life were secured rather by the institution of the *pheiditia* (public meals) than by special enactments. The possession of gold or silver was interdicted to the citizens of Sparta, and the use of iron money alone was permitted by the Lycurgean legislation. "Even in the cities which had early departed from the Doric customs," says K. O. Müller, "there were frequent and strict prohibitions against expensiveness of female attire, prostitutes alone being wisely excepted." In the Locrian code of Zaleucus citizens were forbidden to drink undiluted wine. The Solonian sumptuary enactments were directed principally against the extravagance of female apparel and dowries of excessive amount; costly banquets also were forbidden, and expensive funeral solemnities. The Pythagoreans in Magna Græcia not only protested against the luxury of their time but encouraged legislation with a view to restraining it.

At Rome the system of sumptuary edicts and enactments was largely developed, whilst the objects of such legislation were concurrently sought to be attained through the exercise of the censorial power. The code of the Twelve Tables contained provisions limiting the expenditure on funerals. The most important sumptuary laws of the Roman commonwealth were those which follow. (1) The Oppian law, 215 B.C., provided that no woman should possess more than half an ounce of gold, or wear a dress of different colours, or ride in a carriage in the city or within a mile of it except on occasions of public religious ceremonies. This law, which had been partly dictated by the financial necessities of the conflict with Hannibal, was repealed twenty years later, against the advice of Cato. Livy (xxxiv. 1-8) gives an interesting account of the commotion excited by the proposal of the repeal, and of the exertions of the Roman women against the law, which almost amounted to a female *émeute*. (2) The Orchian law, 187 B.C., limited the number of guests at entertainments. An attempt being made to repeal this law, Cato offered strong opposition and delivered a speech on the subject, of which some fragments have been preserved. (3) The Fannian law, 161 B.C., limited the sums to be spent on entertainments; it provided amongst other things that no fowl should be served but a single hen, and that not fattened. (4) The Didian law, 143 B.C., extended to the whole of Italy the provisions of the Fannian law, and made the guests as well as the givers of entertainments at which the law was violated liable to the penalties. After a considerable interval, Sulla anew directed legislation against the luxury of the table and also limited the cost of funerals and of sepulchral monuments. We are told that he violated his own law as to funerals when burying his wife Metella, and also his law on entertainments when seeking to forget his grief for her loss in extravagant drinking and feasting (Plut., *Sull.*, 35). Julius Cæsar, in the capacity of *præfectus moribus*, after the African war re-enacted some of the sumptuary laws which had fallen into neglect; Cicero implies (*Ep. ad Att.*, xiii. 7) that in Cæsar's absence his legislation of this kind was not attended to. Suetonius tells us that Cæsar had officers stationed in the market-places to seize such provisions as were forbidden by law, and sent lictors and soldiers to feasts to remove all illegal eatables (*Jul.*, 43). Augustus fixed anew the expense to be incurred in entertainments on ordinary and festal days. Tiberius also sought to check inordinate expense on banquets, and a decree of the senate was passed in his reign forbidding the use of gold vases except in sacred rites, and prohibiting the wearing of silk garments by men. But it appears from Tacitus (*Ann.*, iii. 5, where a speech is put into his mouth very much in the spirit of Horace's "Quid leges sine moribus Vanæ proficiunt?"), that he looked more to the improvement of manners than to direct legislative action for the restriction of luxury. Suetonius mentions some regulations made by Nero, and we hear of further legislation of this kind by Hadrian and later emperors. In the time of Tertullian the sumptuary laws appear to have been things of the past (*Apol.*, c. vi.).

