

A History of the Gaseous Electronics Conference

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Next June I will attend my 50th class reunion at M.I.T. This is the 25th G.E.C. conference. The G.E.C. covers half my active career, and it is the better half, for it is at these conferences that I have obtained ideas in discussions with others and in which I have been able to test my ideas in discussions with you. It is this interaction that has helped me in my work.

These conferences grew out of the Nottingham Conferences, which were excellent conferences because of the discussions they stimulated, and unlimited discussion was allowed. Unfortunately, there were a limited number of days: three days, and therefore, discussion being unlimited, some people got squeezed out at the end of the conferences. This was the case for gaseous electronics. We got squeezed out on the Saturday sessions like toothpaste out of a tube. Several of us got together, Dan Alpert, Sandy Brown, Leon Fisher, John Hornbeck, Julius ^{some others,} Molnauer, and I, to seek a similar but better regulated conference in which gas discharges would have time to be discussed, and we organized the Gas Discharge Conference at Brookhaven. This conference was held a Thursday, Friday, and Saturday; there were 230 in attendance; 38 papers were presented, and 25 minutes per paper were available, including presentation and discussion. At this conference Margenau spoke on velocity distributions, Deke and Donohue on striations; Holstein on imprisonment

of radiation. This paper by Holstein is frequently quoted; it has been quoted several times at this conference, but very few people read it. It needs to be redone because line profiles and distributions have changed since it was first written, but nobody dares undertake ^{this task} it. Ted was a prominent member of our earlier conferences, characterized by comments or questions on practically every paper that was presented. We welcome him back to this meeting tonight.

The second meeting was sponsored by Westinghouse and held at the Mellon Institute in Pittsburgh. ~~Va~~ Better vacua were coming in, and positive ions were gradually coming out of the muck. Positive ions had always been in clusters, and at last we were getting clean ions, and there was much confusion over the fact that ^{singly} ~~truly~~ ionized ^{rare gas} atoms generally ~~ions frequently~~ had a lower mobility than the ~~singly~~ ^{corresponding} ionized molecular ions. It was (not at first) understood why the lighter particles should ~~grow~~ more slowly.

At the Mellon conference, Emelaus spoke on "plasma oscillations," ^{which became a by-word to explain any spurious result.} And the first papers of a long series on the retrograde motion of the cathode spot were given. After this conference we ~~sawxxxx~~ ^{sought} respectability by seeking sponsorship by the American Physical Society, but we wished it on our own terms: we wanted to keep the right of rejecting papers arbitrarily and giving different time allotments to different speakers according to what we thought would be the need. In other words, we wished to

keep the ^{best} conference for the audience in order to discuss physics, not just for the speaker to have a right to present his ideas.

The next meeting, ~~was~~ sponsored by Bell Labs and held at the Barbizon Plaza in New York, was sponsored by the D.E.P. as well. In spite of our youth, the Physical Society had accepted our terms. At the Bell Lab meeting Sanborn Brown spoke on microwave breakdown, and the

famous paper on the mercury ^{- argon} ~~iodine~~ discharge by Kenty, Easley, and Barnes ^{the first detailed calculation of excitation and de-excitation rates,} was presented at this session.

The next conference at ~~G.E.~~ ^{the} (Laboratory of General Electric) of Schenectady, was famous largely for its banquet, at which all the celebrated names in gas discharges--Hull, Langmuir, ^u Dishman--were present. ^u Dishman was particularly happy at this conference because he had just finished writing 300 pages about nothing.

The fifth conference was sponsored by RCA at Princeton. Rose and Allis gave a paper on transition to ambipolar diffusion, a subject also discussed at this conference. And ^{Kruskal} ~~Crisc~~ presented a paper on ^{the} instabilities of plasmas.

The sixth, sponsored by O.N.R., was in Washington, D.C.. At this conference, ^{Looney} ~~Funny~~ and ^{Brown} ~~Bownes~~ presented their paper on plasma oscillation, and Bennett his famous paper on self-^{foeu} ~~processing~~ ^{beams} screens.

