

BURNING
C O A L
THEATRE
COMPANY
PRESENTS



COPENHAGEN

WRITTEN BY MICHAEL FRAYN

ARTISTIC DIRECTOR'S NOTES

"You play happily with your toy cap-pistol. Then someone else picks it up and pulls the trigger...and all at once there's blood everywhere and people screaming, because it wasn't a toy at all." - from *Copenhagen* by Michael Frayn

The people who monitor the so-called "Doomsday Clock" have said we are closer to "midnight" (a quaint stand-in for "nuclear war") than any time since the invention of the atomic bomb. In *Copenhagen*, Michael Frayn asks what is really an age-old question: who has served better, the person who *says* they are going to do something, or the person who actually does it. Our terrific scenery designer, Xinyung Li asked me why I wanted to do *Copenhagen* right now. I gave him my answer, and now I give it to you. Any war is a hideous failure on the part of governments, but nuclear war is a threat to every living thing on the planet, to life itself. That fact, rather than be ignored, used as a political football or worse, a dare to one's enemy, as in "They wouldn't dare use nuclear weapons", perhaps we should mend our war-mongering ways. To rid ourselves of the garbage policies that have brought us to the brink, along with their authors.

Copenhagen has something on its mind, and it took me awhile to find it, but when I did, I became very excited about doing this play. The play is filled with a surface musicality of language that is intoxicating. It is full of brilliant ideas set in a cavalcade of words. It presents a dream meeting between two of history's most important and creative men, along with one of their wives. And it allows us to turn over and over a mysterious 1941 meeting when Werner Heisenberg, working with the Nazis, travelled to occupied Denmark to meet his old teacher, collaborator, mentor and friend, Neils Bohr and wife, Margrethe. But why did he come? And why did their meeting end abruptly, with no clear result. Years later, neither Heisenberg nor Bohr could clarify what happened at the meeting, each changing their story several times, without ever coming to a definitive conclusion. However, piecing together facts from history, the often comic writer Michael Frayn, who is most known for the wildly successful farce *Noises Off*, has created a different kind of mousetrap, one that attempts to capture the answer to this question. In doing so, he has created what I believe to be one of the most straightforward, powerful and humane anti-war plays written since the advent of the bomb. And like any good artist, he has buried that message inside a jewel box of a play.

Among the characters in *Copenhagen*, we find one who has hurt many people, one who has literally never hurt another living being, and one who has defended the former. By the play's end, we begin to hear, for the first time, who is who.

Today, as war rages at savage levels that I have not seen in my lifetime, and good and innocent people are falling under the thrasher blade of arrogance, ego, selfishness and genocidal rage, I would like to dedicate my work on this production to one such young girl, a girl who indeed never hurt another living being. Her name was Hind Rajab. She puts us to shame.

-Jerome Davis/Artistic Director—October, 2024

BURNING COAL THEATRE COMPANY SM

Jerome Davis, Artistic Director

Simmie Kastner, Managing Director

Presents

Copenhagen

by Michael Frayn

Directed by

Jerome Davis

Composer

Christian Stahr

Production Stage Manager

Jessica Regehr

Assistant to the Director

Susanna Skaggs

Act One: 1:15 / Intermission: 15 / Act Two 1:00

Scenery Design Xiang Li

Lighting Design Christopher Popowich

Costumes Design **Matthew Snellgrove**

Sound Design Juan Isler

Dialects Coach **Natalie Blackman**

Technical Director/Master Electrician Barry Jaked

Scenic Charge Artist Meredith Riggan

House Manager Carry Vaughan-Sprouse

Assistant Stage Managers Courtney Pisano, Abby Patrick

Assistant to the Lighting Designer Julianna Babcock

Study Guide Eric Kildow

Board Op Addison Florio

Assistant to the Scenic Artist ColeTrain

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Burning Coal is a member of Theatre Communications Group, a national consortium of professional theatres, the NC Theatre Conference, Arts NC, NC Center for Non-Profits and the Downtown Raleigh Alliance.

CAST

(In Alphabetical Order)

Lynda Clark Margarethe Bohr
Ian Finley Werner Heisenberg
Brian Linden* Niels Bohr

*Denotes membership in Actors' Equity Association

MUSICIAN

Lauren Hess Violist

Physics Phun Phact—Complementarity

How you measure something determines what you see (wave or particle behavior). For example, if you send particles (photons or electrons) through two slits, they produce an interference pattern because the particle goes through both slits at once and interferes with itself. If you try to determine which slit it went through (or block one slit at a time to force it to go through the other), you get not an interference pattern but rather two well-defined traces. The conditions under which the interference pattern is produced forbid a determination of the slit through which the particle passes.

