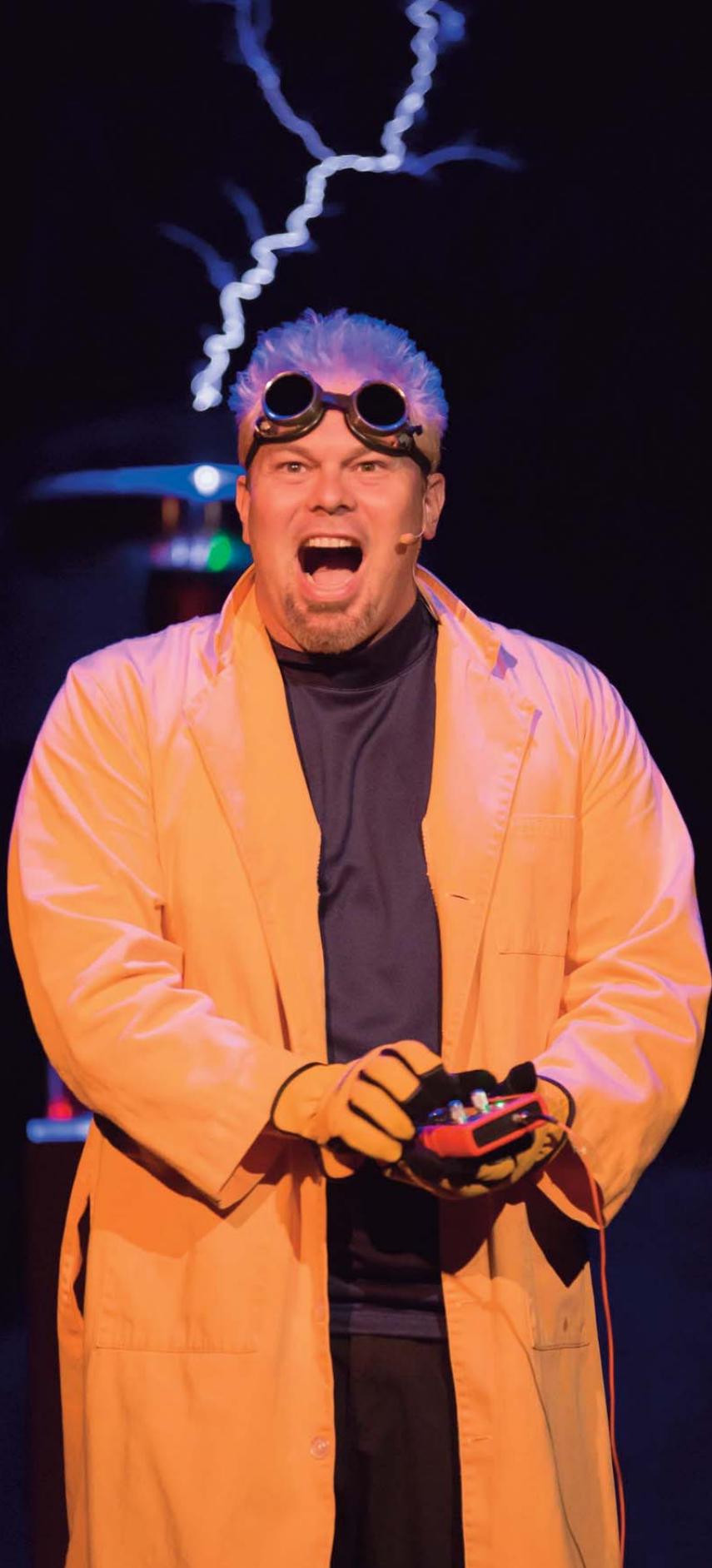


DOKTOR KABOOM

LIVE WIRE!
THE ELECTRICITY TOUR



S STATE THEATRE
NEW JERSEY

KEYNOTES

ABOUT THE SHOW



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*State Theatre New Jersey—creating extraordinary
experiences through the power of live performance.*

Portions of this guide adapted from materials
provided by The Kennedy Center's Artsedge.

cover photo: Scott Suchman

In *Live Wire! The Electricity Tour*, Doktor Kaboom makes science come alive, exploring principles of electricity including electromagnetism, how opposites attract, what makes static electricity, how to convert mechanical energy into electrical energy, and a cool trick you can do with plasma. To demonstrate these principles, he uses some impressive devices—including Tesla coils, Van de Graaf generators, and a ping-pong-ball-shooting robot. Although this is a one-man show, Doktor Kaboom invites the audience to help him conduct his experiments, teaching some serious science through laugh-out-loud comedy.