The seventh conference was sponsored by New York University, and had the ^{famous} Symposium on Breakdown, in which Fisher and ^{Loeb} ~~Mord~~ were pitted against Llewellyn-Jones: ^{streamer} ~~schema~~

Avalanche) Loeb

breakdown vs. Townsend breakdown. ~~Word~~ is unfortunately unwell, and absent this time, for the first time, from one of these conferences. ~~(Continued attention to)~~ sparks His ~~determined~~ work on starts and streamers is continued now by Goldmann who is here from Paris, but unfortunately not speaking: there was no more time available. Progress in this field has largely been set by ~~the gradual improvement of~~ due to improved timing circuits.

The continued determination of

After the meeting at NYU, we returned to our homes, ~~to~~

~~we were~~ greeted by the results of Hurricane Hazel, which had blown down many trees across the roads, ~~as~~

At The eighth conference, again at G.E., we heard the paper by Pack and Helps on drift velocities of electrons in molecular ~~xxx~~ gases. This was the first attempt to derive from mobility measurements the cross sections for excitation of rotation and vibration in molecules.

Due to the poor resolution of low energy electron beams there was, at the time, no other way.

The next conference at Westinghouse lasted three and a half days because, to our regular fare, we ~~had~~ added a Sherwood Symposium. The Sherwood program had just been declassified, and Freeman, ~~Crisco~~, ^{Kruskal} Post, ^{Simon} ~~Symons~~, Tuck spoke about the

recently declassified work. Also with this conference ^{uch} Becksbaum talked about microwave measurements of electron densities above plasma ~~at high~~ ^{resonance} densities, and Margenau on Balmer lines as indicators of electron densities and temperature. Both

these ~~papers~~ were early papers on diagnostics which could be made without introducing a solid body into the plasma.

^{was} It ~~is~~ the beginning of ~~a~~ great improvements in diagnostic methods.

At the next conference at M.I.T., I missed a great opportunity. I spoke at the banquet, but ~~did not know~~ ^{had not heard} that ~~Sputnik was~~ ^{would be} circling overhead at the ^{very} time of the banquet.

Next comes the second conference at Bell Labs. This time a four-day conference, with 62 papers. At this conference Schulz spoke about the trapped electron method in which the accuracy of electron energy measurements was improved by an order of magnitude. It has improved again by another order of magnitude since, and this is another great improvement in gaseous electronics.

The twelfth conference was at the National Bureau of Standards, and here 85 papers were submitted. This created a crisis: we could not present 85 papers and maintain discussion, so we decided that we had to reject a large number, and we chose all papers having to do with surfaces as being inappropriate; gaseous electronics being really restricted to the gas. As a result, 38 papers were rejected, leaving the conference with 47 papers. Of these twenty were on collisions, the influence of Branscomb. At this conference, ⁱ Hershfield and Beck^{ff} talked about cyclotron harmonic radiation, again a very good diagnostic tool not requiring the introduction of a solid body into the plasma. We could now learn ^{much} about what was going on ^(in a plasma) by ^{observing radiations that} simply ~~listening to what~~ came out.

After this conference, arcs left us because they were ^{(because their field was too big & specialized,} attached to their cathode spot. Sherwood left us, and

formed the Division of Plasma Physics; and collisions also

left us, to form the Collision Conference. ^{And} Also, we went

^{(for the first time} West, to the U.S. Naval Post-Graduate School, ^{(at Monterey.} ~~however, we~~ ^{Although the}

^{number of papers was diminished by this move, we} still had as many ~~papers~~ as we wanted, and they were good.

This conference lasted three and a half days. At this conference, thermionic converters were first discussed.

The next conference, the third at G.E., Ali ^aJavan discussed lasers but not by that name, and it was a few conferences later before anybody else introduced laser discharges into our conferences.

After this conference, I resigned to take up a post in NATO, and I missed the next two conferences. As I had been chairman for fourteen conferences, I think many ^{(had been} people ~~were~~ wondering how to get rid of me politely, and ^{this was a good} ~~were glad of this~~ opportunity.

When I came back for the seventeenth conference, sponsored by the Signal Corps at Fort Monmouth, the number of papers had greatly increased and the time-per-paper decreased, even though simultaneous sessions had been introduced. At the Fort Monmouth conference Schulz spoke about resonances in elastic cross sections.

These resonances had failed to ~~be~~ predicted ~~by~~ theory, and indeed theory had also failed ^vto calculate cross sections for ~~right~~ ^(by orders of magnitude) rotational and vibrational excitation.

