North Cambridge Family Opera Company presents

POWERS

OF TEN

Words and Music by David Haines

Directed by Laura Backley, David Bass, and Craig Burket

Cambridge Science Festival 2014
Cambridge, Massachusetts
Congratulations

to all our friends and neighbors participating in North Cambridge Family Opera!

You are one of the local treasures that make this area a great place to live.

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About our company...

We are dedicated to representing our buyer and seller clients with integrity and professionalism. We are also committed to giving back to our community. Our agents donate $250 to a non-profit in honor of each transaction and Thalia Tringo & Associates Real Estate Inc. also gives $250 to a pre-selected group of local charities for each transaction. Visit us at 128 Willow Ave. in Davis Square.
presents

POWERS OF TEN

Words and Music by David Haines

Inspired by the book and film by
Ray and Charles Eames

Directed by Laura Backley,
David Bass, and Craig Burket

Producer: Carla Procaskey
Artistic Director: David Bass

Piano ................................................................. David Haines
Bass ................................................................. Christopher Edel
Slideshow ............................................................ Carla Procaskey
Logo Design ...................................................... Jennifer Fuchel
Graphic Design ................................................... Sue Hall
Website/IT Support ............................................. Nick Aiuto and Phil Budne

Special thanks to the Robbins/de Beaumont Foundation for their support of NCFO

The Andrew Peabody School, Saturday, April 26, 2014, 3:00pm
The Boston Museum of Science, Sunday, April 27, 2014, 5:00pm
INTRODUCTION: THE BEACH

PART ONE: THE JOURNEY DOWN THE MAGNITUDES
Narrator: Ishmael Sharif

TEN FINGERS (What is a base and why do we use base 10?)
OOM = 10^{-1} m = 0.1 m
Digory Digit:
Katarina Dvornik
Frankie Finger:
Ilan Balzac

THE LIFE THAT LIVES ON MAN (Vermin on your body)
OOM = 10^{-3} m = 0.001 m
The Head Lice:
Julia Elkind
Suzanne Elkind
The Flea:
Katarina Dvornik
The Follicle Mite:
Ellen Ryan

AMOEBA
OOM = 10^{-4} m = 0.0001 m

BACTERIA
OOM = 10^{-6} m = 0.000001 m

VIRUS
OOM = 10^{-8} m = 0.00000001 m

CHARMED QUARK
OOM = 10^{-18} m = 0.000000000000000001 m
Up Quark:
Anisha Nakagawa
Down Quark:
Mike Nakagawa
Strange Quark:
Kailash Nakagawa

STRING (The Planck distance)
OOM = 10^{-35} m = 0.0000000000000000000001 m
Soloist:
Kathy Lindsay

THE BEACH (REPRISE 1)

PART TWO: THE JOURNEY UP THE MAGNITUDES
Narrator: Kailash Nakagawa

INTERLUDE: SONGS FROM THE CAMBRIDGE PUBLIC SCHOOLS, 2013

- Amphibians Are Really Grand
  Graham and Parks School, 1st and 2nd grades
- Discovering My Body
  Morse School, 1st grade
- I’m a Wandering Albatross
  Amigos School, 1st grade
- Gravity Waltz
  King Open School, 3rd and 4th grades
- Science Is Real
  Baldwin School, Junior Kindergarten
Powers of Ten: Order of Program (cont’d.)

DON’T PICK THE DAISIES
(The nearby countryside)
OOM: $10^3 \text{ m} = 1,000 \text{ m}$

SONG OF THE TAMAR VALLEY
(The Tamar River Valley in Cornwall and Devon, UK)
OOM: $10^5 \text{ m} = 100,000 \text{ m}$

TECTONIC WALTZ (Continents)
OOM: $10^6 \text{ m} = 1,000,000 \text{ m}$

PLANET EARTH
OOM: $10^7 \text{ m} = 10,000,000 \text{ m}$
Soloist: David Haines

COOL MOON (The Earth-Moon system)
OOM: $10^8 \text{ m} = 1,000,000,000 \text{ m}$

93 MILLION MILES (Earth orbit)
OOM: $10^{11} \text{ m} = 100,000,000,000 \text{ m}$

EIGHT PLANETS (Solar system)
OOM: $10^{13} \text{ m} = 10,000,000,000,000 \text{ m}$
Including the Oort cloud,
OOM: $10^{16} \text{ m} = 10,000,000,000,000,000 \text{ m}$

EXOPLANET EXPLORER
OOM: $10^{18} \text{ m} = 1,000,000,000,000,000,000 \text{ m}$

STARGAZING (Visible stars)
OOM: $10^{19} \text{ m} = 10,000,000,000,000,000,000 \text{ m}$

BLACK HOLE (Milky Way galaxy)
OOM: $10^{21} \text{ m} = 1,000,000,000,000,000,000 \text{ m}$
Soloist: David Haines

GALAXY TO COSMOS
(The visible universe)
OOM: $10^{26} \text{ m} = 100,000,000,000,000,000,000,000 \text{ m}$
Soloist: David Haines

THE BEACH (REPRISE 2)

EIGHT PLANETS ROUND: sing along if you like!