MEET DOKTOR KABOOM!

Doktor Kaboom is the creation of actor/comedian David Epley. David grew up expecting to be a research physicist. Then a biomedical engineer. Then a mathematician, an astrophysicist, a chemical engineer, a marine biologist. So, of course, he became an actor. For almost 30 years, he has written, directed, and performed original comedy shows throughout the U.S. and around the world. In 2006, brought together two of his great passions—science and theater—creating the character of a wacky German scientist named Doktor Kaboom.

David attended North Carolina's School of Science and Mathematics. He is a veteran of the US Army, and a former firefighter and EMT.

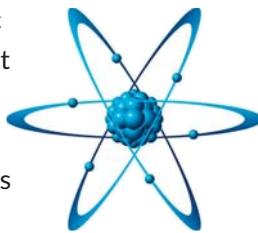


ELECTRICITY

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WHERE DOES ELECTRICITY COME FROM?

Electricity begins with **ATOMS**, which are the basic building blocks of everything. They are so small that millions could fit on a tiny pinhead. Atoms are made up of **PROTONS**, **NEUTRONS**, and **ELECTRONS**—how they interact with each other is where things really get interesting!



Protons have a positive charge and electrons have a negative one (neutrons have no charge). Because opposite charges are drawn to each other, protons and electrons usually stay in the same atom. But sometimes electrons make a radical move to another atom... and KABOOM! This is electricity.

ELECTROMAGNETISM

MAGNETS (materials that can attract other items) have two opposite points—north and south **MAGNETIC POLES**—where the magnet's force is the strongest. This creates a magnetic field that can create electricity. Some of the strongest magnets are made from an element called **NEODYMIUM** (pronounced nee-oh-DIM-ee-um). Magnetic fields are related to electric fields, but they do different things.



PLASMA

Substances have four states—solid, liquid, gas (think ice, water, steam), and another gas-like state called plasma that conducts electricity (think lightning). Plasma makes up the sun and stars, and it is the most common state of matter in the universe as a whole.



You can see plasmas in action in a fluorescent light bulb or neon sign, which are both made from tubes filled with a gas. When the lights are turned on, electricity flows through the tube, charging the gas and creating plasma. The plasma glows a special color depending on what kind of gas is inside.

In the show, Doktor Kaboom will demonstrate a device that uses a flow of electric charge—called electric discharge—to make an **ARC** (or current) of plasma in the air.



ON THE MOVE

If you rub a balloon on your hair, then move the balloon away slightly you will find that your hair stands on end. The balloon has an overall negative charge, while your hair has an overall positive charge. Opposite charges attract one another, so your hair is attracted to the balloon. These electrical charges don't move anywhere because your hair and the balloon don't conduct electricity very well. When electric charge builds up in one place and doesn't move, it's called **STATIC ELECTRICITY**.



CONDUCTORS (like metals) help electric charges move more easily. **INSULATORS** (like plastic) prevent charges from moving easily. **GROUNDING** removes a charge.

The flow of electrons is called **CURRENT**. In **DIRECT CURRENT**, the charge moves in one direction. In **ALTERNATING CURRENT**, it moves back and forth. Machines called **GENERATORS** turn energy created by movement (such as wind turbines) into electricity.

MEASURING ELECTRICITY

AMP – short for “ampere,” a unit for measuring the number of electrons moving in a circuit (a closed loop)



FREQUENCY – how fast sound or electromagnetic waves travel

RESISTANCE – the amount that a conductor slows the passage of current

VOLTAGE – the amount of pressure pushing electrons along an electrical current

WATT – a unit for measuring electric power

DOKTOR KABOOM'S PRINCIPLES OF SCIENCE (& SAFETY)



photo: Martin Albert

SCIENCE IS FOR EVERYONE.

Doktor Kaboom believes it is important to remember that science is not just for people in lab coats or the science fair winners. He believes that science is for everyone, and encourages people to never lose their love and interest for science.

WHAT DO YOU THINK?

- How is science an important part of everyone's life?
- What can we do to help ourselves remember that science is fun?

SCIENCE TAKES EFFORT.

Doktor Kaboom believes: "Science is not hard, but it does take effort. That's not hard, that's just work, and that's just life."

WHAT DO YOU THINK?