Even though all the basic equations are known, there is

still need for much theoretical work in atomic physics. Schulz's measurements again involved a large improvement in the measurement of very small currents, because he was using cross^{ed} beams of atoms and electrons.

From here on, I ~~have been~~^{am} unable to select outstanding papers as I have^{been} ~~up~~ to this conference. Presentation had become too compressed; abstracts were too short; and anyway, ~~I was probably at the other session, so that I did~~^{due to simultaneous} ~~not hear, often,~~^{I was unable to select} the outstanding paper. Eighty-five papers seem to represent an absorption limit at a conference.

The next conference was at Minnesota, and after that we went South to Georgia Tech. Earlier we had been invited by Duke, and everything seemed very attractive until we ~~had~~ looked into the question of hotels, and at that time all hotels in Raleigh were segregated so we regretfully had had to refuse the kind invitation by Duke. But now, with desegregation in the South, we could accept a meeting at Georgia Tech. At this meeting, Carl Kenty gave his last paper. He had attended all our conferences, had ~~and~~ spoken at many of them, and ~~although~~ had also ~~given~~ presented experimental demonstrations. Many of us remember his red and white discharge due to catho^{aph}resis and his ~~fine~~^{strongly constructed} filamentary discharge ~~of~~^{in a} nitrogen ~~in~~^{and} helium mixture.

Then we went to Lockheed, at which there were 111 papers, and the next one at JILA in Boulder, at which there were 116. Then to Oak Ridge^{where} and I have the attendance record at ~~Oak Ridge~~: there were 360 attending,

not a great increase from the original ~~one~~ ^{attendance} at Brookhaven; however, ^{(a four-fold increase,} there were 160 papers). At Brookhaven there were roughly six people attending per paper presented; at Oak Ridge, two people per paper presented. This drastic increase in the number of papers per person attending is due to the "no paper, no travel money" policy of most laboratories, and is one of the greatest obstacles which we have to organizing a conference in which discussion can be free and easy, and yet keep the whole conference down to a reasonable time. Of the people attending at Oak Ridge, five percent were at Brookhaven or at the Mellon Institute, the first two meetings. There were at this conference six arc sessions, two laser sessions, six panels, and seven regular gaseous electronics ^{sessions} ~~conferences~~.

Then we went to Hartford at United Aircraft, at which there were seven arc sessions and seventeen ^{gaseous electronics} ~~g.e.c.~~ sessions. This conference was famous for its interruption-- at ^{one point} ~~this conference~~ Bob Bullis made a frantic announcement, saying, "You can't imagine what ^{has} ~~is~~ happened to us. Agnew is going to speak here tonight, and he has pre-empted one of our conferences' rooms'."

Then we went to the University of Florida, at which there were eight arc sessions, five laser ones, sixteen ^{gaseous electronics} ~~g.e.c.~~, and only 14.8 minutes available per paper. This is the low point in our time available, and we must seek to eliminate the padding ^{by} ~~of~~ papers which frequently the author would prefer not to give.

This time, at Western Ontario, the number of papers has increased even more, but thanks to very good distribution, management, and the use of predawn darkness and evening sessions, we are at 16.2 minutes per paper, with triple sessions, and with this ^{complete} my record of conferences ~~is~~ up to date.

I have told you what the conferences have been; perhaps you would like to know who are the G.E.C. Fred Biondi has presented papers at eighteen conferences. Phelps at seventeen. Leonard ^{Loeb} ~~Laird~~ has spoken at thirteen conferences. Chanin at twelve. Kenty at ten. Fischer, Goldstein, Schulz at nine. And so on. These figures are not quite correct, because there are ~~these~~ two conferences ⁱⁿ of which I do not have the programs, and also looking through the names ~~is~~ quite lengthy, and I may well have missed some people who have given more papers. If so, I must apologize ^{to them}.

Thank you very much, and good night.

A sub-committee has been ^{now} formed to consider the overcrowding of our conferences & we shall recommend something. It will inevitably hurt some of you by restricting your presentation time or eliminating your papers altogether. The objective is a better conference for all & I hope

that should you suffer at the next conference ^{(I hope that} this will be compensated at ^{some following one} the ~~one after~~

The total result will be agreeable.