#58S
Formal talk
Lila Recordings
15-11-06 AM
1 Hr 55 min
Recording 58

Y: Have you brought this--your copy of this with you of *Fundamental Physical Constant*s, Atomic?

B: This one or the other one?

Y: Turn to…

B: The other one

Y: Yes, *Atomic and Nuclear Constants*

B: I was working with it this night. Yes.

Y: So I wanted to make sure that you have this value (B acknowledges.) of the tau Compton wavelength, (B acknowledges.) the Perl value by Dr. Perl – P. E. R. L. P. E. R. L. (B acknowledges.) That value is point 6 9 5 0 6 (.69506) times 10 to the minus 15^{th}.

B: OK. Meters

Y: So that's a little shorter wavelength than the one they have which is based on Balest's (Balest, R.) measurements. OK. I just wanted to make sure you had that. (B acknowledges.) OK. You on?

Punita: Yep.

Y: OK. You have been busy overnight.

B: Yes. (Laughs) Drawing pictures, color pictures, because it is chromo dynamics; (Laughs) (P acknowledges.) …but also the symmetries of the particles, baryons and mesons and hadrons and quarks…

Y: My goodness.

B: It's $SU_{(3)}$ symmetry. Shall I start?

Y: Yes. Go right ahead.

B: First of all, I have stated that concluding with the afternoon session, we shall have exactly 100 hours of work, 100 hours, (Y acknowledges.) because we have started 21^{st} of October until 31^{st} of October. It is 11 days plus 15. Today is 15^{th} of November, is 26 times 4 hours a day is 102 hours. But since we had one afternoon free, --remember, one Monday? --it is exactly hundred hours, hundred hours of work which is, I believe, (laughs) a good number. Today with afternoon session …
Y: Well, that's quite a course in Lila Paradigm. (B acknowledges.) (All laugh.)

B: Hundred hours, hundred hours with Lila which is great! Pure beauty! This was one point. Now, second point… Several times we have mentioned, "*Why 2?"* For instance, when you are finding the number N of nonphysical Individuals based on ratio of particles, you use electron particle over muon or… Always we were asking ourselves, "*Why 2? Why 2?"* But the answer is given, the answer "*Why 2?"* (Y acknowledges.) And when we were comparing the value, for instance, of our particle, we multiplied by 2 (Y acknowledges.) in muon and now tau. I'm sure I'll find tau. It's just a matter of hours, maybe, to find it, maybe even today. I'm not sure. The answer is given here in your article, *The Basis of Physics,* with Seeley and Baker. And since Baker has written, 'Why*?*' in his handwriting, (laughs) I believe the answer written here is given either by you or by Seeley. So, on page 22, it is explained. **[Recording time 04:46]**

When you are finding the ratios of the mass of the electron (Y acknowledges.) in proportion of the expectation value of Hicks Fork structure and the other particle you are using (Y acknowledges.) which is muon, I believe, because of the distribution; and you got the right number which is great! …shows that all the underlying patterns used for this calculation are correct. It is written, "The electron expectation value is divided by 2 because one prong **[Recording time 5:20]** is in the circuit."

Y: Yes, that was my suggestion.

B: Aha! Your suggestion! But it is right, I believe, because…

Y: That's what I couldn't…be sure that it was right.

B: I believe it is right because, for instance, when we are…when I am using the procedures for finding the wavelengths based on Baker's consideration, but extended now, I use comparison with the largest circuit with the smaller one. But if… you see, for instance, this is the illustration done for the tau particle. For tau particle, we have fork of four because tau appears on the third recursion which is…for which we have one, two, three, four, prongs of the fork structure, of the bifurcations, four bifurcations. And the arrow which is practically originating a state of direct knowledge of the referent Individual is five. So we have five. But when… This five, this distribution to the prongs of the fork to the bifurcations, are taken into calculation separately. But if one prong is overlapped with the largest circuit, then this is taken into consideration twice, somehow. (D acknowledges.)

Y: Somehow. I'm not sure what that somehow is.

B: Yes. This, somehow…for instance, in terms of mass because you're finding ratios of mass. (Y acknowledges.) In mass…first of all, I'll start from the beginning. We consider rest mass to be resistance to movement; and the movement to be difference or comparison in the consciousness of the referent Individual of perception of space. (Y acknowledges.) And perception of space arises when…because of the present time for all the Individuals...the mechanism for separating the sub-states is perceived by the referent Individual or is reduced in the overall consciousness of the referent Individual as the difference of sub-states. Now I'm talking the movement. (Y acknowledges.) The movement is this difference of sub-states. And when you are taking into account all these sub-states because, first of all, the equation shows that it is a combination of sub-states because we use F of I. (Y acknowledges.) Or you use N **[Recording time 8:36]** of I which is equivalent F of I, and so on, and so on. It is I root, I factorial. And this I factorial is combination of all these prongs of the bifurcations in the fork structures to the N, to the I minus one. (Y acknowledges.) But when we have one prong…

Y: …in the circuit.

B: …in the circuit, then it is taken twice in all this.

Y: Ohhhhhh! Yes. (D laughs.)

