contain liquids at *c d* without leaking. Into this torricellian vacuum, I passed a piece of camphor, and exposed the arrangement to the sun; having filled the interstice with water, it was found to have crystals on the aphelion side, there being a ring of them as at *ee*, Fig. 19, all round the tube. This fact being observed, the water was poured out and a solution of sulphate of copper and ammonia introduced; on examination it was found, that on the side nearest the sun no crystals were to be seen, but on the other side there was a dense bed of them, extending exactly half way round the tube, and very much resembling the shape of Fig. 20. A yellow liquid, the bichromate of potassa was next introduced, a result to all appearance exactly like the former was again produced, but having observed that the thickness of the media had a very sensible effect, apparently due to their becoming warm, and not casting off their caloric with sufficient rapidity by radiation, I made an alteration in the arrangement, by interposing between the torricellian vacuum and the light, a trough capable of containing the different solutions. This trough being filled with solution of bichromate of potassa, and the ray tested that it could not blacken chloride of silver; in about one hour the tube presented the following appearance:—there were some pretty large crystals which extended round the tube, as at *a* Fig. 21, which, on the aphelion side, suddenly mounted up, forming a kind of hyperbola, on the anterior semi-circumference not a solitary one was to be seen. The trough being now filled with sulphate of copper and ammonia, the arrangement of the crystals was found to be in every respect like the former.

113. Supposing that this result might in some measure depend on the ray having been subjected to reflexion, before passing through the trough, I repeated the trials, when the sun's altitude was small enough to permit the rays to pass without requiring reflexion, yet still the same results were uniformly obtained; so that whether the chemical or the calorific rays were stopped, crystallization took place on the aphelion side of the tube.

114. May it not therefore be, that this attractive force originates wherever the calorific ray impinges on a surface; it does not necessarily follow from the phenomena, that any peculiar class of rays are emitted by the sun, which bring about this action, but if there are such, it is a question of interest to find what is the reason that good conductors of electricity, render their action nugatory.

(TO BE CONTINUED.)

TO THE COMMITTEE ON PUBLICATIONS.

Formulae for the announcement of the principal phases of the Annular Eclipse of the Sun, Sept. 18th, 1838. By E. O. KENDALL. Communicated by SEARS C. WALKER.

GENTLEMEN:

I send you for insertion in the Journal of the Franklin Institute, the following formulæ, computed after the method of Woolhouse, for facilitating the computation of the principal phases of the annular Eclipse of the Sun of September 18th, 1838, for Philadelphia and places not far distant. The part which relates to limits of latitude will be found particularly useful in enabling observers to select convenient places for observation.

$$\begin{aligned} \cos. \alpha'' &= + 1.43404 \\ &- [0.14000] \sin. l \\ &+ [0.04096] \cos. l \cos. (\lambda + 211^{\circ} 16' 5'') \end{aligned}$$

$$\begin{aligned}\cos. \alpha &= + 40.98359 \\ &- [1.57169] \sin. l \\ &+ [1.40297] \cos. l \cos. (\lambda + 230^\circ 45'.5)\end{aligned}$$

$$\begin{aligned}\cos. \alpha'' &= + 1.59753 \\ &- [0.18039] \sin. l \\ &+ [9.94995] \cos. l \cos. (\lambda + 248^\circ 12'.5)\end{aligned}$$

$$\begin{aligned}t_{//} &= + 9^h 26^m 52^s.5 \\ &- [3.70767] \sin. \alpha_{//} \\ &- [3.74730] \sin. l \\ &- [3.84836] \cos. l \cos. (\lambda + 216^\circ 42'.6)\end{aligned}$$

$$\begin{aligned}t_i &= + 9^h 0^m 55^s.4 \\ &- [2.25147] \sin. \\ &- [3.65312] \sin. l \\ &- [3.82359] \cos. l \cos. (\lambda + 235^\circ 48'.9)\end{aligned}$$

$$\begin{aligned}t &= + 9^h 0^m 55^s.4 \\ &- [-\infty] \\ &- [3.65312] \sin. l \\ &- [3.82359] \cos. l \cos. (\lambda + 235^\circ 48'.9)\end{aligned}$$

$$\begin{aligned}t' &= + 9^h 0^m 55^s.4 \\ &+ [2.25147] \sin. \\ &- [3.65312] \sin. l \\ &- [3.82359] \cos. l \cos. (\lambda + 235^\circ 48'.9)\end{aligned}$$

$$\begin{aligned}t'' &= + 8^h 56^m 7^s.9 \\ &+ [3.61381] \sin. \alpha'' \\ &- [3.56251] \sin. l \\ &- [3.79452] \cos. l \cos. (\lambda + 252^\circ 56'.2)\end{aligned}$$

$$\begin{aligned}\cos. (N+l_i) &= - [0.22011] \sec. (\lambda + 230^\circ 45'.5) \cos. N \\ \cos. (N+l^\circ) &= - [0.20964] \sec. (\lambda + 230^\circ 45'.5) \cos. N \\ \cos. (N+l') &= - [0.19891] \sec. (\lambda + 230^\circ 45'.5) \cos. N\end{aligned}$$

$$\begin{aligned}\tan. N &= + [0.16872] \sec. (\lambda + 230^\circ 45'.5) \\ L &= + [1.85612] \cos. \alpha\end{aligned}$$