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Who's Who in the Cast & Crew

Julianna Babcock (Assistant to the Lighting Designer). This is Julianna's second production working with Burning Coal. Recently, Julianna was the lighting designer for the Summer Theatre Conservatory's *Matilda Jr.* With experience spanning over 10 shows, she has contributed as a lighting designer, assistant director, set designer, choreographer, and actress. She has a passion for lighting design and is dedicated to developing her unique style as a designer.

Natalie Blackman (Dialect Coach). New York credits include appearances at The Duke on 42nd Street, Circle in the Square, Theatre Row, the New Ohio Theatre, and The Tank. Regional credits include the Illinois Shakespeare Festival, the Utah Shakespeare Festival, Pioneer Theatre Company, Penfold Theatre Company, and the Classic Theatre of San Antonio. Her solo show, *Disorder*, was a bestseller and award winner at the United Solo Festival in New York City, the world's largest solo theatre festival. Blackman currently serves as Assistant Professor of Voice and Acting at the University of North Carolina at Greensboro. Blackman is a certified Fitzmaurice Voicework® teacher and will complete her Knight-Thompson Speechwork® certification this fall. Blackman holds an MFA in Classical Acting and Civic Engagement from Illinois State University and a BFA from the University of Utah's Actor Training Program. natalieblackman.com.

Lynda Clark (Margarethe Bohr; Costuming Assistant) is an accomplished theatre artist with numerous film and television credits including *Crazy People*, *The Perfect Crime*, *I Know What You Did Last Summer*, *The Water Is Wide*, and recurring roles on the CBS series *American Gothic* and in Showtime's *Linc's*. Lynda was part of a team of theater professionals who originated the NC State University summer repertory program that became known as Theatrefest, where she was a leading lady for more than thirty years. She has appeared extensively on most of the regional stages, including Theatre in the Park, North Carolina Theatre, William Peace University Theatre, Manbites Dog, Theatre Raleigh, Temple Theatre, Virginia Stage, and Cape Fear Regional Theatre. Previously for Burning Coal include *The Cherry Orchard*, *All The King's Men*, *Macbeth*, and *Night and Day*. As Director: *Moonlight*. Previously at TIP: *Switzerland*, *The Lion in Winter*, *Angels in America*, *Who's Afraid of Virginia Woolf*, *Raleigh*, *Harold and Maude*, and many others. Recent projects include *This Little Show of Mine* with Ellyn Daniels, streaming on Amazon; and *The Evil*

Queen Shivarous 1000 for Creative Visions LED Adventure. She appears extensively in regional commercials, industrials, training films and voice-overs. When not performing, Lynda works as a director, producer, costume designer and acting coach. She has been recognized as one of our region's most distinguished theatre artists, with a career spanning four decades.

Jerome Davis (Director). For Burning Coal Theatre: *A Little Night Music, Arcadia, Evita, Ashe in Johannesburg, The Weir* (twice), *Rat in the Skull, Pentecost, Winding the Ball, Steward of Christendom, Night & Day, Company, Road to Mecca* (twice), *Juno & the Paycock, Accidental Death of an Anarchist, Taming of the Shrew, Inherit the Wind, Hamlet, Hysteria, Prisoner's Dilemma, 1960, The Seafarer, Shape of the Table, Enron, Jude the Obscure Parts 1 & 2, Shining City, The Heretic, Iron Curtain Trilogy* (Raleigh and London), *Sunday in the Park with George, Spoonface Steinberg, Written on the Heart, Dark Vanilla Jungle* (London), *Iphigenia in Splott* (Raleigh and DC). Acting: *Love's Labours Lost, Mound Builders, St. Nicholas, Skylight* and *Talley's Folly* (Raleigh and London). Also, *Skylight* in Orlando and *King Lear* (Lear/Wilmington). Other: *See How They Run* (Southern Pines), *Twelfth Night* in Apex and *Turn of the Screw* for NC Opera. Jerry worked with or studied with Uta Hagen, Adrian Hall, Richard Jenkins, Hope Davis, Horton Foote, Denis O'Hare, Nikos Psacharapolous, Julie Bovasso, Ralph Waite, Oliver Platt, Ben Gazzarra and Ellen Burstyn at Trinity Rep (Providence), People's Light & Theatre (Philadelphia), NJ Shakespeare, SoHo Rep, Barrow Group, Columbia University, Phoenix Theatre (SUNY/Purchase). This is his 28th year running Burning Coal which he and his wife Simmie Kastner founded in 1995. He received the 2019 Raleigh Medal of Arts.

Ian Finley (Werner Heisenberg). For Burning Coal Theatre: *A Little Night Music, Arcadia, Sunday in the Park with George, The Jesus Fund, Twelfth Night, Pentecost, 1776, The Taming of the Shrew, Inherit the Wind, 1960* (playwright), *Jude the Obscure Parts 1 & 2* (playwright), *The Greeks* (playwright). Other regional: *Ragtime, Our Town, Moving Pieces*. Ian is a proud graduate of the Actor Training Program at the University of Utah and the Goldberg Playwriting Program at NYU. He is a recipient of the Kennedy Center's Jean Kennedy Smith Award (for *The Nature of the Nautilus*) and served as the 2012 Piedmont Laureate in Playwriting & Screenwriting.