B: It is taken twice because when we, for instance, when we present it on a cylinder, we have a basic circuit. Then we have one sub-state which is of one prong of the fork. Then we have another sub-state, another level of the cylinder taking into account that the surface of the cylinder is time; and it is always present time. **[Recording time 9:47]**

Y: Present time

B: Present time. And the separation we… Now the time is frozen; and we are considering the space. Then the second level is fork of two. Then the third level is fork of three. But all these forks, all these bifurcations, are also taken into account, not just once, but n factorial where n is the number of the prongs of the fork. Because on the third level, when you have three forks, three prongs of the fork, three bifurcations, you take into account all the combinations of them as different, as separate sub-states which are later on compared and perceived as consciousness in the overall state of consciousness in the referent Individual. (Y acknowledges.) But you are taking always combinations of them. For instance, if on the third level, we have the sub-state of three bifurcations and let us name these bifurcations A, B, C, you have AB, AC, BC and so on. This is why we have factorial here. But when it is… but then they are always taken twice. **[Recording time 11:24]**

Y: In the formula here, (B acknowledges.) we're only multiplying the numerator twice.

B: Yes, yes. It is a ratio. So this was a point I was making. Maybe it needs more consideration.

Y: Well, the thing that is confusing to me is: Michael, when he was working out N from the Compton wavelength of the electron, (B acknowledges.) he was multiplying by 2.

B: But later on you…but later on you…

Y: I changed it.

B: Yes, but you always multiplied the measured value by 2. (Y acknowledges.) But if at start, we don't use 2, then you won't be obliged, so-to-say, to multiple the measured value by 2. Two is not needed. About the Michael's paper, I want to say something else which will help us later on.

Y: OK. I heard what you said on this.

B: Yes. OK. This is an insight. **[Recording time 13:00]** Maybe it should need more consideration. I'm glad you were aware of it. Now, you remember about the tau particle that I almost get the digits right. (Y acknowledges.) But the dimensionality was not right. But this was… I was not so much full of joy when you have given me the corrected value because it was corrected only in digits, not the dimensionality. But now, but now, I have another insight. And it is so. And I believe it will solve the problem; and we shall have the tau particle. **[Recording time 13:45]**

You remember… I believe in the considerations of Michael that two things should be stressed. First, we work there with relations and not with the agents. And the confusion took place because in his paper, he's presenting the way to find the number of agents. And yes, since you're using the ratio of masses to find the number of agents, why not use Compton's wavelength to find also the number of agents? But the result should be even correct although the thinking might not be correct. What I have in mind, since we have one relation for every Individual…

Y: …in the circuit…

B: …in the circuit. Otherwise, not…otherwise, of course, we have relation *relata*. But in the circuit, the number of relation and *relata* is the same. (Y acknowledges.) And so sometimes, we don't pay attention whether it is the agents we are taking into account or the relations. But it is the relations.

Y: That he did.

B: Yes. (Y acknowledges.) Now what was my point? My point is I want to redo once again Michael's procedure, correct the mistake which was regarding the transformation of Compton's wavelength of the electron from meters to centimeters. (Y acknowledges.) He has done this transformation; and it is needed because Planck length is given – like 1.6 and so on 10 to the minus 33 in centimeters. And at that point, he makes a mistake. And for Compton's wavelength, he takes 1.6 times 10 to the minus 14, (Y acknowledges.) 14 centimeters. But the original value is 1, or 0.6 maybe it was, 6 times to the 10 minus 12 in meters. But now I have a point. This is why I am staying so much at this point. When we transform this into centimeters, it is actually the wavelength times 10 to the minus 10. So the difference is because in the final formula we have N squared…the difference is of the degree 10 to the 4th. And this is the exact difference I had in my tau calculations. **[Recording time 16:59]**

Y: Yes it is.

B: You remember? I had even the digits right. Maybe now I should have some difference. The digit…but it was, according to my calculations… it was 10 the minus 19th meters instead of 10 to the minus 15 meters. But this difference is exactly 10 to the 4th. This is one point.

Another point: When I redo the calculations of Michael to see the exact value, if we correct this mistake in the transformation of dimensions, if we correct this mistake, then we find for N a number – for instance, 1.3 and so on times 10 to the 27. But for the number for the Individuals is 1.38 times 10 to the 23. (Y acknowledges.) The difference is exactly 10 to the 4th. Why is this so? Is the number of the nonphysical Individuals not correct? No, it is correct. But what he is finding is relations – not *relata*. And relations could be greater. The number of relations could be greater than N. **[Recording time 18:24]**

Now my idea was –maybe I'm wrong-- my idea was now to take the corrected value for N, to redo the whole procedure done by Michael because it has very beautiful logic into it. Use the correct value from Compton's wavelength; then take the correct value for N which is multiplied by 10 to the 27. And since, in the final formula for tau, I have N in the numerator, then it will correct my calculations exactly 10 to the degree of 4. It will multiply my value by 10 to the 4th which will give me the degree right. Instead of obtaining 10 to the minus 19th of meters, this multiplied by 10 to the 4th which will be now the corrected value from N from the procedure for the electron, now applied for tau particle. I will have my value which was even close to the one measured, times 10 to the minus 15 meters. At least I will be happy. Then I will have the degree right. And then maybe refinement once again should be done. But at least the degree should be right…

Y: I follow your reasoning.

B: …because just one point. When you are finding the ratios of masses right, (Y acknowledges.) it is OK because you have a ratio and dimensionality is not an issue. When you have ratio, for instance, something given in one dimension – meters, centimeters and so on – over another quantity of same dimension, then dimensions are eliminated. When you have ratio, the dimensionality is not an issue. And this is why you got your calculations right. But maybe, if you take just one rest mass, maybe the difference should show which is the same difference for the upper particle and for the number. Maybe the picture is too simplified. This is why I tried yesterday to introduce vectors, somehow, and some elements of fill theory which, of course, a great job to do but still as a beginning. But still, since you have so beautiful results compared with the measurement, the picture is OK and the reasoning is very beautiful. I believe if I do this, maybe we shall know something.

Y: Yes. Go ahead. And you don't have to finish it while you are here.