In modern times the first important sumptuary legislation was—in Italy that of Frederick II.; in Aragon that of James I., in 1234; in France that of Philip IV.; in England that of Edward II. and Edward III. In 1294 Philip IV. made provisions as to the dress and the table expenditure of the several orders of men in his kingdom, the most remarkable of which may be seen in Guizot's *Civilisation en France*, leç. 15. Charles V. of France forbade the use of long-pointed shoes, a fashion against which popes and councils had protested in vain. Under later kings the use of gold and silver embroidery, silk stuffs, and fine linen wares was restricted,—at first moral and afterwards economic motives being put forward, the latter especially from the rise of the mercantile theory. In England we hear much from the writers of the 14th century of the extravagance of dress at that period. They remark both on the great splendour and expensiveness of the apparel of the higher orders and on the fantastic and deforming fashions adopted by persons of all ranks. The parliament held at Westminster in 1363 made laws (37 Edw. III. c. 8-14) to restrain this undue expenditure and to regulate the dress of the several classes of the people. These statutes were repealed in the following year, but similar ones were passed again in the same reign. They seem, however, to have had little effect, for in the reign of Richard II. the same excesses prevailed, apparently in a still greater degree. Another statute was passed in the year 1463 (3 Edw. IV. c. 5) for the regulation of the dress of persons of all ranks. In this it was stated that "the commons of the realm, as well men as women, wear excessive and inordinate apparel to the great displeasure of God, the enriching of strange realms, and the destruction of this realm." An Act of 1444 had previously regulated the clothing, when it formed a part of the wages, of servants employed in husbandry; a bailiff or overseer was to have an allowance of 5s. a year for his clothing, a hind or principal servant 4s., and an ordinary servant 3s. 4d.,—sums equivalent respectively to 50s., 40s., and 33s. 4d. of our money (Henry). Already in the reign of Edward II. a proclamation had been issued against the "outrageous and excessive multitude of meats and dishes which the great men of the kingdom had used, and still used, in their castles," as well as "persons of inferior rank imitating their example, beyond what their stations required and their circumstances could afford"; and the rule was laid down that the great men should have but two courses of flesh meat served up to their tables, and on fish days two courses of fish, each course consisting of but two kinds. In 1363, at the same time when costumes were regulated, it was enacted that the servants of gentlemen, merchants, and artificers should have only one meal of flesh or fish in the day, and that their other food should consist of milk, butter, and cheese. Similar Acts to those above mentioned were passed in Scotland also. In 1433 (temp. James I.), by an Act of a parliament which sat at Perth, the manner of living of all orders in Scotland was prescribed, and in particular the use of pies and baked meats, which had been only lately introduced into the country, was forbidden to all under the rank of baron. In 1457 (temp. James II.) an Act was passed against "sumptuous cleithing." A Scottish sumptuary law of 1621 was the last of the kind in Great Britain.

Ferguson and others have pointed out that "luxury" is a term of relative import and that all luxuries do not deserve to be discouraged. Roscher has called attention to the fact that the nature of the prevalent luxury changes with the stage of social development. He endeavours to show that there are three periods in the history of luxury,—one in which it is coarse and profuse; a second in which it aims mainly at comfort and elegance; and a third, proper to periods of decadence, in which it is perverted to vicious and unnatural ends. The second of these began, in modern times, with the emergence of the Western nations from the mediæval period, and in the ancient communities at epochs of similar transition. Roscher holds that the sumptuary legislation which regularly appears at the opening of this stage was then useful as promoting the reformation of habits. He remarks that the contemporary formation of strong Governments, disposed from the consciousness of their strength to interfere with the lives of their subjects, tended to encourage such legislation, as did also the jealousy felt by the hitherto dominant ranks of the rising wealth of the citizen classes, who are apt to imitate the conduct of their superiors. It is certainly desirable that habits of wasteful expenditure and frequent and wanton changes of fashion should be discouraged. But such action belongs more properly to the spiritual than to the temporal power. In ancient, especially Roman, life, when there was a confusion of the two powers in the state system, sumptuary legislation was more natural than in the modern world, in which those powers have been in general really, though imperfectly, separated. How far regulation of this kind could, and might usefully, be carried out by a spiritual power under purely moral sanctions, and whether and to what extent social offices, private as well as public, should be discriminated by costume, are questions which need not be discussed at present. Political economists are practically unanimous in their reprobation of the policy of legislative compulsion in these matters. In a well-known passage Adam Smith protests against the "impertinence and presumption of kings and ministers in pretending to watch over the economy of private people and to restrain their expense, being themselves always and without any exception the greatest spendthrifts in the society." Yet he does not seem to have been averse to all attempts to influence through taxation the expenditure of the humbler classes. The modern taxes on carriages, coats of arms, hair-powder, playing-cards, &c., ought perhaps not to be regarded as resting on the principle of sumptuary laws, but only as means of proportioning taxation to the capacity of bearing the burden.

