That was not a leap year, but began on Sunday. The last leap year that had 53 Sundays was 1888; but that began on Sunday, whereas 1916 began on Saturday. The last year identical with 1916 in all respects was 1876, the year of the centennial of the United States, 40 years, ago which exactly like 1916, began on Saturday and had 53 Sundays. The last three instances preceding that were the years 1780, 1820 and 1848. The next two following instances will be 1944 and 1972. It will be noticed that the intervals are either 28 or 40 years.

ABSTRACTS FROM FOREIGN JOURNALS.

Dr. Abbot on the Life on Venus.—The *English Mechanic* for 5th March has a short note giving the views of G. C. Abbot as to the possibility of life on other planets. Contrary to the usual opinion the distinguished Director of the Smithsonian Astrophysical Observatory considers Venus, being about the same as that of the Earth, would make any other conditions similar. It must be inferred that Dr. Abbot inclines to the belief that Venus has a short rotation period as it is generally conceded that the longer period of 225 days, favoured by some observers, would make life impossible. It may be added that Dr. Abbot considers conditions on Mars too frigid for any kind of life to exist there.

Standard time of Siam.—The following note has been received from Phya Buri, Navarasth, Envoy Extraordinary and Minister Plenipotentiary :—"I beg to inform you that Siam has adopted the standard time of 7 hours 0 min., east of Greenwich (or Zone time of 7 hours,) to date from April 1st, 1920.

The Theory of Gravitation:—Dealing with Newton's views and their subsequent history, Prof Sampson said that it was only familiarity that prevented us from noticing the unexplained wonders on all sides of us. Newton's expressed views on the nature of gravitations, were marked on the one side by a defensive gaurd against those who charged him with bringing back into philosophy an occult property inherent in matter which expressed itself in the formal shape given to his great work, the "Principia" where nothing was admitted beyond what was exactly demonstrated from observation; and on the other side, by great fertility of suggestion and theory in letters, showing, how he regarded gravity as somehow transmitted by an atomic ether, pervading all space.

The question of its nature was inseparably involved in the conception of space, time and matter, and before it could be advanced Newton's theories of these required fundamental scrutiny. But for upwards of a century attention was engrossed in working out the consequences of Newton's Law of Gravitation treated merely as a formula without pre-occupations as to its foundations. The way for its discussion was paved by varions studies of the foundation of geometry, *e.g.* by Hemholtz. This made it clear how arbitary was most of our ideas of the science, and how for example, we may be quite unconscious of changes in our standards of length. Such studies contributed to a state of mind prepared to adopt a radical revision of the ideas of mechanics, but actual advance came from electrical and physical experiments.

J. J. Thompson's discovery of the electron, and that it was endowed with mass, and that this mass was only an expression of its electro-magnetic energy, and depended upon its velocity, pointed out that Newton's conception of mass as inert quantity of matter was inadequate. But the cardinal experiment only slowly appreciated at its full significance, was Michelson and Morley's proof that we were utterly unable to detect any phenomena, the motion

of the earth through the ether, rapid as this was. In the hands of Larmour, Lornitz and of Einstein in his earlier work this was shown to involve a reconstruction of our whole frame of motion and mechanics, even of time. It was known as the Theory of Relativity, because its postulate was that we were unable in any way to perceive absolute motion. The theories however invented in each case *ad hoc* were to some degree partial and incoherent.

The time had come to clear them all away and replace them by due comprehensive calculation, which should start from the begining.—[*Professor R. A. Sampson in English Mechanic and World of Science.*]

A Bright Meteor—One Mr. C.A.C. writes in the *Journal of the R. A. S. Canada*:—"On March 2 at 10·42 p. m. while on St. George Street, Tornoto, the present writer observed an exceptionally fine meteor. It was seen pretty accurately in the N. W. direction and descended almost vertically, tending perhaps to the right hand, (to one facing the meteor). The colour was a vivid bluish green with a tinge of red in the trail. It was judged that it was 40 or 50 miles distant and it was hoped that news would come in of its reaching the earth in the neighbourhood of Orangeville but nothing has been reported.

Displacements of Lines and Einstien's Prediction—Measures have been made by Mr. Narayana Aiyer of the displacements at the Sun's polar limbs of the nitrogen bands near 3883 .Fifteen plates of the limb spectra and carbon arc and ten plates of the spectra at the centre of the dise give the following mean displacements of ten prominent triplet bands :—

	In Angströms.	In K M/Sec.
North Limb	+ 0°0061	+ 0°47
South ,,	+ 0°0088	+ 0°68
Centre of Disc	+ 0·0043	+ 0°33.

These values are very much larger than were obtained by St. John for other groups of lines in the Carbon arc spectrum and taken by themselves they appear favourable to

Einestein's theory. The systematic difference between North and South indicates that displacements may be variable.