Addison Florio (Board Operator) is an early highschool graduate from Score Academy and is delighted to return to Burning Coal Theatre for their 28th season. For Burning Coal Theatre: *Arcadia, Moonlight, Hymn, A Little*

Night Music, KidsWrite Festival 2023/24. From an early age Addison has been involved in the arts: on-stage, production crew, stage managing, and assistant directing.

Lauren Hess (Violist). This is Lauren's second production with Burning Coal Theatre. In July, she appeared in the Summer Theater Conservatory's production of *Matilda Jr.* (Mrs. Phelps/Violist). She has recently stepped into the world of theatre, appearing in *The Sound of Music: Youth Edition* (Herr Zeller) and *Descendants the Musical* (Maleficent). This is her 8th year playing the viola and she is excited for the opportunity to use her talents in a new way. She currently attends Enloe High School.

Juan Isler (Sound Engineer), a native of Kinston, NC, grew up singing and earned a music business degree from Winston-Salem State University. He has worked as a technical director for a local news station, been a DJ in a local nightclub, and a choir director. He has worked on more than 50 plays in venues across the Triangle and Triad of North Carolina. Juan's successes have been seen in all areas of theatre, as an actor, designer, technician, and director. He is a recent recipient of the City of Raleigh Arts Commission's Medal of Arts award and a current member of the Arts Commission. He is currently a Finance and Operations Specialist at NC State University.

Barry Jaked (Technical Director). Barry is the Resident Technical Director and has been working as a Technical Director or Master Electrician for Burning Coal since 2011. Most recently for Burning Coal, *A Little Night Music, Moonlight, Hymn, Arcadia*. If it needs to be built, plugs in, and turns on; he takes care of it. He would like to thank Jerry Davis for putting up with him for all these years.

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The poster features a vibrant background with horizontal bands of orange, red, and teal. A large, ornate crown is the central focus, with a sword resting on top. The text is bold and clear, providing all necessary event information.

Eric S. Kildow (Dramaturg). For Burning Coal: Many shows including *Brigadoon*, *As You Like It*, *Shining City*, *Good, Ruined*, *The Heretic*, *(3 Men) Tempest*, *Jesus Fund*, *Diary of Anne Frank*, *The Wiz*, *Blue Sky*, *Spoonface Steinberg*, *Oakwood*, *Skylight*, *Written on the Heart*, *Heisenberg*, *The Royale*, *Darkside*, *Peter Pan & Wendy*, *Normal Heart*, *King Charles III*, *Stuff Happens*, *Ashe in Johannesburg*, *The Container*, *Camelot*, *Animal Farm*, *A Hundred Words for Snow*, *Conversations I Always Wanted to Have*, *Evita*, *I & You*, and *The Road to Mecca*. Eric is Associate Professor of Theatre at Kent State University and works as a freelance dramaturg & director. As an artistic associate of the London-based Loitering With Intent, he presented the devised work *Turn Right/ Turn Left: A Manual for the End of the World* at Fleet Street Theatre in Hamburg. He is a member of Stage Directors & Choreographers Society, Literary Managers & Dramaturgs of the Americas, Lincoln Center Director's Lab and Burning Coal.

Xinyuan Li ("Lee") (Set Designer). Lee is a LA-based Set and Lighting Designer. He obtained dual master's degrees in Scenic and Lighting Design from the University of Massachusetts Amherst, and bachelor's degree in Lighting Design from the Shanghai Theatre Academy (China). Lee is currently a visiting assistant professor at Occidental College, and a member of George Tsybin Opera Factory and James F Ingalls Lighting Studio. His design works include *Dido of Idaho* (CA), *Pang Spa* (CA), *Yellow Face* (CA), *American Fast* (IN), *A Little Night Music* (NC), *What If Only* & *Air* (NC), *The Water Station* (MA), Shanghai Jazz Music Festival, and more. As design assistant, he has been closely involved in productions such as the opera *Beatrice Di Tenda* (Paris Bastille Opera), the ballet *The Art of Fugue* (Bolshoi Theatre, Moscow), the opera *The Gambler* (Salzburg Festival, Austria), the cultural and tourism project *the Great Chin* (Xi'an), and the music concert *Monochromatic Light (Afterlife)* (Park Avenue Armory, NY), as well as the play *The Seagull* (Druid Theatre Co., UK). Please visit xinyuanlidesign.com and follow him on Instagram @leekhalil.