The *loci classici* on Roman sumptuary laws are Gellius, *Noctes Atticæ*, ii. 24, and Macrobius, *Saturn.*, iii. 17. On the similar English legislation Henry's *History of Great Britain* may usefully be consulted. One of the best extant treatments of the whole subject is that by Roscher, in his essay *Ueber den Luxus*, republished in his *Ansichten der Volkswirthschaft aus dem geschichtlichen Standpunkte* (3d ed., 1878). (J. K. I.)

SUMY, a district town of Little Russia, in the government of Kharkoff, situated 125 miles to the north-west of the chief town of the government, was founded in 1652 by Little Russian Cossacks. It is poorly built, chiefly of wood, but is an important centre for the trade of Great Russia with Little Russia,—cattle and corn being sent to the north in exchange for various kinds of manufactured and grocery wares. It has a classical pro-gymnasium and a technical school. Its inhabitants, who numbered 16,030 in 1884, are engaged in commerce, in various kinds of petty trades, and in agriculture.

SUN. In the article ASTRONOMY (vol. ii. p. 768 *sq.*) the sun has been considered as a member of the solar system, and references are given to various discoveries which have been made from time to time relating to its physical and chemical constitution. In the present article we propose to consider the sun as a star, and to state as briefly as may be the views at present held regarding its structure, and subsequently to refer to the most recent observations dealing with the physics and chemistry of the various phenomena which are open to our study.

The sun as ordinarily visible to us, bounded by the photosphere, is only a small part of the real sun: from observations made during eclipses it is now known that outside the photosphere are—first, an envelope, namely the chromosphere, which is mainly composed of hydrogen, and outside this another envelope, called the corona, while there is evidence that outside these, and especially along the plane of the sun's equator, there is a considerable extension of matter which may or may not be of the same nature as that of which the corona is composed.

These various parts of the solar economy have been examined by the spectroscope, and from this examination two widely divergent views have arisen.

According to the first view, the true atmosphere of the sun is limited by the chromosphere, and the constituents of that atmosphere consist essentially of the vapours of the chemical elements recognized on the earth. It will be seen that on this view the corona and the equatorial extension observed occasionally are merely solar appendages. In the other view the atmosphere of the sun is extended to the confines of the corona, the temperature naturally increasing as we descend; and it is held that towards the photosphere the temperature is so high that the chemical elements are dissociated into finer forms of matter, so that descending vapours get more simple, ascending vapours get more complex, and it is only in the cooler regions of the atmosphere that vapours resembling those of our terrestrial elements can exist, while near the confines of the corona these vapours give place to solid particles and masses. Broadly stated, these divergent views have arisen from the application of two distinct methods of inquiry. In one method, light coming from every portion of the sun, and reflected, let us say, by a cloud into the spectroscope, gives us a spectrum full of absorption lines, and these lines are practically constant from year to year. In the other method, each minute portion of the solar economy has been examined bit by bit, and thus we have the spectrum of the spots, the spectrum of the prominences, the spectrum of the chromosphere, the spectrum of the corona. All these spectra vary enormously, not only among themselves, but from year to year; and, when we consider merely the spots and prominences, we may say that they vary from spot to spot and from prominence to prominence.

It will be obvious that the true mean density of the sun cannot be the same on the two hypotheses to which we have referred. If the atmosphere is practically limited by the photosphere, it has been found that the density of the sun is 1·444, water being taken as unity. If we include the corona in the sun's atmosphere, and assume that its height is half a million of miles above the photosphere, then the volume of the sun is ten times that bounded by the photosphere, and the density is reduced to a tenth of the value given above.

We next proceed to discuss the chemical results obtained by the first method of inquiry to which reference has been made. For these results we are of course dependent upon comparisons of the lines given by various incandescent vapours with the Fraunhofer lines seen in the ordinary spectrum of the sun. If by such means complete evidence is afforded of the existence of one of our chemical elements in the sun, it is obvious that no information is given as to its precise locality; further, if the high temperatures used in our laboratories to produce a spectrum should break up the molecules of the vapours as known to the chemist into finer ones, and if the temperature of the sun were to do the same, there would still be a considerable similarity between the solar and the terrestrial spectrum of any one substance.

The first (A) of the following tables gives the substances present in the sun's atmosphere according to (1) Kirchhoff, and (2) Ångström and Thalén.

