistic philosophy that will cause men to grapple with the dire problems of to-day and show that pain and misery are but Nature's mode of telling us that our lives are not consonant with the laws of God. With a right mode of life mankind will attain to his wondrous birthright a life of successful achievement, made joyous by the sympathetic appreciation of his fellows.

The question remains, how shall this most hopeful theory be made known to science? Eminent scientists are generally specialists picking up new fibres of knowledge and spinning these into beautiful threads. Their whole time is thus occupied in extending special lines of knowledge. But a generalisation is the weaving of many of these beautiful threads to form the fabric of correlated science. The work of the specialist is not this weaving, his work being the discovery of new knowledge itself. Yet theories are valuable, they seem actually to be the landmarks of human progress. Whose work, then, is it to test and place the hall-mark upon such theories? Clearly it belongs to all the branches involved; clearly it is the work of a Conference, which might fitly, I think, be convened by the Royal Colonial Institute—one in which the scientific author shall meet the mathematical astronomer, the engineer, the astrophysicist, the chemist, the spectroscopist.

(To be continued.)