Measures of limb spectra in high latitudes and with iron arc comparison also show the difference between North and South, although these were photographed a year later than the carbon arc spectra. The results of this series of plates, taking the mean ten lines. is as followers :—

	In Angstroms.	In KM/Sec.
North limb	+0·0099	+0 67
South "	... +0·0134	+091
Centre of Disc.	... +0·0070	+0·47

All of these results are free from pole effect in the arc and from pressure shift. Our previous researches having shown that pressure does not affect the displacements of the of the iron lines in the Sun; our results for these lines should be considered to be as important a test of the relativity Theory as the measures of the nitrogen band lines.

The general result that both band lines and iron lines are displaced at the limb by amounts that, if not on the exact agreement with the predicted amount are of right sign and order of magnitude appears favourable to Einstein's hypothesis. But the displacement differs for different substances and for different lines in the same substance; and previous work has shown that there is no proportionality between displacements and wave length. If Einstein's hypothesis be true, therefore, there must be an unknown modifying influence at work.

The measures of Venus spectra offer the most serious difficulty for they appear to show that the line displacement only occurs in the light derived from the hemisphere of the sun facing the Earth.

The hypothesis that motion in the line of light is the only cause of the line displacement has this great advantage, that all of the anamolies mentioned including the Venus results, are readily explained. But it involves the controlling action by the Earth, which is very difficult to believe.

Eratosthenes I.— A study for the astronomers.

Prof : Pickering writes in November (1919) issue of the Popular Astronomy :—Eratosthenes can readily be found by any one who has even a slight knowledge of the lunar sufrace, since it lies 10° to the north west of Copernicus. and on a small scale closely resembles that crater when the Sun first rises upon it, As the lunation progresses, however Copernicus turns white from the precipitated cloud and snow while Eratosthenes turns dark from the growth of the vegetation within and around it. Very soon they are quite unlike as at full moon, while Copernicus is conspicuous, Eratosthenes can only be found by one who has carefully watched and drawn it night after night , and who knows just where to look for it. For three days at this time it is difficult to recognise, but after that it reappears, and remains conspicuous for the remainder of the lunation. Since it is situated in latitude 14° N, it is located near the centre of the disc and there is no trouble from libration. It is 37 miles (59 Km) in diameter, and its walls rise to an elevation of nearly 3 miles above the interior.

Photographs show that large areas of vegetation surround the crater, particularly on the west and north, these areas being nearly invisible in the photographs, taken soon after sunrise on the Moon. If the lunar vegetation has leaves, we must consider that only the twigs and branches are visible near sunrise and sunset. Its form is of course quite unknown to us and the phenomena may consist merely in the darkening and fading of its exposed surface. We assume the phenomena to be due to vegetation, because that explanation is plausible, and because none other of any sort has ever been offered for it. That clouds and snow occur upon the Moon, and that consequently it posseses at least a slight atmosphere has been shown in the papers on Meteorology of the Moon. There is therefore no reason why vegetation should not exist.

The lunar vegetation is not green. It is gray like our sage brush and some of our cacti, and black like our lichens, —almost a purplish black in some places near the equator.

The vegetation on Mars,we know is also grey for most of the surface. The lunar vegetation is scattered, generally in rather small patches over the surface. None is found near the poles The only greenish spot located upon the Moon is the floor of the great crater Grimaldi, but even here the colour is not marked. By far the greater part of the lunar surface, appears to us to be simply a desert waste.The vegetation, where found, is often associated with minute craterlets, as in Alphonsus, the craterlet occurring at or near the centre of the dark area. Sometimes it is associated with rills as in Atlas. In any case its growth and decline must necessarily be very rapid, the changes being most marked, near the time of the crater's summer solstice. Consequently they always occour at a considerable distances from the terminator, or in a portion of the Moon which the amateur seldom examines with care. Near the terminator on the other hand, few changes of interest occur other than the shifting shadows which can hardly interest the professional selenographer.

Einstien's Relativety Theory – R. G. A. writes in the publications of the Astronomical Society of the Pacific:—

Einstien's statement, "If any deduction from it (the theory) should prove untenable, it must be given up" is of special interest. Just above this statement he gives the only three causes yet suggested in which the theory can be subjected to test by actual observation. Let us consider these briefly.

1. The only planet orbit really available for this test is that of Mercury. Grant that the theory here offers an explanation of the observed acceleration of the perihelion; it is also true that there may be an alternative explanation under the Newtonian law of gravitation. Sceliger has shown that the finely divided matter in circulation above the sun within the orbit of the Earth which is revealed to us by the Zodiacal light may be competent to produce the observed perturbation.

2. There is no question but that the English eclipse plates show displacements of the stars at the time of the eclipse

(when the star's rays passed close to the limb of the sun) which are in accord of the displacement predicited by the theory. It is this fact upon which all the recent notice given to the theory rests. It must be remembered, however that the total displacements are extensively small, and that the absolutely unavoidable errors of measurement amount to a considerable fraction of the entire displacements. The observers themselves were the first to point out this fact and to urge the desirability of repeating the observations at future eclipses to secure confirmation of the present results. Then it must be noted that the displacement if thus confirmed may be open to an alterative explanation. So eniment an astrophysicist as Professor Newall of Cambridge (Eng.) said at the Royal Society and Royal Astronomical Society at which the eclipse results were formally announced, "I feel that the Einsten effect holds the day, but I do not yet feel that I can give up my freedom of mind in favour of another interpretation of the effects obtained. If Einsten had not existed or had not predicted a deflection we might have had a similar experiment made to test the presence of an extended atmosphere round the sun and we could have argued from the results back to the hypothesis * * * I prefer to keep an open mind about interpretation".