B: Yes, because I was very unhappy about this tau particle. And tonight I was working several hours and finally I concluded that this will… At least it will bring me, bring us our degree; and we shall be close. And then some refinements could be done. For instance, not neglect the member we are neglecting, and so on. And actually I'll try to use this formula which is improvised **[Recording time 22:27]** formula when (Y acknowledges.) equalizing the moving through the circuits. First, because the tau particle is the result of the third recursion and it is a fork of five and including this original basic of the fork, we have F of five which you used also in your ratios of masses, and then do the comparison. In one bit, I have X going around the largest circuit multiplied by N relations, relations. Otherwise, we shall have contradictions…

Y: Yes. That's a good point.

B: …which we equalize with X plus one going around the smallest circuit which closes through the circumference of N minus F of five where F of five are the probabilities or expected number for the fork structures to appear. This is like distribution. This is like an information spreading around through the prongs of the fork, through all the bifurcations and somehow closing itself, having in mind the original picture always of how consciousness in the referent Individual is formed by comparison of sub-states. But these are sub-states and then so on. Shall I go once again or not? **[Recording time 24:17]**

Y: OK. I think when you are finished with your calculations, it will all be sorted out. (B acknowledges.)

B: I have the whole thing. I have the whole thing. I just have to… Here, for instance, this is the final formula. Maybe we should go through it once again. This is the final formula…and now, since this is lambda tau… And now, if I for N… I don't have now 1.38 times 10 to the 23. But I'll have 1.38 – not 38, but the number obtained from the previous considerations for an electron based on the Michael's paper. We shall have N will be something times 10 to the 27 because once I checked his paper; and I have seen that according to his, if we take the right wavelength for an electron, we have 10 to the 27. And it will correct the result in…at least the dimension will be right.

And the rest is the same as for the electron. (Y acknowledges.) The rest is the same. We equalize this; we find the number of circulatings around the biggest circuit to be N over F of five minus one which is N minus F of 5**, [Recording time 26:04]** F of 5 for X. This is X.

And now, even 2 shouldn't be used. But just take for one bit, we have X and *tq* (s) which is N minus F of 5 over F of 5 for X multiplied by N *tq* (s).

Y: Well, I think your reasoning is correct in this. (B acknowledges.)

B: And the degree will be correct, (Y acknowledges.) only just refinement. And then tq is Planck time over square of 2N. This is per one bit. This is the number of going arounds of circulatings for one bit. (Y acknowledges.) Yes. I eliminate two because it is not needed. And then in the final result, we shouldn't multiply the measured value by two.

Y: I'm multiplying by two in that one, on the mass. **[Recording time 27:22]**

B: OK. We shall see about the two. Maybe it is the doubling of the fork. Maybe it is still correct. We shall see.

Y: I'm just saying there should be a relationship between the masses and the wavelength.

B: And the wavelength. Yes.

Y: OK.

B: Then the frequency (*f*) which is reciprocal value F5 over N minus F5N times square of 2N which comes from the *tq* Planck time to the minus one. Then lambda *f* is *c*. *c*'s speed of light is one Planck length over *tp*. Now *tp (s)* are eliminated. (Y acknowledges.) And we remain with lambda is one over *f* which is reciprocal value of the frequency of *lp (s)* where *lp* is Planck length. And we have now for lambda tau, N minus F of 5 over F of 5 what was actually our X times N times our *tq* which was *tp* over square of 2N; and *tp(s)* were times *c*. But *c* is *lp* over *tp*. So *tp* and *tp* are eliminated; and we remain just with *lp* which is Planck length because the formula is 1 over *f c*. (Y acknowledges.) *c,* the speed of light, is *lp* over *tp*. (Y acknowledges.) But *tp* and *tp* are eliminated. (Y acknowledges.) We remain with this one. And so we have the final formula.

Y: Your logic is correct.

B: Yes. And we have the final formula. Lambda tau is N squared over F of 5 which is the fork structures 5th root of 120N to the 4th square of 2N *lp*. For *lp,* we take the value 1.6 times 10 to the minus 35, now, meters. Usually it is given in centimeters, 10 to the minus 33, but now… And now I was very unhappy with this degree. But now the degree will be corrected because now for N, and N is in the numerator which I need… In the numerator I have for N now, a number of the degree 10 to the 27 which is the correct number from the considerations for the electron. So I'll have a clear procedure. First, for the electron: Out of the electron, I'll take N, N which is relations now. It was confusing me. How could it be for us to have N of the degree of 10 to the 27? But it is possible because this N is referring to relations to (of) the agents of the circuit, to the arrows, and not to the agents themselves. **[Recording time 30:51]**

Y: Well, that would have to include arrows that are not in the circuit, but are across the circuit.

B: Yes, yes. I am thinking of it. It is when we go through this bifurcation. But then, also I have tried with the small n which is N minus N over *e* to K where we have the **[Recording time 31:34]** small n. So the degree will be…at least the degree shall be in the limits of the right degree for the wavelengths.

Y: I was thinking of that statement about 'one of the arrows of the fork is in the circuit'. And that, in the electrons, there's only three forks. Of one that's in the circuit, there's two across the circuit; whereas, for the muon and the tau particle, they have one in the circuit, three across the circuit. And that may make it why the electron is different by a factor of 2 than it is for the muon and the tau particle…

B: …for which we also have the same situation of the one arrow in…

Y: We have one in, but that still remains for three across the circuit (B acknowledges.) and four across the circuit which means you could have three-dimensional space; whereas, the electron would have two-dimensional space. Just a thought. I'll have to think it through more carefully.

B: Yes, to see exactly.