Eight plan-ets or-bit-ing the sun.
What are their names, one by one?

Mer-cur-y is the first we see,
Ve-nus sec-ond and the Earth makes three, and then there's

Mars, Mars, the god of war.
Ju-pit-er and Sat-urn make one, two more.

U-ran-us is the sev-enth plan-et.
Nep-tune is last and com-pletes the set.
Powers of Ten: Singers and Artists

North Cambridge Family Opera Festival Chorus
Directed by Laura Backley, David Bass, and Craig Burket

Andy Adler
Ben Adler
Emma Adler
Ilan Balzac
David Bass
Nadine Berenguier
Kerri Brann
Beckett Brann-Singer
Ann Braude
Craig Burket
Kate DiTrani
Abbe Cohen Dvornik
Bert Dvornik
Katarina Dvornik
Chris Edel
Emma Ehring
Fiona Ehring
Julia Elkind
Suzanne Elkind
Melinda Gray
Susan Hall
Heather Hoffman
Hope Kelley
John Kernochan
Bryn Kerslake
Edward Kerslake
Zenas Kerslake
Kathy Lindsay
Tara McCaffrey
Julie McKinney
Jeff Moore
Anisha Nakagawa
Kailash Nakagawa
Mike Nakagawa
Mary Patterson
Mary Penniston
Laurie Poklop
Carla Procaskey
Rosalind Reid
Ruth Rogers
Ellen Ryan
Tara Shankar
Uma Shankar
Ishmael Sharif
Cora Smilack
Edwin Smilack
Jascha Smilack
Lindsey Smilack
Caroline Williams
Aimee Yermish

Members of Fletcher Maynard Academy Chorus
Directed by Deborah Greene

Kyah Adamson
Jungkeon Ahn
Angelyna Chreung
Anwesha Maity
**Powers of Ten: Singers and Artists, cont’d.**

**Members of St. Peter School Chorus**  
*Directed by Andrea Gaudette*

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Olivia Almeida</td>
<td>Grace O'Shea</td>
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<td>Orla Anderson</td>
<td>Sofia Rose Papatsoris</td>
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<td>Slater Anderson</td>
<td>Preeya Patel</td>
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<td>Tiara Biswas</td>
<td>Rohan Patel</td>
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<td>Alessandro Carleton</td>
<td>Dylan Pathiraja</td>
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<td>Francesca Cho</td>
<td>Hayden Plihcik</td>
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<td>Sophia Ferreira</td>
<td>Reese Plihcik</td>
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<td>Thomas Fino</td>
<td>Bernat Sepulcre</td>
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<td>Beyonce Hector</td>
<td>Hanna Smith</td>
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<td>Evelynn Hickey</td>
<td>Noa Tardif</td>
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<td>Siobhann Hickey</td>
<td>Emilie Theophile</td>
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<td>Wesley Jackson</td>
<td>Sarah Theophile</td>
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<tr>
<td>Chloe Lyons</td>
<td>Sophia Williams</td>
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<tr>
<td>Samantha Lyons</td>
<td>Mathias Why</td>
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**Many thanks to those providing artwork!**

- students of Lillian Martinez at the Baldwin School  
- students of April Silbert at Cambridge Street Upper School  
  - students of Kelley Mowers at King Open School  
- students of Lolly Lincoln at Fletcher Maynard Academy  
  - students of Andrea Gaudette at St. Peter School  
- current and former members of the NCFO Festival Chorus

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**SCALES TO SCHENKER: AN INTRODUCTION TO MUSIC THEORY**

Starting from scratch, we will cover fundamentals of Western music theory (intervals, notation, rhythm, harmony, form and analysis), with brief excursions into Acoustics, Psychoacoustics, Mathematics, Linguistics, Music History (including the 20th and 21st Centuries!) and Music Appreciation, focusing on orchestral music, chamber music and opera. Some class exercises will involve group singing. For adults and teens.

**Instructor:** Craig Lee Burket  
**Schedule:** 7 consecutive Mondays, 6/30/14 - 8/11/14  
**Location:** Veterans Memorial Building  
900 Main St., Millis, MA 20254  
7:00pm - 8:00pm  
**Fee:** $50 per person total for all 7 sessions
David Haines has been Cambridge Science Festival’s songwriter-in-residence since 2011 and has collaborated with NCFO in mounting science-based choral concerts each year since the festival’s inception in 2007. As a direct result of NCFO’s North American premiere of Powers of Ten in 2008, the work was chosen to open the inaugural USA Science and Engineering Festival in Washington DC on the most auspicious date possible, 10.10.10, featuring a choir of 250 local children, young people and adults, plus professional jazz soloists. It has received several UK performances, including at the British Science Festival in Birmingham with around 200 performers in September 2010.