Physics Phun Phact—Uncertainty

Copenhagen interpretation

According to what became known as the "Copenhagen interpretation" of quantum mechanics (though Bohr and Heisenberg did not call it that), the behavior of a particle is described completely by its wave function (or, equivalently, by the matrix formulation of Heisenberg), which contains the maximum amount of information that nature allows us concerning the particle's behavior. It describes the probabilities of the outcomes of measurements on the system. Thus quantum mechanics is indeterminate at its foundation. However, in the appropriate limit (large objects, small energy changes) its predictions approach those of classical physics (*correspondence principle*).

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by Michael Frayn
October 10-27, 2024

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by N. Richard Nash
December 5-22, 2024

Paint Me This House Of Love

by Chelsea Woolley
January 30-February 16, 2025

Being Chaka

by Tara Amber, Chuk Obasi,
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Merrily We Roll Along

by Stephen Sondheim
and George Furth
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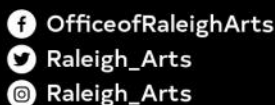
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BURNING COAL PRODUCTION HISTORY

1997/98 Season

Rat in the Skull by Ron Hutchinson—RP
Love's Labours Lost by Shakespeare
Pentecost by David Edgar —RP

1998/99 Season

Winding the Ball by Alex Finlayson—AP
Einstein's Dreams by Kipp Cheng—RP
Question of Mercy by David Rabe —RP
History of King Henrie the Fourth by R. Rand —WP

1999/00 Season

The Steward of Christendom by Sebastian Barry —RP
St. Nicholas by Conor McPherson —RP
Romeo & Juliet by Shakespeare
Night and Day by Tom Stoppard

2000/01 Season

The Weir by Conor McPherson —RP
Macbeth by William Shakespeare
Uncle Tom's Cabin by Rand and Kay —WP
Watership Down by Deb Royals from Adams —WP

2001/02 Season

A Doll House by R. Rand from Ibsen —WP
The Mound Builders by Lanford Wilson —RP
Company by Sontheim and Furth
Road to Mecca by Althol Fugard —RP

2002/2003 Season

Travesties by Tom Stoppard —RP
Juno and the Paycock by Sean O'Casey
Tartuffe by R. Rand from Moliere —RP
Crumbs from the Table of Joy by Lynn Nottage —RP

2003/2004 Season

All the King's Men by Adrian Hall —WP
Waiting for Godot by Samuel Beckett
Man Who Tried to Save the World by Davis/Kay (from Scott Anderson) —WP

2004/2005 Season

James Joyce's The Dead by Nelson & Davey —RP
90 in 90 by Jerome Oslar / *Safe House* by Lydia Stryk —AP
Lipstick Traces by Rude Mechs —RP
Accidental Death of an Anarchist adapted by Simon Nye from Dario Fo —AP

2005/2006 Season

Taming of the Shrew by William Shakespeare
A New War by Gip Hooge —RP
A Map of the World by David Hare —RP
Miss Julie adapted by Kelsey Egan and Jack Lienke from Strindberg —WP

2006/2007 Season

1776 by Stone and Edwards

Einstein's Dreams by Kipp Cheng
Pentecost by David Edgar
Midsummer Night's Dream by Shakespeare

2007/2008 Season

Hamlet by William Shakespeare
Love Song of J. Robert Oppenheimer by Carson Kretlyzer —RP
Inherit the Wind by Lawrence and Lee
Crowns by Regina Taylor —RP

2008/2009 Season

The Prisoner's Dilemma by David Edgar —AP
Hysteria by Terry Johnson —RP
Twelfth Night by Wm. Shakespeare
Way to Heaven by Mayorga & Johnston —AP
1964 by Ian Finley & Burning Coal —WP

2009/2010 Season

Hair by Ragni, Rado & McDermott
Much Ado About Nothing by Shakespeare
The Seafarer by Conor McPherson —RP
SECCA by Angus MacLachlan —WP
Gee's Bend by Elizabeth Wilder —RP

2010/2011 Season

To Kill A Mockingbird by Harper Lee
St. Nicholas by Conor McPherson
Crowns by Regina Taylor
Blue by Kelly Doyle —WP
The Shape of the Table by David Edgar —AP

2011/2012 Season

Errors by Lucy Prebble —RP
Henry V (on Trapeze) by Wm Shakespeare
Man of La Mancha by Danon, Leigh & Wasserman
Jude the Obscure, Parts 1 & 2 by Finley, Fitts & Benedict (Hardy) —WP

2012/2013 Season

Bingedon by Lerner & Loewe
Shining City by McPherson—RP
As You Like It by Shakespeare
Good by C.P. Taylor
Ruined by Lynn Nottage —RP

2013/2014 Season

The Heretic by R. Bean —AP
(3 Men Tempest) by Shakespeare
Jesus Fund by T. Miner—WP
Diary of Anne Frank by Hackett/Goodrich

2014/2015 Season

Iron Curtain Trilogy(D) Edgar WP
Romeo & Juliet by Shakespeare
Sunday in the Park with George by Sontheim & Lapine