- Why do you think science takes a lot of effort?
- Can you think of a time you couldn't figure something out? Did you give up? How did you solve the problem?
- Is there something you love to do, even if it's difficult or requires a lot of patience and effort? What motivates you to put in the time and effort to do it? How can you apply this motivation to things you may not like to do as much?

EVERY PERSON IS VALUABLE.

Doktor Kaboom believes every person is intelligent, creative, valuable, and should know that about themselves.

WHAT DO YOU THINK?

- What does it mean to be intelligent? What does it mean to be creative?
- How can creativity help you in science?
- When do you feel valued?
- What are you capable of when you are confident in yourself?

ALWAYS PRACTICE SAFE SCIENCE!

As Doktor Kaboom says, "Science can hurt you, especially if I'm the one doing the science." In working with electricity, he has to watch out for sparks, burns, and fires.

Even an expert experimenter can face unexpected dangers, so Doktor Kaboom suits up even if there's only the tiniest chance it will be necessary.



GOGGLES: Much as they do for swimmers, goggles protect scientists' eyes.

GLOVES: Gloves protect Doktor Kaboom's hands.

LAB COAT: Long sleeves cover Doktor Kaboom's clothing and his skin.

SPARKS OF INSPIRATION

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These are some of the great scientists and inventors who helped the world understand how electrical energy works and made possible much of the technology we use today.



BENJAMIN FRANKLIN (1706-1790)

LIVED IN: Philadelphia, Pennsylvania

DISCOVERED: Positive and negative electrical charges, and that lightning is a form of electricity (the famous “kite and key” experiment).

INVENTED: Lightning rod, Franklin stove, swimming fins, bifocal lenses for eyeglasses, odometer (measures distance)

INTERESTING TO KNOW: Benjamin Franklin was the first Postmaster General of the United States. He was also a founder of the University of Pennsylvania and started the first public library in America.



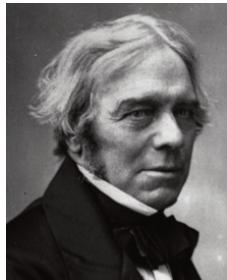
ALESSANDRO VOLTA (1745-1827)

LIVED IN: Como, Italy

DISCOVERED: Methane gas.

INVENTED: The first battery, called the “Voltaic pile.” The electrophorus, which produced static electricity.

INTERESTING TO KNOW: The words “volt” (a measure of electric pressure) and “photovoltaics” (converting light into electricity) were named for Alessandro Volta. Toyota named their new battery-powered concept car the “Volta.”



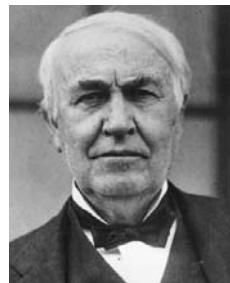
MICHAEL FARADAY (1791-1867)

LIVED IN: London, England

DISCOVERED: Electromagnetic induction—if he moved a magnet through a loop of wire, the wire would become electrified. The “Faraday effect,” that proved that light and magnetic force are related. Electrolysis, which uses electricity to separate matter. Also discovered the chemical benzene.

INVENTED: The dynamo, which converted motion into electricity. The “Faraday cage,” which blocks electric waves.

INTERESTING TO KNOW: Many scientists didn’t believe Faraday’s ideas because he didn’t have a college education—he was completely self-taught.



THOMAS EDISON (1847-1931)

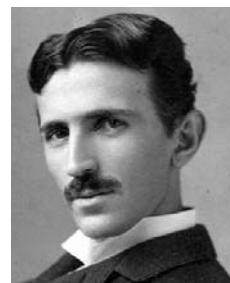
LIVED IN: Ohio and New Jersey

DISCOVERED: The “Edison effect”—the flow of electric current from a heated element to a cooler metal plate inside a vacuum. This discovery allowed

for the invention of radios, televisions, computers, and other wireless products.

INVENTED: An improved incandescent light bulb, sound recorder, movie camera, telegraph machines, electric vote recorder, stock ticker, microphone, batteries, X-ray machines - and more than 2,000 other devices.

INTERESTING TO KNOW: Thomas Edison was almost completely deaf. He lost most of his hearing as a young boy.



NIKOLA TESLA (1856-1943)

LIVED IN: Croatia, Hungary, France, New York, Colorado

DISCOVERED: Alternating current electricity, hydroelectric power, radio waves, radar, robotics

INVENTED: The “Tesla coil” electric transformer, the first long-distance power system, electric motors, loudspeakers, X-ray machines, remote controls, man-made lightning bolts.