Y: But, I'm not worried about it. I know even if we don't know the reason that the numbers come out so close, that it's got to be correct.

B: Yes, yes. It couldn't be coincidence.

Y: But I would like to see very neatly done up the mathematics of the approach of the wavelength.

B: Yes. I'll repeat the whole procedure for the electron, clearly. Then take N from there and then apply N in my approach here. And since I have done it several times, I know that now the degree will be right because I have done it. I have done it. I have found N to be 10 to the 27. I have found my number several times to be of the degree of 10 to the minus 19th. But now it will be to the degree of 10 to the minus 15. And for the digits, even the digits were right. Maybe I should check it once again. But we are close. **[Recording time 34:13]**

Y: OK. Let's let that be for now.

B: Yes. Thank you.
Y: OK. Yes. Go onto…

B: Shall we look at this? (She laughs.)

Y: Yes. What is it?

B: Since this is our last sessions, actually including the afternoon session, (Y acknowledges.) I was doing some sort of summary what we should do and what was done…

Y: Where do you get all this information about color dynamics?

B: Aha, yes, in the *Encyclopedia of Britannica*… and I combine with some of your books, *Q is for Quantum*, and (Y acknowledges.) (All laugh.)

Y: Very good. It was quick study.

B: Yes, yes. Pity I didn't have a printer, otherwise, I would… So it was very beautiful because several times yesterday, we were discussing hadrons, confinement; and, of course, many times when we were studying the inflation curve. And so this is one line of thinking leading us to quantum chromo dynamics. And the other one is the matrices because since we have introduced our sets of arrangements now, whole arrangements to be a group, the next step will be including lie groups **[Recording time 36:20]** as it is done in contemporary physics of particles. And the lie groups are introduced in regard to SU(3) symmetry. And so, I considered this worth studying.

Y: SU(3) you said?

B: SU(3) symmetry. (Y acknowledges.) And so I have found this very beautiful explanation of what symmetry is. And it's really profound. It's very beautiful. We have hadrons; there are two types of hadrons which are mesons and baryons. Mesons are further divided into quarks and anti-quarks; and baryons there are three quarks. (Y acknowledges.) And all this is visible here in this beautiful chart.

Y: Isn't that something!

B: Ahh?

Y: He did a wonderful piece of work there.

B: Yes, yes…very beautiful because here we have two parameters here into picture. One parameter is a charge which is Q and this is done in parallel lines here with green. And the charge could be minus one, could be zero, could be one. For instance, for the neutrons, it is one. And then the other parameter taken into consideration is the strangeness which is one parameter of the quarks, or for that matter, also for the other particles. But since we have strange quark, it is somehow related to it. So we have strangeness. And for the strangeness as parameters, we have the red horizontal lines. And the parameter could be as zero, could be as minus one and could be as minus two. And what is strangeness? It is the property that is conserved in the strong nuclear reactions in which the particles are created. In the decay, however, a different weaker force is at work. And this weak nuclear force does not conserve strangeness as it is with **[Recording time 38:30]** symmetry which is reflected by the strong nuclear force. And so this is why it was named strangeness. (Y acknowledges.) And so this parameter has numbers. These numbers could be as zero, as minus one, as minus two. For instance, this strangeness for a neutron is zero. So at the intersection of the line for Q which is Q zero for the neutron and S zero for the strangeness, we find the neutron.

And now the combinations or quarks are given. And in picture here, there are three types of the quarks because they are to be made into neutrons and protons and pions, these out of all six types which include other ones, as charm and so on. We have here just three of them. So combinations of the quarks, up, down and strange are taken into account in forming hadrons. (Y acknowledges.) And since hadrons are of two types, baryons and mesons, we have one octet here for baryons and one decuplet. This picture is decuplet because somehow its structure reminds us of one decupleting. This is for baryons. And we have two octets for mesons. And different combinations are here given. And they are symmetrical. It should be seen they are symmetrical. For instance, for neutron, we have up, down, down. For proton, we have up, up, down. So it is symmetrical. (Y acknowledges.) For sigma particle here, we have down, strange, strange; and for the other one, the other intersection of Q and S, we have up, strange, strange, and so on. They are in **[Recording time 40:46]** all. In baryons, we have combinations of three quarks which is up, down, strange. And for mesons, we have quark (Y acknowledges.) and anti-quark. And so for the mesons, always we have anti-particle for up… anti up quark and down. And we have then up and anti down. So this is also symmetrical for different particles, and so on, **[Recording time 41:14]** and so on; for pions, for… And so if we consider this, we shall find the symmetry.

Y: Now, let me say at this point. To see how the Lila Paradigm connects up with this, you look at that paper on beta decay. (B acknowledges.) Now, I actually wrote that. (B acknowledges.) But it's put out under the name of Seeley and Baker (B acknowledges.) because I wouldn't let them use my name at that time. And it shows you what is behind this being this way. (B acknowledges.) It shows what the Lila patterns are that produce this. (B acknowledges.) And if you ever do that (B acknowledges.) or do it with some particle physicists, you'll know that that paper is there. And that will open up how it attaches to the Lila Paradigm. (B acknowledges.) That's all I had to say.

B: Thank you.

Y: He did a nice piece of work.

B: Yes, it's very beautiful. Maybe I'll…

Y: Murray Gell-Mann

B: Aha! Ah yes. Gell-Mann's… **[Recording time 42:50]**

Y: You have more?

B: I have, but maybe the rest is like summary because these are our last sessions, what to be done maybe in the future, maybe in the afternoon session or now; whatever you want. It was like a summary what to do. For instance, we have to develop logic or the further step with matrices or Monte Carlo or the philosophical.

