

## Copenhagen – the play, or two men decide the future

(As published in The Oak Ridger's Historically Speaking column on April 7, 2009)

On Wednesday, April 1, 2009, I was privileged to attend the play, *Copenhagen*, written by Michael Frayn and performed by David Brian Alley (Werner Heisenberg) and Dan Kremer (Neils Bohr) at the University of Tennessee's Clarence Brown Theatre. The play runs through April 11, 2009. I encourage you to go, if you have any interest in the history of World War II and understanding the full implications of how physicists changed the world forever in 1945, or was it sooner that the die was cast?

Here is the link: <http://www.clarencebrowntheatre.com/2008-09Season/cbtCOP.html>

The play, about a single brief conversation between Neils Bohr and Werner Heisenberg in Copenhagen, Denmark during September 1941, is a fictional, though thoroughly researched, account of the actual meeting of the two renowned physicists. Arguably two men who, at the time, may well have held the fate of the world in their hands!

The intent of Heisenberg in requesting the meeting and the actual words spoken during a short walk outside Bohr's home has been the source of much conjecture and consternation ever since. Even the two principals, Bohr and Heisenberg, could never agree on exactly what was said or why the meeting even took place. Heisenberg spent the next 30 years defending his integrity with regard to the meeting.

A third character in the play, Margrethe Bohr (Linda Stephens,) adds immensely to the insights the audience gains from the conversation. Margrethe is presented as a strong influence in the whole affair as she demonstrates immense love for Bohr and generally keen insight into the thinking of Heisenberg. She dislikes him because of what Germany is doing to Denmark and for what she perceives he may be attempting to do to her husband, but still holds him in high esteem because of his relationship with Bohr.

Her role is central to the whole play and serves to tie the various iterations of the single conversation into a more coherent ebb and flow. She begins the story with the inquiry of "Why, why did he come to Copenhagen?" - said in obvious reference to Heisenberg's visit. Thus begins the dialog between three people regarding a single conversation lost to memory, yet firmly imprinted forever in each of their minds.

Playwright, Michael Frayn first began to consider the possibility of writing *Copenhagen*, eventually the 1998 Evening Standard Award for Best Play of the Year and 2000 Tony Award for Best Play (USA), when he read Thomas Powers' book, *Heisenberg's War*. I have this book and fully appreciate why Frayn found the story of Heisenberg's visit to Neils Bohr in Copenhagen in 1941 so fascinating.

When I first read Powers' account of Heisenberg's story, I immediately came to the conclusion that here is the single key to the failure of the German atomic bomb program. I thought, "Heisenberg deliberately failed to supply Hitler with an atomic bomb!" This was exciting new information for me. It was new and fresh and, for just a moment, I wondered if I was the only one who might have perceived Heisenberg in this light. Of course, that was not the case. Well before I came to my conclusion, many others had studied the situation and explored all aspects of Heisenberg's life searching for the true identity of this complex minded individual who was the top man in Hitler's uranium program.

The play is written such that the audience is continually asked to consider the reason Heisenberg came to visit Bohr in Copenhagen in 1941 when Denmark was overrun by Germany and fully under their control. Was it to get Bohr to help with the German atomic bomb program? Was it to find out what Bohr knew about the Allied efforts to produce an atomic bomb? Was it just to show off what Heisenberg had achieved to his old mentor, Bohr? Or was there something more involved and deeper in the subconscious mind of Heisenberg? Was there something that drove him to seek the counsel of a beloved friend and former co-worker and mentor in the "Copenhagen Interpretation?"

Well before this September 1941 meeting, Bohr and Heisenberg had worked to develop the Copenhagen Interpretation of quantum mechanics. The Principle of Complementarity (that items could be separately

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analyzed as having several contradictory properties) was primarily one of Bohr's many contributions to theoretical physics. Heisenberg contributed the Uncertainty Principle (that certain physical quantities, like position and momentum, cannot both have precise values at the same time). Did this previous relationship draw Heisenberg to visit Bohr during the height of his work on Hitler's atomic program?

The complicated interaction between Bohr and Heisenberg observed and often interpreted by Margrethe is actually presented in the play as the spirits of the long dead trio as they look back on the events of that evening and give several "drafts" of what was really happening in Bohr's home in 1941. Each of them struggles mightily to convey their recollections of the singular event. Each of them looks independently at the conversation between Bohr and Heisenberg from all perspectives in their attempt to explain the details of the conversation and the true meaning of the visit by Heisenberg.

A number of times during the play, I thought, "Ah Ha! I've got it, that's it." Only to have the rug pulled from beneath my thoughts in the next exchange. The depth of feeling and the strong emotional exchanges quickly and steadily draw one into the play and cause serious thoughts about the difference between what is said and what is beneath the surface.

All through the performance, I kept thinking, what if these two individuals plotted the future. What if they knew the inevitable outcome of the fission of uranium and deliberately chose to take a course that controlled Hitler through Heisenberg's delicate balance of keeping just enough respect to stay in control of the reactor he was building to produce plutonium, yet kept the funding so low that little real progress was made? What if Bohr, knowingly, did not answer Heisenberg's moral question, if that was the content of their brief discussion during that 10-minute walk outside his home?