2015/2016 Season

Asylum —WP
The Wiz by Smalls & Brown
Blue Sky by Clare Bayley—AP
Spoonface Steinberg by L. Hall—AP

2016/2017 Season

Skylight by David Hare
Written on the Heart by D Edgar—AP
Heisenberg by S. Stephens—RP
The Royale by Marco Ramirez—RP

2017/2018 Season

Darkside by Stoppard/P Floyd—RP
Peter Pan & Wendy—WP
The Normal Heart by L. Kramer
King Charles III by M. Bartlett—RP

2018/2019 Season

Stuff Happens by David Hare
The Weir by Conor McPherson
Ashes in Johannesburg by Hannah Benitez—WP
The Great Celestial Cow by Sue Townsend—RP

2019/2020 Season

The Container by Clare Bayley RP
Camelot by Lerner & Loewe
Talley's Folly by Lanford Wilson
Silent Sky by Lauren Gunderson (postponed)

2020/2021 Season

A Hundred Words for Snow by Tatty Hennessey
Until the Flood by Dael Orlandersmith RP
Forever by Dael Orlandersmith RP
Evita by Andrew Lloyd Webber & Tim Rice

2021/2022 Season

I and You by Lauren Gunderson
The Road to Mecca by Althol Fugard
Art by Yasmina Reza
Galileo by David Edgar/Brecht RP

2022/2023 Season

a great big wooly mammoth ... by Tatty Hennessey WP
Silent Sky by Lauren Gunderson
Milne's Tale by Lynn Nottage RP
The Cherry Orchard by Anton Chekhov WP

2023/2024 Season

Arcadia by Tom Stoppard
Moonlight by Harold Pinter
Hymn by Lolita Chakrabarti
A Little Night Music by Sontheim and Furth

WP = World Premiere / AP = American Premiere / RP = Regional Premiere

Take a Seat Campaign

After sixteen years of bringing quality professional theatre to downtown Raleigh, Burning Coal Theatre Company finally had to 'retire' our old audience chairs. We've replaced them with some of the very best quality chairs in the business, thanks to our "Take a Seat" campaign, and those who contributed. Thanks to all of them. If you'd still like to participate in the campaign by naming a chair with a plaque on the chair, or by getting your name added to this list, which will be in every one of our mainstage programs going forward until these new chairs themselves need to be replaced. The cost of naming a chair is \$500. We have approximately 50 more chairs to be named.

Jeanne Abmayr

Anonymous

William David Austin

Julie Bagley

Carla and Don Berryann

Pamela Blizzard and Willis

Lumpkin

Alli Mae Carnes

Lynda Clark

Lucy Daniels

Phyllis and Martin Demko

Alec and Georgia Donaldson

Jean Gross and Donald Miller

LanYing Fan

Ian Finley

Forest Commons

Abbe Fralix

Friends of John Allore

Martha Gerrity

Linda Grew

Mark and Carol Hewitt

Martha Huelsbeck and Chris

Bavolack

Dave and Sue Huff

Paul Leone

Griffin Lockett

Amelia Lumpkin

Leah Mazade

Christopher & John McLachlan

John Paul Middlesworth

Kathleen Milligan

Judith Moore

Michael O'Foghludha

Russ and Heather Owen

Janet Ramey & Dave Edwards

Connie and Robert Shertz

Angela Santucci

John Sarratt and Kathy

Klotzberger

John Shutt

Ian Shields

Mary and Gerald Sibrack

Mike Sneed and Marizol

Martinez

Louise Stanley

Blaise and Katalin Strenn

Elizabeth Strickland

Barry Sullivan and Alan Scott

Ike Takahashi

Mark and Judy Thompson

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David Wade

Brian Linden (Bohr) is happy to return to Burning Coal Theatre Company where he made his debut seventeen years ago in *The Love Song of J. Robert Oppenheimer*. Since then, he has performed with the company in *The Road to Mecca*, *Darkside*, *Hysteria*, and David Edgar's *Iron Curtain Trilogy* here and at the Cockpit in London. Regionally, he has appeared in *Picasso at the Lapin Agile*, *Lend Me a Tenor*, and *Dr. Jekyll and Mr. Hyde* at Chenango River Theatre; *Waiting for Godot* at the Colonial Theatre; *A Bold Stroke for a Wife* in the Expand the Canon Staged Reading Series at the Pittsburgh International Classic Theatre; *Better* at Bridge Street Theatre; and at Shakespeare festivals on Shelter Island, Nebraska, Pennsylvania, San Francisco, Carmel, Idaho, and Marin. He lives in New York City where he has recently been part of a developmental workshop for *McCourt*, an adaptation by Ilya Khodosh of the novels *'Tis* and *Teacher Man* with Tenney Diamond Productions. He sends his love to his companion VRS and in memory of CBX.