Y: We will take that up this afternoon.

B: This afternoon. Yes, science and religion, the philosophy, the metaphysics. (Y acknowledges.)

Y: I have a few odds and ends of technical things to take up myself this morning. And then, we'll do that this afternoon. (B acknowledges.) OK, back to **The Radical Theory.** Page 37 in the Appendix. I'll be right back. (Y returns.) Now for this, we'll want to boot up your Mathematica. (B acknowledges.) Section D on page 37.

It says: **[Recording time 46:04]** the formula for the Compton wavelength of the electron is *e* plus or minus. That is, the electric charge magnitude times K times little n and using the best measurement for the elementary electric charge expressed as length. And there's the number; there's 138 again (laughs) times 10 to the minus 34 centimeters; and the formula for n which is N minus N over *e* to the K. Then the Compton wavelength of the electron is *e* plus or minus times K, times N minus N over *e* to the K. And solving for N, we have N is equal to the wavelength of the electron times K divided by the value expresses as length for the electric charge times one minus *e* to the K.

And I've got a value. It comes out 138258 times 10 to the 23rd where the measured value for the Compton wavelength is 2.4 da, da, da, da, times 10 to the minus 14th. So I said, "This is different from 10 to the *e* to the pi by about minus 3 times 10 to the minus 7th percent." (B acknowledges.) Well, that's close; but let's see if it gets closer (B acknowledges.) because they have a new value, (B acknowledges.) measured value. You see that was out of Cohen 1990; and this is 2002. (B acknowledges.) So…

B: For lambda *c,* I take this, no?

Y: So, for the wavelength of the electron… So, I'd like to put in all our values into this formula for N and see what value we get.

B: OK. Then step by step, huh?

Y: So, instead of it as 2426, instead of 2425. So that's significantly different.

B: 2426.

Y: 2426310…

B: 2426310238…

Y: **[Recording time 49:36]** times 10 to the minus 12 meters.

B: K is 12.7.

Y: Well, no. We have to do much better than that. (B laughs.) OK.

B: Start with alpha.

Y: Well, I've got it done here. (B acknowledges.) Where is the value for K? (looks through his papers) So here's the value for K: 12.70623721. Now let's see if that will get any better. We'll start with alpha as you suggested. Now alpha is on the other data sheet.

B: Also for the charge, I shall take this one minus 1.758.

Y: No, you can't take that because it's not in meters.

B: Oh, yes.

Y: So, what you have to do is take the one that I read off. Where did I have that?

B: Here you have it. Misner, ah, no… Ten to the minus 34 centimeters?

Y: Which page is that?

B: The same one.

Y: Which page is that?

B: 37, the other

Y: Page 37?

B: 37, here …10 to the minus 34. Here…

Y: Yes. Here it is from Misner.

B: 10 to the minus 34.

Y: 1.38

B: This one.

Y: Yes. That's the one. And *e* you'll have in your machine.

B: **[Recording time 52:14] …**times 10 to the minus 34 centimeters. OK. And for N, you said? I have in the machine… Ah, *e*. Yes *e, e* I have, yes. I want**…**

Y: Yes, the natural number that's in the machine. So does that give you enough?

B: Yes. For N, I'll find once again N with…

Y: Well, you want to calculate using this formula for N.

B: For N, I have a value with 50 digits.

Y: No, but I…

B: For N big.

Y: We're going to calculate the value of N using this formula for the wavelength.

B: Ah, yes.

Y: We're going to use the formula N equals (B acknowledges.) the Compton wavelength times K (B acknowledges.) divided by the value for *e* plus or minus.

B: OK. Step by step…first the numerator… The upper number is lambda is N of 2.426310238 multiplied by N of…

Y: …the full value of K

B: …K is this one: 12.70623721. We have for the numerator: the upper is 30.8293; and now, I have the charge N of 1.38114132 times 10 to the degree of minus 23. **[Recording time 55:02]…**

Y: Have you put in K already? Yes, you have. (B acknowledges.) OK.

B: So this is the charge…

Y: I have the natural number here if you want that.

B: Uh huh, I'll take it. I'll do it separately. So this is multiplied by minus *e.* Now for e, I'll do a separate charge.

Y: I have *e* here if you want it.

B: I'll find it. N of *e*… with 20 digits or 25? 30? (laughs) 40 (laughs)

Y: 12 is enough. (B laughs.)

B: I have it with 40. This is 10. So I take this minus… this is out of two…

Y: You take that to the K.

B: …of two. Take to the K. Now K, take to the K. Take number of K which is 12.7. Oh! Aha! Yes. I have K twice, OK. 0623721 **[Recording time 56:45]** lambda… Ah! *e* to the K. I have *e* to the K. Every step… I'll do this every step. Lambda is 1.38114132 times 10 to the minus 34. (talking low to herself and noise in the background) **[Recording time 58:00]** Ah, I know where I made the mistake. OK. N minus *e*… Aha! This is N. **[Recording time 58:49]** I got a negative result because… **[Recording time 1:00:49]**

Y: Say it a little louder.

B: …because one minus *e* to K is negative; *e* to K is very large. *e* to K or *e* to… Ahhh! N minus… Why? No. Aha! From here you have… You know, I get here negative number because of this one, we have *e* to K. Let me check this one. We have lambda is *e* **… [Recording time 61:20]** KN minus N … *e* to K.

Y: Why aren't you just using this formula?
B: I'm using, but I'm getting negative number because one minus *e* to K is negative. You know, here. One, one…

Y: Yes.

B: *e* to K is very large number. It is seven digits. One minus this one is negative. And the whole number is negative. Now I want to find out why.