3 The shifting of spectral lines towards the red end of the Spectrum in case of night coming to us from stars of appreciable mass has been very carefully tested in the case of the Sun. Here the magnitude of the shift required by the theory is from 50 to 100 times the error of modern measurement. In fact the predicted shift on plates taken with the powerful equipment on Mount Wilson is almost great enough to be detected, if it exists, by the unassisted eye. In spite of this, Dr. St John's investigations at Mr. Wilson and Mr. Evershed's at the Kodaikanal Observatory, agree in giving negative result. No displacement at all corresponding to the demand of the theory were detected.

It thus appears that while two of the tests proposed by Einstein give favourable results, each of them may also be

accounted for on the old Newtonian theory; and that the third —and this is precisely the one best adapted to accurate and repeated measurement gives an unfavourable answer. Recalling once more Einsten's words, "if any deduction from it should prove untenable, it must be given up", we may concur in the opinion recently expressed by a number of prominent American physicists that the Theory of Relativity has not yet been established.

A Giant Meteorite - What seems to have been an unusually large meteorite fell into Lake Michigan, south of Grand Haven, on the 27th November last, causing a panic among the inhabitants of the district for some distance round. As usual on these occasions, the accounts given are more lucid than scientific. Reports say that a bright light, like, "the rays of a bright Sun," was followed by a roaring noise that brought the inhabitants rushing from their houses, a large column of flame and stream shot up over the spot where the meteorite disappeared. Various other phenomena reported, such as magnetic disturbances and a squall of wind may or may not, have been due to the meteorite.

The Distant Stars—a chat with beginners.

The World of Wonders writes:—

The wise man only wonders once in his life, but that is always; the fool never. The education of the wise man begins with wonder and ends with devout admiration; but the fool "doth not consider," and shuts his eyes to things arround him. Strictly speaking, wonder is not a vulgar nor a foolish attribute, "All wonder," said a dogmatic writer, is but the effect of novelty upon ignorance." Nay, we answer, you cannot be ignorant if you would feel the greatest effect of wonder. Thus it is that Coleridge, the most encyclopædic of men, declares, "In wonder all philosophy began, in wonder it ends and admiration fills the interspace but if the first wonder is the offspring of ignorance, the last is the parent of adoration."

Let us consider shortly one of the commonest wonders about us—Space. Gaze up into the sky from off the page

you are reading, and try to pierce as far as your eye can reach, and then as far as your mind can conceive. Our globe—the speck of dust on which we stand is 8,000 miles in diameter, or 24,000 in circumference but with its sun, planets, and satellites, and those "less intelligible orbs called comets", it occupies space, which, calculated only by the uttermost bound of orbit of Uranus - and we know that beyond Uranus there are worlds—is not less than three thousand six hundred millions of miles in diameter. The mind, it has well been said, fails to comprehend so vast an area, "Some fair idea of this," says an eloquent writer, "can be ascertained from the fact that, if the swiftest reachorse ever known had begun to traverse it at full speed at the time of the birth of Moses, or nearly our thousand years ago, he would as yet have accomplished only half his journey."

The sun, which so many have worshipped and which is humanly speaking, the source of life to us all, is another perpetual wonder. Its circumference is about 2,770,000 miles. Its distance from the earth is so great that a railway train moving at 32 miles per hour would take three millions of hour or three hundred and forty-two years and three months to travel from London to the sun, supposing that it could travel incessantly night and day during that time. A cannon-ball moving fifty times faster than such a train, would expend seven years in reaching it. To make a globe like the sun it would take 1,400,000 globe like the earth rolled into one; or, to make these facts simpler,and yet more stupendous, the bulk of the sun is five hundred times greater than the aggregate bulk of all the other bodies of the solar system of which night only reveals to us a small part of that which appears above our hemisphere, and above our particular stand-point. The centre of the sun is a dark mass covered with a garment of flame. But in this luminous matter there are vast rents. We talk of spots in the sun; spots indeed; the space occupied or laid bare by the principal spot is 928,000,000 square geographical miles. Arago, by a physical test proved that the garment of flame, this luminous matter, must be gaseous; so

that the sun floats in an ocean of flame, and this is so powerful that the strongest blast furnace yet ignited by man at its highest power, is seven times weaker than the sun's heat at its surface. If the heat be electric, how great is the wonder: How is this electricity maintained, if, according to a later theory, the heat is derived from perpetual combustion of matter flying into the sun as coal is projected on a furance? What millions of tons must every year be consumed; the heat being dispersed over space so great that the earth's surface, at a distance of 95,000,000 miles, notwithstanding the alteration of night, receives in a year sufficient, if uniformly diffused, to liquefy a crust of ice 100 feet in thickness.