the mean wave-length of the iron lines in the light reflected from Venus is

quite appreciably smaller when the angle Venus-Sun-Earth exceeds 90 degrees. At 45 degrees the sun-arc displacements are nearly the same as in ordinary sunlight, but there is a progressive diminution of wave-length as Venus passes round toward superior conjunction; and those lines which ordinarily show larger displacements toward the red than the average diminish in wave-length more than those lines which show smaller displacements. The September series, taken from a hemisphere of the sun turned 135 degrees from the Earth, show a shift to the *violet* of the solar Fe lines.

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Whether we like it or not it seems necessary to admit that the Earth does affect the Sun, causing a movement of gases analogous to that taking place in a comet. Is it possible that this action controls to some extent the distribution of sun spots and prominences, which seem also to betray an earth influence?

It has long been suspected that the occurrence of sun spots is influenced in some way by planetary configurations, though the small gravitational influence of the planets upon the sun seemed to make such an influence improbable. In *Philosophical Transactions* of 1869 and 1870 and in *Philosophical Magazine* of 1870, De La Rue, Stewart and Loewy give data for every day for a long term of years on the portion of the visible hemisphere of the sun which was covered with spots. These records are from solar photographs which were made at Kew and were all carefully measured. In addition to their own records they used the most reliable records back to 1832. They give the variation in millionths of the sun's visible surface from the mean spottedness for the period of the investigation, the plus sign indicating an excess and the minus sign a deficiency of spottedness as compared with the mean.

They then relate these data to planetary configurations, and give a table showing the relative spottedness of the sun for each 30 degrees of the orbit of Mercury, starting at perihelion, and for each 30 degrees of separation of Jupiter and Venus, Jupiter and Mercury, Venus and Mercury and Jupiter and Mars. The earth was not included in this comparison. In the following table their data are tabulated by combining the two sets taken when the planets are at the same angular distance on opposite sides of their conjunction, and in the case of Mercury, when the planet is at the same angular distance from perihelion on opposite sides of its orbit.

TABLE I

PLANETARY CONFIGURATIONS AND SUN SPOTTEDNESS

Angular separation	Jupiter and Venus	Venus and Mercury	Mercury and perihelion	Mars and Jupiter
0– 30	+1107	+1979	+103	−136
30– 60	+ 210	+ 89	+ 47	− 76
60– 90	− 191	− 718	+ 74	−220
90–120	− 421	− 962	− 90	−369
120–150	− 728	− 885	−389	−348
150–180	− 826	−1042	−773	−453

The data given in Table I seem to show conclusively two facts concerning the influence of planetary configuration upon sun spottedness. They show, in the first place, that the spottedness of the sun *is* affected by the relative positions of some of the planets, and, in the second place, that the planetary effects are not due to gravitational tides; for the tide-raising influence of two planets would be combined both at conjunction and at opposition, while their resultant influence would be at a minimum when their angular separation was 90 degrees. On the other hand, if the planetary influence is of the nature of electrostatic induction the resultant effect of two planets will be a maximum when they are in conjunction and a minimum when they are in opposition, as is seen to be the case.

The comparison of Jupiter-Venus with Mercury-Venus indicates that Mercury is more effective than Jupiter in the production of sun spots. Since the electric potentials of the different planets are not known, it is impossible to compute their relative inductional effects upon the sun. If we assume them to be charged to the same potential, their separating effect upon the sun's charge will be as follows, calling that of the earth 1: Mercury, 6:5; Venus, 2.6; Earth, 1; Mars, 0.16; Jupiter, 0.08. This leads us to suspect that the three inner planets are the ones most influential in the formation of sun spots.

The relation of planetary configurations to the periodicity of sun spots deserves more consideration than can be given it in this paper.

Since it is now possible to detect cyclonic disturbances upon the sun which are not sufficiently intense to produce visible spots, perhaps a test of the theory here set forth might be made by observing whether the region of the sun opposite to the planet Mercury is especially susceptible to cyclonic disturbances.

FERNANDO SANFORD

PALO ALTO, CAL.