TABLE A.

Kirchhoff.	Sodium, Iron, Calcium, Magnesium, Nickel, Barium, Copper, Zinc.
Ångström and Thalén.	Sodium, Iron, Calcium, Magnesium, Nickel, Chromium, Cobalt, Hydrogen, Manganese, Titanium.

A subsequent method of inquiry, which was capable of tracing merely a small quantity, gave the additional substances shown in Table B.

TABLE B.

Elements whose Longest Lines coincide with Fraunhofer Lines.

Certainly coincident.	Aluminium, Strontium, Lead, Cadmium, Cerium, Uranium, Potassium, Vanadium, Palladium. Molybdenum.
Probably coincident.	Indium, Lithium, Rubidium, Cæsium, Bismuth, Tin, Silver, Glucinum. Lanthanum, Yttrium or Erbium.

When we come to bring the chemical evidence together which has been acquired by the examination of separate parts of the solar economy, we find, as has been already hinted, that the apparent similarity in chemical structure suggested by the foregoing tables entirely breaks down. Not only is the chemical nature of each separate solar phenomenon different from that of any other, but the facts of observation are in all cases entirely new and strange, so that very little light is obtained towards the understanding of them from ordinary laboratory work.

We will consider the chemistry of the chief solar features in order.

Chemistry of the Constituent Parts.

Spectra of spots. The spectrum of the spots differs from that of the ordinary surface of the sun chiefly by the widening of certain of the Fraunhofer lines in the spot spectrum,—some being excessively widened. The lines which are most widened change from spot to spot and from year to year. The most extensive sun-spot observations of this nature have been carried on in Kensington, and the conclusions derived from 700 observations on spots between 1879 and 1885 are as follows:—

(1) The spot spectra are very unlike the ordinary spectrum of the sun: some Fraunhofer lines are omitted; new lines appear; and the intensities of the old lines are changed.

(2) Only very few lines, comparatively speaking, of each chemical element, even of those which have many among the Fraunhofer lines, were seen to be most widened. It was as if on a piano only a few notes were played over and over again, always producing a different tune.

(3) An immense variation from spot to spot was observed between the most widened lines seen in the first hundred observations. Change of quality or density will not account for this variation. To investigate this point the individual observations of lines seen in the spectrum of iron were plotted out on strips of paper, and an attempt made to arrange them in order, but without success, for, even when the observations were divided into six groups, about half of them were left outstanding.

(4) If we consider the lines of any one substance, there is as much inversion between them as between the lines of any two metals. By the term "inversion" is meant that of any three lines, A, B, C, we may get A and B without C, A and C without B, B and C without A.

(5) Very few lines are strongly affected at the same time in the same spot, although a great many lines of the same substance may be affected, besides the twelve recorded as most widened on each day.

(6) Many of the lines seen in the spots are visible at low temperatures (some in the oxy-hydrogen flame), and none are brightened or intensified when we pass from the temperature of the electric arc to that of the electric spark.

(7) Certain lines of a substance have indicated rest, while other adjacent lines seen in the spectrum of the same substance in the same field of view have shown change of wave-length.

(8) A large number of the lines seen in spots are common to two or more substances with the dispersion employed.

(9) The lines of iron, cobalt, chromium, manganese, titanium, calcium, and nickel seen in the spectra of spots are usually coincident with lines in the spectra of other metals with the dispersion employed, whilst the lines of tungsten, copper, and zinc seen in spots are not coincident with lines in other spectra.

(10) The lines of iron, manganese, zinc, and titanium most frequently seen in spots are different from those most frequently seen in flames, whilst in cobalt, chromium, and calcium the lines seen in spots are the same as those seen in flames.

(11) Towards the end of the first series of investigations there appeared among the most widened lines a few which are not represented, so far as is known, among the lines seen in the spectra of terrestrial elements. This change took place when there was a marked increase in the solar activity.

