

FRAGMENT FROM AN UNPUBLISHED DIALOGUE OF  
GALILEO

Time: Between about 1910 and 1920

by

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SAGREDO: These are very remarkable things, that follow, as you say Sr. Salviati, from the theory of our academician at Leiden and from the various experiments devised to prove it. All the ultimate building stones composing matter are, so you say, electrically charged, and, considering their smallness, quite strongly.

SALVIATI: Indeed this is so. What amazes one most is that the charge is relatively so big. Listen. A minute oil drop, just detectable in the microscope, compares, of course, with an elementary particle as a block of rock with a grain of sand. Still when such an oil drop catches one single elementary particle and its charge, you will see that the droplet at once starts wandering, provided that you have procured to establish an electric field in the chamber in which the droplet is suspended, and if subsequently it catches two or three of these charges, it wanders twice or thrice as quickly.

SIMPLICIO: Whence is it known when it catches a charge?

SALVIATI: Well, just from the fact that it starts wandering or changes its velocity.

SIMPLICIO: Surely you are not serious in this, Sr. Salviati. Is not this the kind of inference which Aristotle has branded as a vicious circle?

SALVIATI: Allow me to interpose a question: When you left us yesterday night and went home, did it rain?

SIMPLICIO: Indeed it did, and you know it. You got wet on the short way to the garden gate, whither you accompanied us.

SALVIATI: And whence knew you that it was raining?

SIMPLICIO: Pardon me, but I am amazed at these naïve questions of yours: of course from the fact that we got drenched.

SALVIATI: So you would say: if it rains, one gets wet?

SIMPLICIO (angrily): Indeed, just so.

SALVIATI: Would not Aristotle have termed this a vicious circle, since we have just stated: the fact that it rains is noticed from the fact that one gets wet.

SAGREDO: Allow me, gentlemen, to return to our subject, which interests me more than your logical controversy. What electric tension would prevail on such a charged elementary particle?

SALVIATI: Well, if you judge of it as in the case of a palpable body, say of a sphere of metal - ie, from the ratio of charge and size - then you compute something like 2,000 electro-static units or, in round terms, half a million volts.

SAGREDO: You frighten me. I know that much smaller electric tension suffices to kill a man.

SALVIATI: When put into practice on a large scale, this might be so. Yet it does depend on the particular case. To touch a live cable of 500 volts may be dangerous. From an insulated sphere of brass, say the size of a football, charged to 50,000 volts, you might with your knuckle draw a long spark - you'd get a shock, but it would do you no harm.

SAGREDO: Are we to understand that all and every matter consists of such highly charged particles? Even the water in the river, even the rain drops?

SIMPLICIO: As regards the latter I am least amazed. Are there not lightning flashes from one cloud to another and from cloud to earth?

SALVIATI: Congratulations, Sr. Simplicio. This time you have contributed a remark that is very much to the point.

SAGREDO: But what about the particles of which our own bodies consist?

SALVIATI: They too, naturally. Why should they make an exception? They too are, if you please, charged to about half a million volts each. What are you up to, Sr. Simplicio? Do you want to strafe me by pinching my nose for having once again dealt a good one to Aristotle? Why pursue you the tip of my nose with the knuckle of your forefinger?

SIMPLICIO: I wanted to chance the half million volts and draw a spark from your nose. But there, there, behold, now I touch it, yet nothing happens. Would you still back up your academician of Leiden?

SAGREDO: Sr. Simplicio's sense of humour has not yet been harmed by his studies in the peripatetic philosophy. This really is a point that will have to be cleared up. But first I should like to hear from you, Sr. Salviati, something more about what you called the porousness or perforatedness of matter. You told us yesterday that the particles themselves are so small compared with the dimensions of the edifices they compose, as atoms, molecules, crystals, that the space ostensibly taken up by the latter is really, to its overwhelming part, completely empty. This, you said, has been proved by

most ingenious experiments of that great natural philosopher at Cantabriga.

SALVIATI: Quite so. He shot swift corpuscles through the atoms and found that the body of the atom is mainly "air" (you know what I mean!). The flying corpuscle is deviated only on the rare occasions when it passes very near to an atomic nucleus. And this nucleus is a 100,000 times smaller than the atom! However, the interstices are not really quite empty. They are the playground of electromagnetic fields, much stronger than any we are able to produce in the laboratory.

SIMPLICIO: Also, I suppose, much stronger than the same fields in the light waves. For did you not tell us the other day, that light too consists of electromagnetic waves - fields of exactly the same kind.

SALVIATI: That is correct. And you are quite right, they too are much, much weaker than those in the interstices.

SIMPLICIO: And being so much weaker, they cannot penetrate the strong fields in the atoms. Am I right?

SALVIATI: No, this is a mistake, indeed a very natural mistake. These fields penetrate each other freely; they are, as it were, non-existent for one another. This may amaze you. However the mathematical description, whose consequences are confirmed in many experiments, leaves no doubt about it. We may enlarge on this point presently. For the moment, take it from me and rely upon it.

SIMPLICIO: All right. Then do me the favour of reading us this paragraph from a book in which I have great confidence (he hands Salviati the opened book and plants himself broadly before the narrow window, plunging the room into darkness).

SAGREDO: Sr. Simplicio, please step aside. How is our friend to read these lines if you - as it were to spite him - prevent the light from entering?

SIMPLICIO: Sr. Sagredo, I cannot understand you. How could poor me bar the light with my skeleton body which, so I understand, is so riddled with holes, that a bare thousand-billionth part of it is Something, while the space in between is occupied by fields completely permeable to the blessed rays of light - so to speak non-existent? If that be so, I fail to understand why my standing in front of the window should prevent Sr. Salviati from reading.