EXPERIMENTS WITH BACTERIAL FILTERS AND FILTERABLE VIRUSES

WE have come to divide bacteria and viruses into filterable and non-filterable, and we have come to think that those organisms, visible or invisible, which are smaller than the pores of our filter are filterable. That size, however, can not be the sole criterion we

have known from the behavior of certain aniline dyes. Thus Victoria blue, a basic dye, will not pass a Berkefeld filter while Congo red, an acid dye, will readily pass through the same filter. Now it happens that the filters which we use in bacteriologic practice, namely, sand, porcelain and diatomaceous earth, are all of them some form or compound of silicic acid, so that really when one speaks of a filterable organism, dye or other colloid, one ought to say filterable through siliceous filters.

One may speak of a filter when it is in action as a suspension of the material of which the filter is composed, in the fluid which is being filtered. Now silica has a definite negative charge and it may be that if one constructs a filter of a material of charge opposite to that of silica, one might find that bacteria or colloids which are filterable through silica filters are non-filterable through such other filters, and *vice versa.*

Accordingly, filters were made of plaster of Paris and experiments with various dyes and viruses were made. Thus Victoria blue which does not pass a Berkefeld or siliceous filter readily passes through a filter made of plaster of Paris; while Congo red, which readily passes through the Berkefeld filter, does not pass through a plaster of Paris filter. If, however, we make a dilute solution of Congo red and render it very slightly acid, thereby changing the color to blue, we find that the blue dye does not pass through the Berkefeld filter but does pass through the plaster of Paris filter. In other words, by reversing the electrical charge one has reversed the filterability.

Acid and basic dyes should be used to test filters. In this work, any Berkefeld filter which does not completely remove Victoria blue from the solution is rejected. The gypsum filter is tested with Congo red.

Now when we came to consider the nature of plaster of Paris a very interesting phenomenon was found. Plaster of Paris is supposed to be calcium sulfate, but when filters were made of calcined chemically pure calcium sulfate, it was found that such filters had no action on any of the colloid dyes used. Both Victoria blue and Congo red readily passed through such filters. Calcium sulfate is neutral and without charge. Then it was found that the plaster of Paris of commerce contains up to 5 per cent. of calcium carbonate, and when calcium carbonate was added to our chemically pure calcium sulphate and filters made from this mixture, such filters acted as did the filters made of commercial plaster of Paris. The calcium carbonate is alkaline and has a positive electrical charge. It is probable that the calcium sulphate in our filters acts as a binder for the calcium carbonate and that it is the calcium carbonate which is the active adsorbing component of our filter.

It was thought that, if a filter was made of plaster of Paris and silica or diatomaceous earth intimately mixed before setting, we might produce a filter which would remove both positively and negatively charged dyes and colloids. When this was done, however, it was found that such filters were neutral and that neither category was filtered out. Evidently the calcium carbonate and silica neutralized each other. If, however, the filter was made so that the core was a Berkefeld filter with a cortex of plaster of Paris poured over this, so that the contact of materials was only at the joint surface, then it was found that dyes, viruses and colloids of both positive and negative charge could be removed by filtration through this apparatus. The outer layer when made of plaster of Paris removed the acid or negative particles, and the inner or siliceous core removed the basic or positive particles.

It was found that one could increase the efficiency of the basic or gypsum filter by incorporating in the plaster of Paris up to 25 per cent. of magnesium oxide, calcined at 1300° C.

Experiments were made with so-called filterable microorganisms and viruses which were available and the following all failed to pass the gypsum filter: The bacteriophage of *Staphylococcus aureus,* the *Vibric percolans* of Stuart Mudd, mosaic disease of tobacco, vaccine virus and the virus of rabies.

It was also found that one could remove various bacterial toxins by filtration. The following were removed by filtration through the gypsum filter with 25 per cent. magnesium oxide: Diphtheria toxin, botulinus toxin, abrin and tuberculin. Tetanus toxin is unaffected by filtration through any gypsum filter, but, as has long been known, is removed in limited quantities by passing through siliceous filters.

Experiments were also made in filtering with both gypsum and siliceous filters watery infusions of various neurotoxic drugs with the idea of removing, if possible, their neurotoxic components. A large number of such experiments were made, but the details will be given in another communication. However, I wish to say here that both with bacterial toxins and toxic components of various neurotoxic drugs the following rule has held: namely, that all narcotizing toxins and drugs are filtered out with the basic or positively charged filter and the spasm-producing toxins and drugs come out with the siliceous or acid or negatively charged filter. And this makes it strongly probable that the respective nerve cells involved in the production of the above two classes of symptoms have a similar though opposite difference in reaction or charge.

S. P. KRAMER