The implications are tremendous. The play's insight into the mind of the two exceptionally intelligent individuals, although fictional, strikes so unerringly close to conceivable truth as to make the audience believe the character's conclusions or their failure to reach conclusions. Heisenberg contends he alone held the power to either give Hitler the bomb or to withhold it. Bohr finds that difficult to deal with as he had gone to Los Alamos where the United States' atomic bombs were assembled. Heisenberg accuses Bohr of choosing the path of death by creating the atomic bomb while he remained true to his conviction that the world was not ready for the enormous power unleashed by the splitting of the atom.

Heisenberg resented the incarceration of German scientists at Farm Hall after the surrender of Germany and the way information was fed to them to gauge their knowledge and reaction to the atomic bomb. That too becomes a source of no small argument between Bohr and Heisenberg. The play tends to place Heisenberg in a more positive light than might the history books.

I found myself thinking again that Heisenberg surely understood what he was doing and did it deliberately. Yet, his own words in the play indicate he was operating on instinct and conviction, not technical knowledge or superior intelligence. In fact, he did not know how much uranium 235 was required for a critical mass. He avoided the calculation. I am not sure he really knew why he did that.

Here is a quote from the transcript of the Farm Hall recordings: "HEISENBERG: Well, that's not quite right. I would say that I was absolutely convinced of the possibility of our making a uranium engine, but I never thought we would make a bomb, and at the bottom of my heart I was really glad that it was to be an engine and not a bomb. I must admit that." By "engine" he meant the uranium reactor Germany was building.

Bohr belittled Heisenberg by pointing out that if they had ever gotten their reactor to go critical it would have killed them all. They had no way to control the reaction, they had no cadmium. Heisenberg denied that stating they had a "lump" of cadmium, one of the several humorous moments in the play.

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The play concludes with highly emotional charged scenes where Margrethe takes the audience with her to insights into the characters of both Bohr and Heisenberg. She emerges as the vehicle the audience uses to understand the profound implications of the moral dilemma faced by individuals who have the knowledge to create something as deadly as an atomic bomb and how they must each deal with their own consciences. She proves to be the key to understanding the broad world changing implications of the 10-minute conversation between two men who may well have held the fate of the world in their hands!

Needless to say, I was most impressed by this play. I immediately thought that Oak Ridge is THE place where this play should be promoted. I soon learned from Lee Riedinger, UT Professor of Physics, that the play was actually brought here to Knoxville as a result of the *Quark Matter 2009* international physics conference that brought over 600 physicists from 35 countries to Knoxville. The Oak Ridge National Laboratory organized the conference along with the University of Tennessee, Vanderbilt University, Duke University, Florida State University, North Carolina State University and Georgia State University.

Lee responded to my comment that I would love to see *Copenhagen* presented at the Y-12 New Hope Center as I thought that an appropriate venue for such a profound play, by reminding me that two other related performances had actually been conducted in Oak Ridge. Those were *The Trial of Robert Oppenheimer* by Paul Ebert, presented at the Oak Ridge Playhouse and a dramatic reading about Lise Meitner, who with Otto Hahn discovered nuclear fission. She was overlooked by the Nobel Prize committee who presented Hahn with the award.

I called Bonnie Nestor who along with Gene Spejewski and Charlie Crume performed the Meitner dramatic reading. She told me of the several times the reading was done through Oak Ridge Institute for Continued Learning and at the Museum of Science and Energy.

I also learned that ORICL provides a class that consists of two parts: a backstage tour of the theater and lectures by the artists for the Clarence Brown Theater production of *Copenhagen* and attendance at a nighttime presentation of the play with a post-performance talk back with the actors. The tour and lecture will be followed by lunch at Bravo's Italian Restaurant which specializes in homemade pasta and original Italian dishes. The performance will be preceded by an elegant dinner at The Orangery, East Tennessee's most awarded restaurant. This information was taken from the ORICL web page.

Think of the potential of presenting the three plays in Oak Ridge as a series at the Y-12 New Hope Center. I believe we could attract a huge audience.

*The Trial of Robert Oppenheimer* might need to be revised a bit now that the book *The American Prometheus* sheds some additional light on the trial and the testimony of Edward Teller and Lewis Strauss, both of whom sealed the fate of Oppenheimer with their pointed and derogatory statements.

The dramatic reading featuring the story of Lise Meitner could quickly be brought back. What a tremendous potential this one has for the search for "ultimate truth" and the sad commentary on fairness.

Lastly, *Copenhagen*, could be revived from Paul Ebert's script and with proper permissions performed regularly in Oak Ridge. I believe these three powerful plays could add dramatically to Oak Ridge's heritage tourism potential.

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Program for Copenhagen, the Play running at UT's Clarence Brown Theatre through April 11, 2009