LI. *Electrical Experiments, made in pursuance of those by Mr.* Canton, *dated* Decem. 3, 1753; *with Explanations by Mr.* Benjamin Franklin, *Communicated Mr.* Peter Collinson, *F. R. S.*

Philadelphia, March 14, 1755.

Principles.

Read Dec. 18, 1755.

I. Electric atmospheres, that flow round non-electric bodies, being brought near each other, do not readily mix and unite into one atmosphere, but remain separate, and repel each other.

This is plainly seen in suspended cork balls, and other bodies electrified.

II. An electric atmosphere not only repels another electric atmosphere, but will also repel the electric matter contained in the substance of a body approaching it; and without joining or mixing with it, force it to other parts of the body, that contained it.

This is shewn by some of the following experiments.

III. Bodies electrified negatively, or deprived of their natural quantity of electricity, repel each other, (or at least appear to do so, by a mutual receding) as as well as those electrified positively, or which have electric atmospheres.

This is shewn by applying the negatively charged wire of a phial to two cork balls, suspended by silk threads, and by many other experiments.

Prepa-

Preparation.

Fix a taſſel of 15 or 20 threads, 3 inches long, at one end of a tin prime conductor; (mine is about 5 feet long, and 4 inches diameter), ſupported by ſilk lines.

Let the threads be a little damp, but not wet.

Experiment I.

Paſs an excited glaſs tube near the other end of the prime conductor, ſo as to give it ſome ſparks, and the threads will diverge.

Becauſe each thread, as well as the prime conductor, has acquired an elaſtic atmoſphere, which repels, and is repelled by, the atmoſpheres of the other threads: if thoſe ſeveral atmoſpheres would readily mix, the threads might unite, and hang in the middle of one atmoſphere, common to them all.

Rub the tube afreſh, and approach the prime conductor therewith, croſsways, near that end, but nigh enough to give ſparks; and the threads will diverge a little more.

Becauſe the atmoſphere of the prime conductor is preſſed by the atmoſphere of the excited tube, and driven towards the end where the threads are, by which each thread acquires more atmoſphere.

Withdraw the tube, and they will cloſe as much.

They cloſe as much, and no more, becauſe the atmoſphere of the glaſs tube, not having mix'd with the atmoſphere of the prime conductor, is withdrawn intire,

intire, having made no addition to, or diminution from, it.

Bring the excited tube under the tuft of threads, and they will cloſe a little.

They cloſe, becauſe the atmoſphere of the glaſs tube repels their atmoſpheres, and drives part of them back on the prime conductor.

Withdraw it, and they will diverge as much.

For the portion of atmoſphere, which they had loſt, returns to them again.

Experiment II.

Excite the glaſs tube, and approach the prime conductor with it, holding it acroſs near the oppoſite end, to that on which the threads hang, at the diſtance of 5 or 6 inches. Keep it there a few ſeconds, and the threads of the taſſels will diverge. Withdraw it, and they will cloſe.

They diverge, becauſe they have received electric atmoſpheres from the electric matter before contained in the ſubſtance of the prime conductor; but which is now repelled and driven away, by the atmoſphere of the glaſs tube, from the parts of the prime conductor, oppoſite and neareſt to that atmoſphere, and forced out upon the ſurface of the prime conductor at its other end, and upon the threads hanging thereto. Were it any part of the atmoſphere of the glaſs tube, that flowed over and along the prime conductor to the threads, and gave them atmoſpheres (as in the caſe when a ſpark is given to the prime conductor, from the glaſs tube), ſuch part of the tube's

tube's atmoſphere would have remained, and the threads continue to diverge; but they cloſe on withdrawing the tube, becauſe the tube takes with it *all its own Atmoſphere*, and the electric matter, which had been driven out of the ſubſtance of the prime conductor, and formed atmoſpheres round the threads, is thereby permitted to return to its place.

Take a ſpark from the prime conductor, near the threads, when they are diverged as before, and they will cloſe.

For by ſo doing you take away their atmoſpheres, compoſed of the electric matter driven out of the ſubſtance of the prime conductor, as aforeſaid, by the repellency of the atmoſphere of the glaſs tube. By taking this ſpark you rob the prime conductor of part of its natural quantity of the electric matter; which part ſo taken is not ſupplied by the glaſs tube, for when that is afterwards withdrawn, it takes with it its whole aſmoſphere, and leaves the prime conductor electriſed negatively, as appears by the next operation.

Then withdraw the tube, and they will open again.

For now the electric matter in the prime conductor, returning to its equilibrium, or equal diffuſion, in all parts of its ſubſtance, and the prime conductor having loſt ſome of its natural quantity, the threads connected with it loſe part of theirs, and ſo are electriſed negatively, and therefore repel each other, by *Pr.* III.

Approach the prime conductor with the tube near the the ſame place as at firſt, and they will cloſe again.

Becauſe

Becauſe the part of their natural quantity of electric fluid, which they had loſt, is now reſtored to them again, by the repulſion of the glaſs tube forcing that fluid to them from other parts of the prime conductor: ſo they are now again in their natural ſtate.

Withdraw it, and they will open again.

For what had been reſtored to them is now taken from them again, flowing back into the prime conductor, and leaving them once more electriſed negatively.

Bring the excited tube under the threads, and they will diverge more.

Becauſe more of their natural quantity is driven from them into the prime conductor, and thereby their negative electricity increaſed.

Experiment III.

The prime conductor not being electrified, bring the excited tube under the taſſel, and the threads will diverge.

Part of their natural quantity is thereby driven out of them into the prime conductor, and they become negatively electriſed, and therefore repel each other.

Keeping the tube in the ſame place with one hand, attempt to touch the threads with the finger of the other hand, and they will recede from the finger.

Becauſe the finger being plunged into the atmoſphere of the glaſs tube, as well as the threads, part of its natural quantity is driven back through the

hand and body, by that atmoſphere, and the finger becomes, as well as the threads, negatively electriſed, and ſo repels, and is repelled by them. To confirm this, hold a ſlender light lock of cotton, two or three inches long, near a prime conductor, that is electrified by a glaſs globe, or tube. You will ſee the cotton ſtretch itſelf out towards the prime conductor. Attempt to touch it with the finger of the other hand, and it will be repelled by the finger. Approach it with a poſitively charged wire of a bottle, and it will fly to the wire. Bring near it a negatively charged wire of a bottle, it will recede from that wire in the ſame manner, that it did from the finger; which demonſtrates the finger to be negatively electriſed, as well as the lock of cotton ſo ſituated.

LII. *Extract of a Letter concerning Electricity, from Mr.* B. Franklin *to Monſ.* Delibard, *incloſed in a Letter to Mr.* Peter Collinſon, *F. R. S.*

Philadelphia, June 29, 1755.

Read Dec. 18, 1755. YOU deſire my opinion of Pere Beccaria's Italian book. I have read it with much pleaſure, and think it one of the beſt pieces on the ſubject, that I have ſeen in any language. Yet as to the article of water-ſpouts, I am not at preſent of his ſentiments; though I muſt own with you, that he has handled it very ingeniouſly. Mr. Collinſon has my opinion of whirlwinds and