Abby Patrick (Assistant Stage Manager). Abby is excited to be on the crew for *Copenhagen!* She was recently onstage at Burning Coal for *KidsWrite 2024* and at Raleigh Little Theatre in *My Wonderful Birthday Suit*. Favorite backstage credits include *Beauty and the Beast*, *Assassins*, and *Dracula*. Abby holds a BFA in musical theatre from William Peace University.

Courtney Pisano (Assistant Stage Manager) For Burning Coal: *A Little Night Music*, *Hymn*, *Moonlight*, *Arcadia*, *Talley's Folly in London*, *The Life of Galileo*, *Art*, *Evita*, *A Hundred Words For Snow*, *Talley's Folly*, *Camelot*, *Oakwood Series (2019, 2018, 2017, 2016)*, *KidsWright (2018, 2013, 2009)*, *The Great Celestial Cow*, *Ashe in Johannesburg*, *The Weir*, *As You Like It*, etc. Courtney is a Burning Coal Company Member, and graduated from UNC Chapel Hill with a degree in Media Production – Go Heels! She would like to thank the birds that live in her book-shaped birdhouse, for no other reason, but that it allows her to make bookworm jokes.

Christopher Popowich (Lighting Designer) has designed the lighting for numerous productions for Theater, Opera, and Dance in Canada, the UK, Asia, and the United States. His professional highlights include the world premiere of *Balls* and the Asian premiere of *Art*, for Singapore Rep; *Nonsense* in Rome for Teatro Dell'Orologio; *Journey West* in London and the Edinburgh Fringe Festival; *Terrorism* and *A Midsummers Night's Dream* in London. He is a frequent designer for Burning Coal Theatre Company in

Raleigh. Recent productions: *Moonlight*, *Arcadia*, *The Cherry Orchard*, *Mlima's Tale*, *Road to Mecca*, *Oscar and Walt*, *I and You*, *Evita*, *Camelot*, *The Weir*, *King Charles III*, and *The Royale*. Christopher's opera design credits include *The Ring Saga*, *Magic Flute*, *Lost in the Stars*, and *Soldiers Tale* for Opera Theatre of Pittsburgh. Other Pittsburgh credits include *The Skull of Connemara*, *House*, *Julius Caesar* and the Beckett Festival for Pittsburgh Irish and Classical Theatre. In Canada, Christopher's work includes shows for Alberta Theatre Projects, Calgary Opera, Toronto Workshop Productions, Stephenville Festival, and the Globe Theatre. He is Co-owner and Principal Designer in C & C Lighting, an architectural and entertainment lighting design company (cclightingdesign.com) located in Pittsburgh. Major projects include lighting for the Gulf Tower, the Koppers Building, the Hunt Library and the Randy Pausch Memorial Bridge.

Jessie Regehr (Stage Manager). This is Jessie's first production with Burning Coal Theatre. She has been acting on stage since age 7, and made her film debut more recently, in *The Problem of The Hero*. She holds a Bachelor's of Arts in Theatre from Campbell University, where Jessie was involved in over ten university productions, including *When She Had Wings* (Wingman), *Graceland/Asleep on the Wind* (ASM), *The Many Adventures of Winnie the Pooh* (Kanga), and *Can't Buy Me Love* (Director). Jessie attributes their time at Campbell, and their work in the box office at Raleigh Little Theatre, as the catalysts for their love of stage management and arts administration. After graduation, Jessie spent 6 months in Florida making magic through the Disney College Program and is excited to be back in the Triangle theatre world!

Meredith Riggan (Scenic Charge Artist). Meredith is a North Carolina based artist and is excited to be returning to Burning Coal Theatre Company for the production of *Copenhagen*. This will be Meredith's 9th season painting for Burning Coal Theatre. After receiving her Bachelor's Degree in Scenic Art from the University of North Carolina School of the Arts, Meredith has worked as the Scenic Charge Artist at several theatres around North Carolina including William Peace University, Half Pint Theatre, Sweet Tea Shakespeare, Triad Stage, City Arts-Greensboro Children's Theatre, Winston Salem Theatre Alliance, ECU Loessin Playhouse, along with several freelance jobs such as painting for The International Festival and painting custom pet portraits through her business, Riggan Originals.

ColeTrain (Shop Dog/"Paint Assistant"). ColeTrain is excited to be a part

of another production at Burning Coal . He has been “assisting” his Scenic Artist Mom in several theatres since he was 7 weeks old. He has no formal training in Scenic Art, but will retrieve a paint brush occasionally. He is great at supervising projects, looking cute, and tries to leave a paw print on every set. ColeTrain is a 10/10 good boy.

Susanna Skaggs (Assistant to the Director) is an actor and recent alumna of UNC Chapel Hill. Her professional theatre career began at Burning Coal Theatre in their 2016 production of David Edgar's *Written on the Heart*. Since then, she has worked in film, television, and theatre. Her most recent film credit was playing Lina in the Netflix Original Rom-Com *Love and Gelato*. When she's not acting or working at Burning Coal, she loves to knit sweaters, watch as many movies as she can, and cuddle with her tuxedo cat, Pepper.