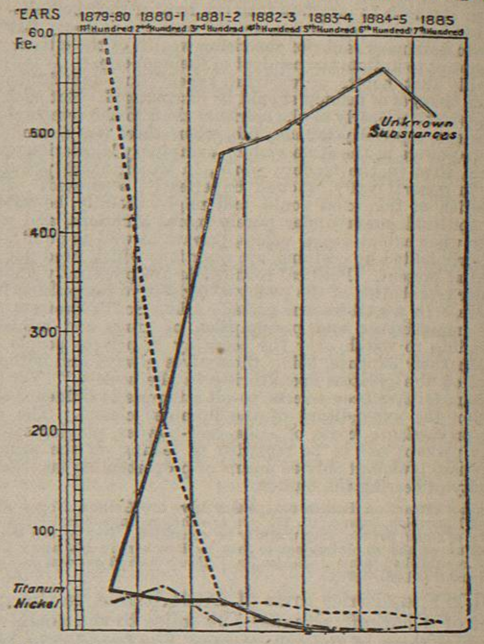
(12) The most widened lines in sun spots change with the sunspot period.

(13) At and slightly after the minimum the lines are chiefly known lines of the various metals.

(14) At and slightly after the maximum the lines are chiefly of unknown origin.

(15) On the hypothesis under discussion the change indicates an increased temperature in the spots at the sun-spot maximum.

The general result is that in passing from minimum to maximum the lines most affected change from those of the ordinary chemical elements to lines whose significance are not known. The accompanying diagram represents graphic-



Most widened lines, F – b region, in sun-spot spectra.

ally the disappearance of the lines of iron, nickel, and titanium and the simultaneous appearance of unknown lines in the spot spectra in passing from minimum to maximum. In the region of the spectrum for which the curves are drawn six lines were recorded in each observation, and therefore 600 in each series of 100 observations. In the curves the vertical ordinates represent not merely the number of individual lines recorded but the number of occurrences of lines of each substance. The dotted curve shows the variation in the frequency of the iron lines; at the minimum in 1879 practically all the 600 lines observed were iron lines; towards the end of 1881 they had dwindled down to 30; and during the three following years they fell to 10. The dot and dash curve shows a similar variation in the nickel lines, and the double line curve that of the titanium lines during the same periods. The continuous curve shows the gradual increase in the number of occurrences of unknown lines in passing from the minimum in 1879 to the maximum in 1884.

The chromosphere when quite quiescent merely gives us a spectrum of hydrogen together with a line in the yellow, which, from its proximity to D_1 and D_2, is called D_3. The chromosphere is disturbed in two ways,—first, by prominences, of which more hereafter, and second, by the formation gradually and peacefully of domes, which are of no great height but sometimes extend over large areas and last for weeks. These last-named phenomena have been termed "wellings up," the idea being that they were produced by the gradual uprise of vapours from below; but it is clear that the same phenomena might be

produced by the very slow descent of matter from above. The spectrum of these higher portions of the chromosphere, whether produced from below or above, is more complicated than the ordinary one. The following table (C) gives the principal lines which have been recorded up to 1887:—

1869.	Hydrogen D_3	All lines.				
	1474 (5315·9)	Unknown.				
	b^1 b^2 b^4	Magnesium,	3	out of	7	(Thalén).
	b^3	Nickel,	1	,,	34	
	D_1 D	Sodium,	2	,,	8	
	4933·4 4899·3	Barium,	2	,,	26	
	4923·1 5017·6	Iron,	2	,,	460	(Ångström).
	5275 5233·6 5179·9 4921·3 5014·8 bright	Unknown.				
After 1869.	f4471 4924·5 B—C B—a	Unknown.				
	5019	Titanium,	1	out of	201	(Thalén).
	H K	Calcium,	2	,,	74	

The first new line in this table is called in spectroscopic language 1474, because when this work was begun the only maps available were those made by Professor Kirchhoff, and this particular line fell at 1474 on his scale. Since then these artificial scales have been discarded in favour of the natural one, which is given by the wave-lengths of light of different colours. In this the reference number of the same line is 5315·9, which represents the wave-length in ten-millionths of a millimètre of that particular quality of light. After this we observe three lines of magnesium, only 3 out of 7; next a line of nickel, one only, however, out of 34; then two lines of sodium, although we might naturally expect to get all the 8 lines; then two lines of barium out of 26; and so on. Almost all the other lines have origins which are absolutely unknown: that is to say, we never get them in our terrestrial laboratories, and never, therefore, are able to match the bright lines in the chromosphere of the sun with any chemical substance. In 1871 the sun was more active, and this activity resulted in the addition of new lines, all, however, absolutely unknown to us, except one, which represents a line in the spectrum of titanium; but in that case we get one line out of 201 in exactly the same way as we get two only of iron out of 460. It is most important to note that practically none of the lines shown in table C are among those which are widened in spots.