Y: So is the solution for N wrong?

B: I'm trying to check.

Y: OK. I see what you're doing now.

B: Lambda *c* **[Recording time 62:02]** is *e* K…

Y: I had it checked by a physicist in Trieste at the Fermi Institute.

B: e to K minus N over e to K**…** (continues talking softly to herself while checking equation accuracy) **[Recording time 65:05]** It should be N is lambda *c*, not K but *e* to K. And I'll check once again. But let us see… **Recording time 1:05:21]**

Y: So it should be *e* to K.

B: *e* to K. *e* to K, not K but *e* to K. And down, A plus minus K *e* to K minus one. Let me check roughly if this is right. If not, I'll do once again. **[Recording time 1:05:50]** We have lambda *ce* to K. So, *e* to K is… Ah, let me check once again**. [Recording time 1:06:14]** Lambda *c* equals KN minus… (continues talking quietly to herself while doing formula with noise in background) So we have lambda *ce* to K over *e* K *e* to K minus one. So first, the upper lambda *ce*… **[Recording time 1:07:42]**

Y: I have a new value for K. (B acknowledges.) It's based on the new alpha (B acknowledges.) And…you have K here?

B: Yes.

Y: And it says 21. Change that to 64. (B acknowledges.)

B: 64, OK. **[Recording time 68:04]** K is 70623764.

Y: OK. Now we got it! (B laughs.)

B: Now lambda *c*…

Y: So you've got a different formula.

B: Yes, a different formula. It should be N is lambda *ce e* to K over *e* plus minus the charge e to K minus one. And now I'm checking. Now, the first one, lambda *c,* step by step, once again. Lambda is this one. Lambda is N **[Recording time 69:00]** 2.426310238. Once again check here. 2.426310238 multiplied by *e* to K. So, number of *e* 40 digits to the degree of K which is of 706237. So, for this number, for this number lambda *ce* to K, I got 81.9. Now *e* to K minus one is **[Recording time 1:10:43]**…*e* to K minus one. I have number of forty digits *e* to K, lambda of *e* to K *e* to K minus one. *e* to K will be 76... For *e* to K minus one, I have 31329798. This is *e* to K. **[Recording time 1:11:01]** And now, *e* plus minus K, number *e* to K minus one is… I have *e* is N of 1.38114122 times number of 10 to the degree of minus 34. There's the charge multiplied by K of 12.70623764; **[Recording time 1:14:19]** multiplied by 329799. And now finally, lambda *ce* to K ... 1.38 but the degree is not right.

Y: It's not 10 to the 23^{rd}? 1.38 what?

B: 10 to the 33 I think I find**… [Recording time 1:15:43]**

Y: to the 33. (He laughs.) Let's check the numbers. 1.38…

B: 258

Y: …25875.

B: No. I have not this.

Y: We need 10 places. (B acknowledges.) Which equation are you using?

B: This one.

Y: This one? (B acknowledges.) Huh?

B: The beginning is OK. But why? The degree is now… Let me check the degree. This for the charge… You know, this should be meters also; isn't it so? The charge should be meters, not in centimeters because lambda is in meters.

Y: For lambda?

B: Lambda is in meters and… **[Recording time 77:12]** is in…

Y: It's in meters.

B: So this is one mistake. This should be centimeters. It should be 10 to the 36^{th}.

Y: What is that?

B: The charge *e* plus minus.

Y: The charge.

B: It is in centimeters, but lambda is in meters. So, *e* should be 1.38114134…

Y: The charge was in centimeters, yes.

B: …times minus 36 meters. This is one thing but **[Recording time 1:17:56]**

Y: Yes, that is correct.

B: So here is times … 36…

Y: It's not an easy equation to solve. (P laughs and acknowledges.) I made a mistake with it, so I gave it to this guy who's an American, works at Fermilab in Chicago (P acknowledges.) and also the Triese Institute for theoretical physics. And he got it wrong. (P laughs.)

Punita: Well, this… I don't know if I transcribed it incorrectly, but this is not even close. This expression is not even close to that. Maybe I just typed it up wrong; but…

B: So this is the charge to the…. The charge *e* times K which is … **[Recording time 79:08]** OK this is *e* charge multiplied by… This is *e* to K minus one, once again. N is lambda *ce* *e* to K over *e*K *e* to K minus one. *e* to K minus one is… I have here *e* to K **…** minus one; *e* to K minus **…** That is *e* to K plus minus times K… **(**continues doing equation while Y talks to P**)**

Y: What were you pointing out?

Punita: Oh, I was just… This formula here that I've written down is not the same as that. What she's doing matches… You know, I did the same derivation **[Recording time 80:30]** to solve this for N; it doesn't come out to this. You've changed it on your paper also, I see. But I thought maybe that I had just typed it in… done it wrong here; but it appears that's what I got from the paper. But what she has matches what I've come up with. So, it's something.

B: (still talking softly to herself) So, we have this multiplied by … charge for K… times 329798. **[Recording time 1:21:26]** This is denominator. And the upper is lambda *ce* to K; lambda *ce* to K is **…** The degree is not right. We have 1.38…

Y: 1.38…

B: …which is OK

Y: 258…

B: No, something else. But the degree is not…

Y: The degree is not right either. **[Recording time 1:22:30]**

B: But why I have now… lambda *c* to the …1.38259; but the degree is not OK …

Y: …2 5 9.

B: 138259 but the degree? Something with the…

Y: I've got 2587521 for 10 the *e* to the pi. So it's close.