David’s residency with Cambridge Science Festival falls into three parts: assisting NCFO in their science concerts; interviewing scientists about their work, then interpreting this for a general audience through the medium of music; and leading dozens of collaborative songwriting workshops in the city’s public schools each year, helping to create songs (mainly science-based) some of which he goes on to arrange for performances in both the UK and USA.

David’s career in science-song-writing goes back to 1984 when he was commissioned to write a set of Spring Songs for children, including “Hedgehog” (about hibernation), “Swallow” (migration) and “Queen Bee” (social insects). These songs later became part of the Lifetime science oratorio, premiered in North America in 2007 by NCFO as part of the first Cambridge Science Festival.

In 1988-9, David wrote his second children’s opera, Granny Galactica, about an astronomer and her grandchildren taking a tour of the galaxy courtesy of an alien robot with ulterior motives. Several songs from this show also found their way into Lifetime (“Four Billion Years”) and Powers of Ten (“Charmed Quark”, “Planet Earth”, “Moon”, “93 Million Miles”, “Black Hole”, and “Planets”).

David’s second professional chamber opera production (Northcott Theatre, Exeter), The Hypnos Hormone, was set in a sleep research laboratory where scientist Angelica is attempting to formulate a sleep antidote by studying a non-sleeping computer games programmer. This comedy nevertheless asks some serious questions about the ethics of science trials – especially where the subject doesn’t know the true research question – and about the effect of the scientific quest upon its human practitioners.

Several subsequent music theatre works have had scientific themes as central or sub-plots: The Chronovirus looks at the issue of ageing; while Prince Donald & The Average Family explores genetics. The overriding theme of this latter show is whether blood really is thicker than water, and the issue is further explored through the means of instantaneous home genetic testing – an innovation that seems to be approaching ever nearer in real life.

Both the above works are comedies with serious themes, but the mini-opera Blind Corner is a serious piece that examines a critical moment in time in the lives of a married blind couple. It explores the mixed emotions of the potential of regaining sight for the husband (blind since birth) and the wife (who lost her sight gradually over a number of years).

David says he has two main ambitions for the next few years: first, to create a “Sung Science Curriculum” which would encapsulate key points of learning for students K-12, so that singing and song-learning become a standard part of a science lesson every week of the school year; and second, to write a one-hour cantata about organ- and tissue-donation, based entirely on in-depth interviews with those involved with every aspect of the work, whether patients, families, medical practitioners, researchers... The aim would be to inform a general audience about the issues and practicalities involved, through personal stories, and thereby engage both hearts and minds.
Powers of Ten: Program Notes
A Science Oratorio by David Haines
Inspired by the book and film by Ray and Charles Eames

The narrative takes the form of two visionary journeys made by two brothers sitting on a beach on a summer afternoon. The first is gazing at his own hand and this becomes the starting point of his journey down the magnitudes of scale. The second is gazing out at the horizon and this leads him towards his own journey of the imagination up the scales of magnitude.

THE BEACH – An atmospheric evocation of a beach in summer, capturing that feeling of the oneness and strangeness of the universe that sometimes comes to us in a beautiful setting when ordinary things suddenly appear extraordinary and mysterious.

PART ONE: THE JOURNEY DOWN THE MAGNITUDES

TEN FINGERS – A funky song sung by the boy’s ten fingers, not only describing the numerous functions they are capable of, but with a spoken explanation midway of why base 8 might have been a better number system; and an explanation of the meaning of “powers of 10” as a mathematical concept.

LIFE THAT LIVES ON MAN – Partly spoken, partly sung, this describes just three of the numerous lifeforms inhabiting the human skin and hair.

AMOEBA – With a spiky, angular melody, the amoebae argue their case: “I would sob with misery if I couldn’t be a blob like me, so What’s so great about being the same shape from day to day?”

BACTERIA – Scientists believe that bacteria were probably the earliest widespread life form on Earth and that their incredible resilience and evolutionary adaptability will ensure their survival until the day Earth is swallowed up by the swollen Sun in a few billion years time.

VIRUS – A friendly and informative common cold virus thanks its human host for lending its DNA for reproductive purposes in a very rhythmic and slightly bluesy song.

CHARMED QUARK – In the style of a 50’s pop song, two quarks bemoan their fate – never to be left alone together, since quarks always (well, nearly always) come in threes.

STRING – An evocation of string theory and of Theories of Everything in general.