Prominences. The prominences are of two kinds—those which are relatively quiet and give almost exclusively the lines of hydrogen and those in which the motions are as a rule very violent. The spectrum of the latter class generally includes a large number of metallic lines; hence they are generally called metallic prominences. The first stage of metallic prominence is usually the appearance of three lines of the following wave-lengths—4943, 5031, 5315·9. As the prominence increases in magnitude and violence other lines are added, until at times the spectrum seems full of lines. The rate of uprush of these prominences sometimes reaches 250 miles per second, or nearly a million miles an hour,—figures which convey an idea of the enormous energies involved. The lines seen in these prominences, although many are present in the spectra of the metallic elements, appear with greatly changed intensities: the lines seen brightest in the prominences are frequently dim lines in the terrestrial spectrum. Again it may be remarked that these are not the lines which are most widened in spots. In the case of the spectrum of any one substance the number of lines seen usually in the prominences is very small.

The general conclusions which have been derived from a discussion of the prominence observations made by Profs. Tacchini and Riccò, in connexion with the sun-spot observations already mentioned, are as follows.

(1) The chromospheric and prominence spectrum of any one substance, except in the case of hydrogen, is unlike the ordinary spectrum of the substance. For instance, we get two lines of iron out of 460.

(2) There are inversions of lines in the same elements in the prominences, as there are inversions in the spots: in certain prominences we see certain lines of a substance without others; in certain other prominences we see the other lines without the first.

(3) Very few lines are strongly affected at once, as a rule, and a very small proportion altogether,—smaller than in the case of spots.

(4) The prominences are less subject to sudden changes than spots, so far as lines of the same element are concerned.

(5) There is a change in the lines affected according to the sun's spot period.

(6) The lines of a substance seen in the prominences are those which in our laboratories become considerably brightened when we change the arc spectrum for the spark spectrum.

(7) None of the iron lines ordinarily visible in prominences are seen at the temperature of the oxy-hydrogen flame. Some of the oxy-hydrogen flame lines are seen in the spots, but none have ever been seen in the prominences.

(8) A relatively large number of the lines ordinarily seen are of unknown origin.

(9) Many of the lines seen are not ordinarily seen amongst the Fraunhofer lines. Some are bright lines.

(10) As in the spots the H and K lines of calcium in the ultra-violet are always bright in the spot spectrum, the other lines of calcium and the other substances being darkened and widened, so it would appear that the lines H and K of calcium are always bright in the prominences in which the other lines are generally unaffected.

(11) Many of the lines are common to two or more elements with the dispersion which has been employed.

The spectrum of the inner corona indicates that it is chiefly composed of hydrogen. All the hydrogen lines are seen in it, and up to a certain height the H and K lines of calcium, proving the presence either of calcium or of something that exists in calcium which we cannot get at in our temperature.

In the outer corona most of the hydrogen lines disappear; but one, the green line F, remains for a considerable height side by side with the 1474 line, indicating, as far as we can see where everything is so doubtful, that the constituents of the outer corona consist most probably of hydrogen in a cool form and the unknown stuff which gives the 1474 line. We also know that the outer corona contains particles which reflect the ordinary sunlight to us, because in 1871 Dr Janssen, and in 1878 Professor Barker and others, saw the dark Fraunhofer lines in the spectrum of the corona. We must imagine, therefore, that some part of that spectrum depends for its existence on solid particles which not only give a spectrum like that of the lime-light but have the faculty of reflecting to us the light of the underlying photosphere. It was also put beyond all question in the eclipse of 1882 in Egypt that this corona has another spectrum of its own. There are bright bands in the spectrum, showing that with these additions it is not a truly continuous spectrum like that of the lime-light, and that its origin is therefore in all probability very complex.

Association and Distribution of Phenomena.

Observations of prominences, spots, and other phenomena which require continuous investigation have been carefully made from day to day for several years, and one conclusion arrived at is that when and where the (disturbed) spots are at the maximum the faculæ and metallic prominences are also at the maximum. When the maximum changes from north to south latitude in the spots it also changes from north to south in the metallic