Where

$t_{//}$ = Greenwich mean time of beginning.

t_i = " " formation of the Ring.

t = " " nearest approach of Centres.

t' = " " rupture of the Ring.

t'' = " " end.

λ = Longitude from Greenwich + East, — West.

l = Geocentric latitude of place of observation.

l_i = " " Northern limit of the annular eclipse for longitude λ .

l° = Geocentric latitude of central eclipse for longitude λ .

l' = " " Southern limit of the annular eclipse for longitude λ .

L = least distance of centres in seconds of arc of great circle.

l , l° and l' may be reduced to geographical latitudes by adding the angle of the vertical, which is $11'$ nearly.

These equations have been computed for Philadelphia, for which place only they are rigorously correct. The sum of the Semi-diameters has been diminished $5''$ for irradiation.

If we assume $6''$, as the probable error in the difference of the sun's and moon's declination taken from the Nautical Almanac, we shall have 30 geographical miles, nearly, as the probable error in the limits of latitude resulting from the above formulæ.

The following table contains the times of the principal phases, correct for Philadelphia, and approximate for several other places, with the limits for the annular phase expressed in geographical latitudes.

	Baltimore.	Harrisburg.	Haverford.
Geographical latitude,	$39^{\circ} 17' 13''$	$40^{\circ} 16'$	$40^{\circ} 1' 12''$
Longitude from Greenwich,	$76 37 50$	$76 50$	$75 19 0$
Beginning, mean time,	$3h 6m 36s.2$	$3h 3m 24s.0$	$3h 11m 35s.5$
Formation of Ring, mean time,	$4 24 44.0$	$4 21 54.2$	$4 29 33.3$
Nearest approach, “	$4 27 38.8$	$4 24 36.7$	$4 31 59.6$
Least distance of centres,	$14''4$	$29''7$	$41''1$
Rupture of the Ring, mean time,	$4h 30m 33s.6$	$4h 27m 19s.2$	$4h 34m 25s.9$
End, “	$5 40 4.4$	$5 37 16.8$	$5 43 56.9$
N. limit of ann. phase for this long.	$42^{\circ} 43' 12''$	$42^{\circ} 51' 42''$	$41^{\circ} 52' 12''$
Lat. of central eclipse “	$38 30 42$	$38 37 48$	$37 46 42$
S. limit of ann. phase “	$35 0 18$	$35 6 54$	$34 20 54$

	New York.	Philadelphia.	Washington.
Geographical latitude,	$40^{\circ} 42' 40''$	$39^{\circ} 56' 59''$	$38^{\circ} 52' 54''$
Longitude from Greenwich,	$74 1 8$	$75 10 59$	$77 1 48$
Beginning, mean time,	$31h 6m 34s.1$	$3h 12m 25s.4$	$3h 5m 28s.4$
Formation of the Ring, mean time,	$4 35 5.3$	$4 30 18.7$	$4 23 43.7$
Nearest approach, “	$4 36 17.9$	$4 32 44.7$	$4 25 42.0$
Least distance of Centres,	$65''6$	$41''3$	$2''5$
Rupture of the Ring, mean time,	$4h 37m 30s.5$	$4h 35m 10s.7$	$4h 29m 40s.3$
End, “	$5 47 47.7$	$5 44 38.0$	$5 39 14.5$
N. limit of ann. phase for this long.	$41^{\circ} 5' 24''$	$41^{\circ} 47' 6''$	$42^{\circ} 59' 24''$
Lat. of Central Eclipse, “	$37 6 30$	$37 42 24$	$38 44 24$
S. limit of ann. phase, “	$33 45 6$	$34 16 0$	$35 12 48$

Franklin Institute.

Quarterly Meeting.

The Fifty-fourth Quarterly Meeting of the Institute was held at their hall on Thursday, July 20th, 1837.

MR. JOSEPH M. TRUMAN, was called to the Chair.

ISAAC B. GARRIGUES, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations of Books were received from:

The Hon. Secretary of War U. S., Washington City, D. C.—the Institute of Civil Engineers—the Royal Society—Zoological Society—Society for the encouragement of Arts, Manufactures and Commerce; James D. Forbes, Esqr., and Petty Vaughan, Esq., London; David Stevenson, Esq.,