Matt Snellgrove (Costume Designer). *Dial M for Murder, Trouble in Mind, Die Zauberflöte, Fixing King John, The 39 Steps, 12 Ophelias, The Motherf*cker w/ The Hat, Jump, Do You Feel Anger?* (Kansas City, MO), *Ragtime* (Ithaca, NY), *Spring Awakening, Ragtime* (Flint, MI). Assistant Costume Design: *A Little Night Music* (Raleigh, NC), *Poor Clare* (Kansas City, MO). Matt has an M.F.A. in Costume Design from the University of Missouri- Kansas City Conservatory and a B.F.A. in Theatre Design and Technology from the University of Southern Mississippi. He currently resides in Kansas City with his husband and cat Miss Bernina.

Christian L. Stahr (Composer) is a Norwegian Composer, Music Director and Orchestrator, excited to work with Burning Coal again! In 2004 he served in the Norwegian Army, as a trumpet player, composer, music arranger and royal pianist for the King's Guard Band in Norway. He holds an MFA in Musical Theatre Writing & Composing from Tisch School of the Arts at NYU and has composed and orchestrated music for musicals, concerts, short films, and podcasts. For years, he was the pianist for the Dramatists Guild Fund of New York, where he performed for Alan Menken, Marc Shaiman, Stephen Flaherty, and Benj Pasek & Justin Paul, among many others. Between March 2018 and June of 2024 he was the Director of Culture for the Norwegian Seamen's Church and Cultural Center in New York City. In 2015, Christian was the Music Director for Burning Coal's production of *Sunday in the Park with George* where he met the love of his life, Sarah Lynn Winter. A year later he returned as the pianist for the play *Spoonface Steinberg*. And in March this year, he was Music

Director of *A Little Night Music*, working with his wife on the same stage they met 9 years ago. Now living in Raleigh, Christian is excited to work closely with the thriving Triangle theatre scene. Feel free to check out his music at www.stahrmusic.com.

Carry Vaughan-Sprouse (House Manager/ASM) has been with Burning Coal since 2013. She is a graduate of App State with degrees in Theatre Education and Creative Writing. Her most recent credits include: *I and You* (AD), *A Hundred Words for Snow* (AD), *A Great Woolly Mammoth Thawing from the Ice* (ASM) and *The Cherry Orchard* (ASM).

Special Thanks

City of Raleigh Arts Commission, NC Arts Council, United Arts of Wake County & Raleigh, Shubert Foundation . The Warner Fund . ManBites Dog Fund . Theatre in the Park. Play-Makers Repertory Company, David Ranii, Dennis Berfield and Raleigh Little Theatre, Downtown Housing Improvement Corporation, Cari Grindem-Corbett . Gabriel Simone, KD Kennedy, Nick Karner, House Managers & Ushers all the wonderful volunteers who have

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FUEL THE FIRE!

"Thanks to the generosity of our Fuel the Fire donors, we are over 2/3rds of the way to our goal of raising \$300,000 to upgrade your Burning Coal experience. So far, we have been able to hire an in-house Technical Director/Facilities Manager, purchase critically needed infrastructure upgrades (hello, new light board!) and are increasing the production value of each show 10 to 20%. This increase includes things like being able to hire bright new talent and spend more on material goods that bring these stories to life. It doesn't take a physicist to do the math, however, and we need your help to get to the finish line! Please consider donating to Fuel the Fire today, and your name will be added to this illustrious 'cast' in all our 24/25 and 25/26 programs."

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Kay Dickersin and Robert Van Wesep
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Larry Meisner Household
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TIMELINE OF THE DEVELOPMENT OF QUANTUM MECHANICS

~4th-5th cent. B.C. First theories of the atomic structure of matter developed in Greece.

1670s Isaac Newton concludes from the straight-line paths of reflected light that light is a particle. Robert Hooke and Christiaan Huygens (and later Augustin-Jean Fresnel) disagree, arguing based on other experiments that light is a wave.

1801 Thomas Young performs the double-slit experiment demonstrating that light behaves as a wave.

Albert Einstein explains the photoelectric effect (demonstrated by Hertz in 1887) based on Planck's hypothesis that light consists of discrete particles (photons). In another paper, he theoretically derives the equivalence of matter and energy, $E = mc^2$.

Geoffrey Ingram Taylor demonstrates that interference patterns of light are generated even when photons are introduced one at a time. This establishes the wave-particle duality of light, though this not yet recognized.

1912 Niels Bohr and Margrethe Nørlund marry.

Niels Bohr formulates the basic principles of the quantization of electron orbits in atoms (the *Bohr model*), providing a physical basis for Rydberg's empirical formula of spectral lines.