INTERESTING TO KNOW: Nikola Tesla worked for Thomas Edison, but they later became enemies. One of Tesla’s best friends was the writer Mark Twain. Tesla Motors, innovators in electric cars and energy storage, is named after him.

DO AND DISCUSS

ELECTRIC BALLOONS

Use balloons to explore static electricity. You'll need:

- a dry winter's day
- two balloons
- two long pieces of string
- a piece of fur or wool clothing

Blow up and tie closed one balloon. Press it against the wall. Does it stick?

Now quickly rub the balloon back and forth against the fur or wool. Try the wall again. What happens, and why?

Next, blow up and tie closed a second balloon. Tie a piece of long string to each balloon. Rub both as before. Holding each by the string, try bringing them together. What happens? Why?

ELECTRICITY ALL AROUND US

Make a list of all the electricity you use in one day of your life. Include things around your home like lights (and don't forget things that run on batteries!). Also include things outside your house like traffic lights.

Get in a group with some of your classmates and compare lists. Are there any differences?

DISCUSS:

- What would life be like if electricity hadn't been discovered?
- Are there things you do that use electricity during your day that you could cut back on, and therefore use less electricity? What are other ways we can reduce the use of electricity?
- What did you learn about electricity during Doktor Kaboom's performance that you didn't know before?



photo: Jason Paddock

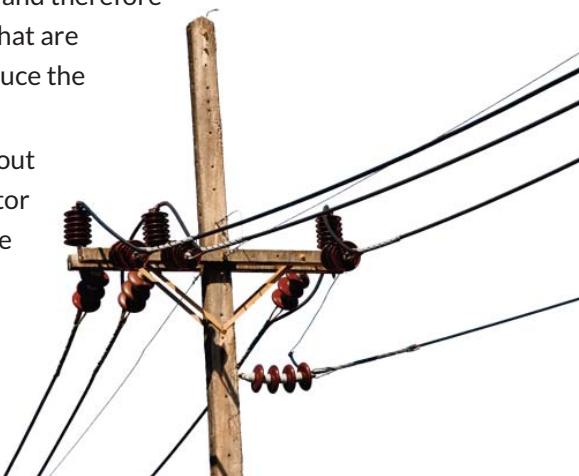
THEATER ETIQUETTE

Being a good audience member isn't rocket science—during the show, just stay seated and quiet, and remember to watch, listen, and clap. Review these basic rules before going to the theater.

WRITE A REVIEW

Imagine you are a critic for the school newspaper. Write a review of Doktor Kaboom: *Live Wire!* Use detailed descriptions to paint a picture with words so your readers can imagine what the show was like. In your review, answer these questions:

- Who was the performer? What did he look like? What did he sound like?
- What did the stage look like? The sets and lighting?
- What happened in the show? Describe in specific detail what you saw and heard, and also how it made you feel.
- Did the performance remind you of anything you have seen or experienced before?
- What was your favorite part of the show? Why?
- What was one thing from the show you learned about electricity that you didn't know before?
- If you could give Doktor Kaboom one suggestion for making the show even better, what would it be?



RESOURCES

WEBSITES

Doktor Kaboom

www.doktorkaboom.com

Doktor Kaboom/David Epley talks with kids about *Live Wire!*.

www.youtube.com/watch?v=vAS8aTOOxcg

Electricity and How to Use It Safely

www.switchedonkids.org.uk

Electricity for Kids

www.sciencekids.co.nz/electricity.html

Physics 4Kids.com: Electricity and Magnetism

www.physics4kids.com/files/elec_intro.html

Top Secrets about Nikola Tesla - History Channel

www.youtube.com/watch?v=5qqYuM8HC5k

KidsZone: Electricity

<http://www.enwin.com/kids/electricity/>

BOOKS

Electricity Demystified, by Stan Gibilisco. McGraw-Hill Education; 2nd edition, 2012.

Inventing the Future: A Photobiography of Thomas Alva Edison, by Marfe Ferguson Delano. National Geographic Children's Books, 2006. Grade 5 and above.

Nikola Tesla: A Spark of Genius (Lerner Biographies), by Carol Dommermuth-Costa. Lerner Publications, 1994. Grades 5-9.



EDUCATION & OUTREACH SUPPORTERS

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