B: But the degree is not OK. The degree – this centimeters because the largest degree comes from the charge which is 10 to the 36 which is… This gives the degree to be… But the digits are right which is encouraging. Only this degree… Is it OK? And the degree of lambda should be OK; 10 to the minus 12. Aha! Oh, I know now. It was lambda is times 10 to the minus 12. Lambda is upper, times ten to the minus 12… **[Recording time 1:24:50]** Lambda is 10 to the minus 12… Ah, here is the formula. So it is OK. Everything is OK. The formula is OK. Only the precision… So I got N is 1.38259 times 10 to the 23.

Y: Read it out to me again. 1.38

B: N is 1.38259…

Y: 259…

B: …times 10 to the 23.

Y: Why are you giving me only 6 places, six significant numbers instead of 10? I gave you things that had 10.

B: I should have precision everywhere, precision.

Y: So we match as far as you've gone, to 259. But I have 87521.

B: Yes. Now, just … I'll do that. But now, let me write the…

Y: You have to put in…

B: …the median **[Recording time 1:26:38]** results (Y acknowledges.) to know which one is which because there are too many of them. So, at least it is right. All is right, just the precision.

Y: All is right. It's just precision.

B: Just the precision. The formula is right; the values are right, just the precision. But now, let me write all this. So we have here… equals lambda. We have…

Y: Do you want to check that?

B: We have lambda times *e* to the K. I have *e* to the K. Only I miss here…

Y: So there, you have eleven places.

B: …times N of …N **[Recording time 1:27:26]** This is lambda *ce* to the K. So once again: lambda *ce* to the K… Oh, sorry; this one. Out of 22; in of 22. In of 22 is lambda *ce* to the K. Only, the precision should be better. So I have here: point 30. And I have here… (continues talking to herself)

Y: It's snowing in Hobart. (P laughs.)

B: Oh, I have done it once; but it was a common precision, but… **[Recording time 1:29:54]** Then you have N; then one; then N is…to give the result within N digit precision. But I don't know why it doesn't give it here. For instance, this number with the precision comes to precision of 30 digits. It doesn't give it with the… **[Recording time 1:31:15]**

Y: What, for *e*?

B: For *e* I have it. For *e* I have, for instance, for *e* I have precision of 40 digits. I have it. I have precision of 40. (Y acknowledges.) So the manner in which I give them is right. But now, for this one, for instance, which is… Aha here! Maybe here also… precision 30 and here also, precision 30. And now, let us see. This is for what is lambda *c* to the 10 to the minus 12. Let us see, for lambda *c* doesn't give me the precision. I put the precision for all of them. But for … If I put here this, then this, then this, then colon, then 30, then I close. Let us see. So this is the number of… for lambda. **[Recording time 1:32:55]**

Y: We know the value for lambda.

B: Yes, I know. But I want to get the precision.

Y: Oh, you want to have that be in your calculation? OK.

B: **[Recording time 1:33:27]** N of expression point precision. This is what I give. I give N… I give… Aha! Pardon me, N is needed here. Now let me check this to this one; or maybe, the whole thing**… [Recording time 1:34:12]** Aha! … Aha, aha! Now, this one… Now I have the number, but still not the precision. **[Recording time 1:36:51]** (Y acknowledges.) Maybe it gives the precision, but there is these zeros.

Punita: (talking with other people in the kitchen)

B: I give the precision, the expression; then the precision. Then the precision is thirty.

Y: And it won't do it?

Punita: **[Recording time 1:38:25]** I'm just wondering if it is because of the lambda precision only being… What do we have? Nine digits and so…

Y: No, lambda has 10.

Punita: You sure?

Y: Don't you count 10? I count 10 digits.

Punita: The one that's in the paper here? Oh, you're looking at…

Y: No, I'm taking the one out of the…

Punita: Yes, I don't have that.

B: (talking to herself in background)

Y: That's part of the idea here… is we're using the 'up to date.' (P acknowledges.)

Punita: Yes. I didn't… Can you give that to me? I didn't write that down.

Y: You want that value?
Punita: The new one.

Y: Yes, I'll give it to you--2.426310238 times 10 to the minus 12 meters. And that's the Compton wavelength for the electron.

Punita: Uh huh. It's 2002. It's quite a difference. It's different in the third decimal place, third place after the decimal.

B: There is no sense of error; and still it doesn't give me the precision.

Y: It won't give you the precision.

B: I have read them, the help. Help…Browser…Precision

Y: Well, we can do it on this calculator, this hand calculator.

B: Maybe get precision. OK. Let us do it.

Punita: Sometimes low-tech is best. (laughs)

Y: Yes. They give us 10 places.

B: There should be a way but… first, the formula lambda *ce* to K, lambda *c*, this one.

Y: And that's in meters.

B: You give the degrees with this one, 10 to the X?

Y: **[Recording time 1:42:26]** (B acknowledges.)

B: I'm not use to this one.

Y: You read me the numbers.

B: Too many…

Y: You give me the numbers.

B: Lambda C is 2.426…

Y: Just one moment. OK. 2 point…

B: 4 2 6

Y: 2 6

B: 3 1

Y: 3 1

B: 0

Y: 0

B: 2 3 8

Y: 2 3 8

B: Times 10 to the minus 12^{th}

Y: Times 10 to the minus 12^{th}. Yes.

B: This is lambda c. This should be multiplied by *e* to the K.

Y: I need e to the K first. (All laugh.) So…

B: I'll take it from here because I have it…

Y: You can just… I can do *e* to the K.

B: OK. Then from the beginning, *e* to the K. You need K.

Y: You're going to give me K. Is that right?

B: K is…

Y: I need *e* first.