1922 Bohr is awarded the Nobel Prize in Physics "for his services in the investigation of the structure of atoms and of the radiation emanating from them." Werner Heisenberg meets Bohr for the first time, in Göttingen. Aage Bohr, fourth son of Niels and Margrethe Bohr, is born.

1924 Wolfgang Pauli formulates the *Pauli exclusion principle* that no two identical particles can occupy the same quantum state, explaining many features of the periodic table. Heisenberg arrives in Copenhagen to work with Bohr. Ernest Bohr, fifth son of Niels and Margrethe Bohr, is born.

1925 Samuel Goudsmit & George Uhlenbeck postulate the existence of electron spin. Heisenberg publishes a paper explaining the energy levels of an oscillator. The mathematics involved lead the way to the uncertainty principle. He works with Max Born and Pascual Jordan to develop the matrix mechanics formulation of quantum mechanics.

1926 Erwin Schrödinger publishes his wave equation formulation of quantum mechanics (wave mechanics). He shows that it is equivalent to the matrix mechanics formulation of Heisenberg. (A more rigorous proof of the equivalence was arrived at by John von Neumann in 1932.)

1927 Heisenberg develops his *uncertainty principle*. Bohr and Heisenberg develop the "Copenhagen interpretation" of quantum mechanics. Bohr presents the *complementarity principle*.

1928 Linus Pauling outlines the quantum-mechanical basis for molecular structure and bonding. Harald Bohr, sixth son of Niels and Margrethe Bohr, is born. He is institutionalized at the age of four due to severe mental disability and dies in 1938 of meningitis.

1932 James Chadwick discovers the neutron. Heisenberg is awarded the Nobel Prize in Physics for the creation of quantum mechanics.

1933 Leó Szilárd pitches the concept of a nuclear chain reaction then files a patent for a nuclear reactor.

1934 Christian Bohr dies in a boating accident.

1935 Schrödinger develops the "Schrödinger's cat" thought experiment, which illustrates what he saw as problems with the Copenhagen interpretation.

1937 Werner Heisenberg & Elisabeth Schumacher marry. From 1938-1950 they have 7 children.

1938 Otto Hahn and Fritz Strassmann observe the formation of barium (and other elements) when uranium is bombarded with neutrons.

1939 Szilárd and Enrico Fermi discover neutron multiplication in uranium. The first cyclotron is built in Copenhagen. The German nuclear weapons program is begun, with Heisenberg's participation.

1940 Germany occupies Denmark. Rudolf Peierls and Otto Frisch use the diffusion equation to estimate the critical mass of pure ²³⁵U needed to produce a nuclear weapon.

1941 Heisenberg visits Bohr in Copenhagen.

QUANTUM CONCEPTS MENTIONED IN COPENHAGEN

Fission, fast and slow neutrons, and the lump of cadmium

Natural uranium is 99.3% ^{238}U and 0.7% ^{235}U . The two are chemically the same (same number of electrons and protons) but ^{238}U has three more neutrons in its nucleus than does ^{235}U . To control a chain reaction (for use in a reactor) you need to *moderate* the neutrons, i.e. slow the fast neutrons down to make fission more likely. Graphite serves this purpose, which is what Enrico Fermi used in the “Chicago pile,” the first self-sustaining chain reaction at the Univ. of Chicago in December 1942. Pushing the graphite rods in made more fission happen (because it slowed the neutrons down), pulling the rods out reduced the number of fission reactions.

Calculation of the critical mass for a nuclear weapon

You can think of the critical mass in terms of critical *size*. You get a chain reaction (and, ultimately, an explosion) when on average more than one secondary neutron is produced in each fission.

In the spring of 1940 Otto Frisch said to Rudolf Peierls, “suppose someone gave you a quantity of pure 235 isotope of uranium—what would happen?” They estimated that the critical mass for a bomb made of pure ^{235}U was “about a pound,” (not tons, as would be required with natural uranium), which was too low because they did not account for the fact that some neutron captures by ^{235}U do not result in fission.

Isotope separation: getting to (nearly) pure ^{235}U

The two isotopes of uranium are chemically identical and thus difficult to separate. A lot of the Manhattan Project (especially at Oak Ridge, TN) was devoted to separating enough ^{235}U to make a bomb.

Cloud chamber

The cloud chamber is a means of visualizing the track of a high-energy particle.

Physics Phun Phact—Schrödinger's cat

Schrödinger used a thought experiment to identify what he regarded as a problematic aspect of the interpretation of the wave function. In this scenario a cat is in a sealed box with a radioactive nucleus and a flask of poison. If the nucleus decays the flask will be broken and the poison will kill the cat. After half an hour, is the cat alive or dead? We can't know if the nucleus will decay in that time (we can only know the probability that it will). The cat is in a combination of the alive state and the dead state until we make a measurement (open the box). It's not that we don't know whether it is alive or dead—the cat's wavefunction is made up of both states. The wavefunction “collapses” into one state when we make the measurement.



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