THE BEACH – A reprise of the opening number returns us to the everyday human scale before the outward journey begins.
Powers of Ten: Program Notes

PART TWO: THE JOURNEY UP THE MAGNITUDES

SONGS FROM THE CAMBRIDGE PUBLIC SCHOOLS 2013 – A medley of five songs from David’s workshops in CPS, including:
- *Amphibians Are Really Grand* - Hatched in water, but living on land
- *Discovering My Body* - It sure looks different on the inside!
- *I’m a Wandering Albatross* - I can soar thousands of miles without rest
- *Gravity Waltz* - The weakest force of the fundamental four
- *Science Is Real* - ...if you follow the scientific method!

DON’T PICK THE DAISIES – Moving out into the countryside, this appealing song, especially suited to very young children, asks walkers and ramblers to refrain from picking the flowers.

SONG OF THE TAMAR VALLEY – At the level of landscape, the Tamar itself (the river border between Devon & Cornwall) sings of its history of human exploitation in a stately anthem glorifying in the power of Nature to triumph eventually over our puny efforts.

TECTONIC WALTZ – This lilting melody recounts the slow choreography of the continents over Earth’s lifetime.

PLANET EARTH – A sombre vision of Earth as a fragile jewel in space.

COOL MOON – A slow bluesy account of the Moon’s cold lifelessness.

93 MILLION MILES – A lively song with a Latin tinge to the accompaniment, full of factual information about the sun and our relationship to it.

EIGHT PLANETS – The introductory section laments the loss of Pluto from the pantheon of planets, explaining why it happened. This is followed by a simple four-part round listing the planets in order of distance from the sun.

EXOPLANET EXPLORER – David Haines says his meeting with MIT Astrophysicist Sara Seager was an inspiring glimpse into a modern-day explorer’s mind. “She’s obviously a rigorous scientist who moves freely and easily in a mathematical world I can only vaguely appreciate, but she’s driven by a passion to explore our cosmos and is riding a wave of tangible excitement towards the near-certain discovery of an Earth-like planet—perhaps even bearing life—within the next few years.”

STARGAZING – A meditation about the perspective on human existence gained through appreciating the universe’s scale and structure.

BLACK HOLE – A jazzy, joky number about the dangerous characteristics of a black hole.

GALAXY TO COSMOS – An evocation in music and words of the vastness of the Milky Way and of its relative insignificance at a cosmic scale.

THE BEACH – A return to the opening number rounds off *Powers of Ten*. 
THANK YOU

The North Cambridge Family Opera gratefully acknowledges the following people and organizations for their generous support of the NCFO Science Festival Chorus.

As always, we would like to thank John Durant and everyone at the Cambridge Science Festival for their continuing efforts to promote science for all. And thanks to the Museum of Science for once again donating their Cahners Auditorium for our performance.

We are very lucky to have David Haines, composer of *Powers of Ten*, and “Songwriter-in-Residence” of the Cambridge Science Festival for the fourth year running, visiting us from his home in Devon, England. Thanks, David, for your wonderful music, for playing piano and singing, and of course for once again sharing your love of composing with the schoolchildren in the Cambridge Public Schools. And thanks to the Cambridge Public Schools for accommodating and supporting David’s work. We are also grateful to everyone who contributed artwork to our splendid slideshow.

A special thank you to Andy Adler and Ann Braude, and to David Bass and Sue Hall, who once again graciously hosted David Haines during his stay in the US. Thanks also to Carla Procaskey and Hope Kelley, who accompanied David on his classroom visits to the schools.

We are very grateful to both Thalia Tringo Real Estate and the Harvard Summer School Secondary School Program for their NCFO Sponsorships; and to both the Cambridge Community Foundation and the Robbins/de Beaumont Foundation for their very generous grants to the North Cambridge Family Opera.

Of course this production would not be possible without our loyal chorus members. Our sincere appreciation goes out to all of you for being part of our eighth Cambridge Science Festival performances and sharing with us your music, your friendship, and your financial support.

MISSION STATEMENT

The North Cambridge Family Opera (NCFO) provides an opportunity for children and adults to experience and enjoy telling a story through song by performing original, high-quality, fully-sung operas and choral works for audiences of all ages. Our casts of children and adults come from Cambridge and other communities in the greater Boston area. We encourage participation by multiple family members. Solo and chorus roles varying widely in difficulty are assigned to both children and adults, so that everyone is both challenged and given an opportunity to succeed. To the extent possible, productions are financed through donations and volunteerism.

NCFO began as a participant in the 2nd North Cambridge (NoCa) All Arts Open Studios weekend in May 1999, and has since incorporated as a 501(c)(3) non-profit and produced a family opera every spring. Since 2007, NCFO has also presented a concert of science songs every year as part of the Cambridge Science Festival.

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