B: OK, e…

Y: *e* is…

B: Is 2.71

Y: 2.71

B: 8

Y: 8

B: 2

Y: 2

B: 8

Y: 8

B: 1

Y: 1

B: 8

Y: 8

B: 2

Y: 2

B: 8

Y: 8

B: 4

Y: 4

B: 5

Y: 5

B: 9

Y: 9

B: 0

Y: 0

B: Enough? Or …

Y: That's enough. (B &P laugh.) That's all I got room for. So, I'm going to take that to the K…

B: …to the K of…

Y: …K of…

B: 12

Y: 12 point…

B: …point 7 0 6 2 3 7 4… Pardon, 7 6 4

Y: 7 6 4

B: *e* to the K

Y: 7 6 4
B: *e* to the K

Y: OK. Now you want to write down the results? **Recording time [1:46:31]**

B: Yes.

Y: It is 3 point 2 9 7 9 8 6 6 3 9 times 10 to the 5^{th}.

Punita: That's *e* to the K?

Y: That's *e* to the K.

B: *e* to the K.

Y: Now, I got to multiply that times lambda.

B: Lambda is…

Y: Times…

B: 2 point 4 2 6 3 1 0 2 3 8 (Y repeats each number after B says it.) times 10 to the minus 12^{th}.

Y: Times?

B: Times 10 to the…

Y: Times 10 to the minus…

B: Minus 12^{th}.

Y: 12.

B: Yes.

Y: That's 8…

B: OK, 8…

Y: 8 0 0 1 9 3 8 7 4 7 times 10 to the minus 7.

B: OK. Yes, it's correct only I have with the small digits.

Y: OK. Now, we've got the numerator.

B: OK, numerator.

Y: Now, we kept *e* to the K, right?

B: *e* to the K minus one
Y: So, you could do the minus one.

B: Yes. OK. Aha! …the minus one

Y: Yes, that should be easy.

B: Yes. It is 2 point 2 9 7 9 8 6 6 3 9 times 10 the 5^{th}.

.

Y: And that's… I'm going to multiply that times *e* plus or minus, right? (B acknowledges.)

All right. You read that number off to me again.

B: It is one point …

Y: Just a moment. Say it. Which number are you giving me?

B: *e* plus minus, the charge, (Y acknowledges.) one point 3 8 1 1 4 1 3 2 (Y repeats each number after B says it.) times 10 to the 34.

Y: Times 10 to the 34…

B: …to the minus 34.

Y: Ten to the minus...

B: ...minus 34...

Y: 34

Punita: …centimeters

B: Aha, pardon, to the minus 36 meters. It should be meters, to the minus 36.

Y: So it takes three of us. (B laughs.)

B: Times 10 to the minus 36

Y: And I multiply that times, times… 12? You have to read off K to me again.

B: 12 point 7 0 6 (Y repeats.)

B: 2 3 (Y repeats.)

B: 7 (Y repeats.)

B: 6 4 (Y repeats.)

Y: And the result is 1 point 7 5 4 9 1 0 9 8 3 times 10 the minus 35. Now, I multiply that times *e* to the K minus one time…you have *e* to the K minus one?

B: It is 2 point 2 9 7 9 8 6 6 3 9 (Y repeats each number after it is said.) times 10 to the 5^{th}.
Y: 10 to the 6^{th} is 4…

B: …to the 5^{th}, I have.

Y: To the 5^{th}?

B: Yes…to the five.

Y: Ohhhhhh. I did it to the 6^{th}. I thought I heard 6. Well, we have to do it all over. OK.

B: 1 point 7 5…

Y: Which number are you giving me?

B: The one that should be multiplied by…

Y: …by *e* to the K minus one…

B: …by *e* to K minus one.

Y: OK. Go.

B: It is 1 point 7 5 4 9 1 0 9 8 3 (Y repeats each number after it is said.) times 10 the minus 35...

Y: …times…

B: …10

Y: Times what?

B: Times 10 to the minus 35.

Y: Yes. I already have that.

B: Aha! Times – OK, times 2 point…

Y: …times 2 point…

B: …2 point 2 9 7 9 8 6 6 3 9 (Y repeats each number after it is said.) times 10 to the 5^{th}, to the five.

Y: Times 10 to the minus five?

B: 5, plus 5.

Y: Five. And the result is 4 point 0 3 2 7 6 1 9 9 2 times 10 to the minus 30. (B acknowledges.) Now we have…

B: OK. Now this is the numerator; the denominator.
Y: That is…

B: …the denominator

Y: The denominator. So you give me the numerator first.

B: The numerator is 8…

Y: Just a moment. 8

B: 0 0

Y: No point?

B: No.

Y: 8 0 0

B: 19

Y: 8 0 0 what?

B: 1 9

Y: 1 9

B: 3 8

Y: 3 8

B: 7

Y: 7

B: 4 7

Y: 4 7

B: times

Y: times

B: ten to the minus 7…

Y: …to the minus 7. There's no point in that, huh?

B: No.

Y: I smell a rat!

B: Over…

Y: …divided by…

B: …divided by 4 point

Y: …4 point…

B: 0 3

Y: 0 3

B: 2 7

Y: 2 7

B: 6 1

Y: 6 1?

B: 6 1

Y: 6 1

B: 9

Y: 9

B: 9

Y: 9

B: 2

Y: 2

B: …multiplied by 10 to the minus 30

Y: …times 10 to the minus

B: …minus 30. I must find out here the precision.

Y: And it's 10 to the 32^{nd}. **[Recording time 1:55:16]** Oh well, I think we're due for a break.

Punita: Yes, I think so. Are we done?

Y: We're done for now.