

Effective Posters— *Presenting your Results Clearly and Persuasively*



Courtesy Carlos A. Alvarez Zarikian

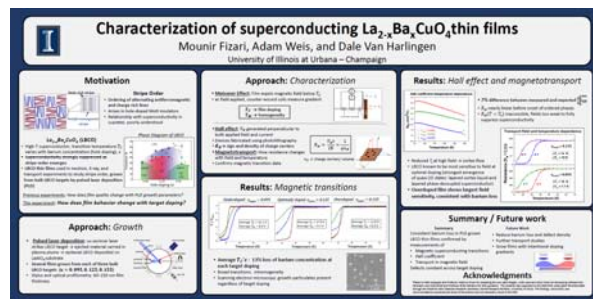
Celia M. Elliott
Department of Physics
cmelliot@illinois.edu



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Overview

- Message
- Graphics
- Text
- Layout
- Use of color
- Acknowledgments
- Presenting your poster



Courtesy Mounir Fizari

Message

Characterization of superconducting $\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ thin films

Mounir Fizari, Adam Weis, and Dale Van Harlingen
 University of Illinois at Urbana – Champaign

<p>Motivation</p> <p>Stripe Order</p> <ul style="list-style-type: none"> • Ordering of alternating antiferromagnetic and charge-rich lines • Arises in hole-doped Mott insulators • Relationship with superconductivity is cooperative, poorly understood <p>$\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ (LBCO)</p> <ul style="list-style-type: none"> • High-T superconductor, transition temperature T_c varies with barium concentration (hole doping), x • Superconductivity strongly suppressed as stripe order emerges • LBCO thin films used in reaction, H_2 and electron measurements to study stripe order, grown from bulk LBCO targets by pulsed laser deposition (PLD) <p>Open questions: How does film quality change with PLD growth parameters? This session: How does film behavior change with target doping?</p>	<p>Approach: Characterization</p> <ul style="list-style-type: none"> • Motsoner Effect: Film exports magnetic field below T_c as field applied, counter-external fields measure gradient • T_c vs film doping • T_c vs homogeneity <p>• Hall effect T_c generated perpendicular to both applied field and current</p> <ul style="list-style-type: none"> • Grains fabricated using photolithography • R_{xx} vs sign and density of charge carriers • Magnetotransport: new resistance changes with field and temperature • Confirms magnetic transition data 	<p>Results: Hall effect and magnetotransport</p> <p>• 7% difference between measured and expected T_c</p> <ul style="list-style-type: none"> • R_{xx} nearly linear before onset of ordered phases • $R_{xx}(T < T_c)$ inaccessible, fields too weak to fully suppress superconductivity <p>• Reduced T_c at high field \rightarrow surface flow</p> <ul style="list-style-type: none"> • LBCO known to be most sensitive to field at ordered doping (strongest emergence of super-SD states), neutral vortex liquid and ordered phase-decoupled to superconductor • Overdoped films shows largest field sensitivity, consistent with barium lines
<p>Approach: Growth</p> <ul style="list-style-type: none"> • Pulsed laser deposition: no reaction between LBCO target \rightarrow excited material carried in plasma plume \rightarrow optimal LBCO deposited on LBCO substrate • Several films grown from each of three bulk LBCO targets ($x = 0.095, 0.125, 0.155$) • XRD and optical profilometry: 80–130 nm film thickness 	<p>Results: Magnetic transitions</p> <p>• Average T_c's: 1.0% loss of barium concentration at each target doping</p> <ul style="list-style-type: none"> • Small transitions, inhomogeneity • Scanning electron microscope: growth particulates present regardless of target doping 	<p>Summary / Future work</p> <p>Summary</p> <ul style="list-style-type: none"> • Consistent barium loss in PLD grown LBCO thin films confirmed by measurements of • Magnetic superconducting transitions • Hall coefficient • Transport in magnetic field • Defects revealed across target doping <p>Acknowledgments</p> <p>• Future work</p> <ul style="list-style-type: none"> • Reduce barium loss and defect density • Further transport studies • Grow films with intentional doping gradients

Courtesy Mounir Fizari

Your poster must be tailored to your audience to be effective

Who is your audience?

What do they want to know?

What will capture their interest?



PHYS 499 Posters, October 2012; (l) Kevin Pitts, (r) undergraduate Matthew Coon

An effective poster must

Attract and engage the audience—

- prominent title
- visually interesting figures (lots)
- clean, uncluttered appearance

Highlight key points so they are *immediately* recognizable

Be arranged logically so a viewer quickly understands the “story”

Contain all elements of a good research paper—motivation, methods, results, discussion, conclusions, acknowledgments

Distill your message

What one idea do you want your audience to remember when they walk away from your poster?



How can you best represent that one idea?

In pictures?

In plots?

In words?

Tip: Note that “words” is the last item on the list! (and should take up the least space on your poster)

Graphics

Characterization of superconducting $\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ thin films

Mounir Fizari, Adam Weis, and Dale Van Harlingen
 University of Illinois at Urbana – Champaign

<p>Motivation</p> <p>Stripe Order</p> <ul style="list-style-type: none"> • Ordering of alternating antiferromagnetic and charge-rich lines • Arises in hole-doped Mott insulators • Relationship with superconductivity is currently poorly understood <p>$\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ (LBCO)</p> <ul style="list-style-type: none"> • High-T superconductor; transition temperature T_c varies with barium concentration (hole doping) • Superconductivity strongly suppressed as stripe order emerges • LBCO thin films used in reaction, R_2O_2, and sputter experiments to study stripe order; grown from bulk LBCO targets by pulsed laser deposition (PLD) <p>Open questions: How does film quality change with PLD growth parameters? This session! How does film behavior change with target doping?</p>	<p>Approach: Characterization</p> <ul style="list-style-type: none"> • Motson Effect: Film exerts magnetic field below T_c • at field applied, counter-rotated coils measure gradient <p>T_c vs film doping $T_c \rightarrow$ homogeneity</p> <ul style="list-style-type: none"> • Hall effect: V_H generated perpendicular to both applied field and current • Grown fabricated using photolithography • R_H vs sign and density of charge carriers • Magnetotransport: new resistance changes with field and temperature • Confirms magnetic transition data <p>$R_H = \frac{V_H}{I B} = \frac{1}{q n}$ n_H vs charge carrier density</p>	<p>Results: Hall effect and magnetotransport</p> <p>Hall coefficient temperature dependence</p> <ul style="list-style-type: none"> • 7% difference between measured and expected $\frac{R_H}{R_{2D}}$ • R_H nearly linear before onset of ordered phase • $R_H(T < T_c)$ inaccessible; fields too weak to fully suppress superconductivity <p>Temperature dependent T_c vs film doping</p> <ul style="list-style-type: none"> • Reduced T_c at high field \rightarrow surface flow • LBCO known to be most sensitive to field at ordered doping (strongest emergence of super-2D states); hybrid vortex liquid and ordered phase-decoupled superconductor • Overdoped films shows largest field sensitivity, consistent with barium films
<p>Approach: Growth</p> <ul style="list-style-type: none"> • Pulsed laser deposition: no reaction laser excites LBCO target \rightarrow excited material carried in plasma plume \rightarrow optimal LBCO deposited on LBCO substrate • Several films grown from each of three bulk LBCO targets (x = 0.095, 0.125, & 0.155) • XRD and optical profilometry: 80–130 nm film thickness 	<p>Results: Magnetic transitions</p> <p>Superconducting T_c vs film doping</p> <ul style="list-style-type: none"> • Average T_c's: 1.0% loss of barium concentration at each target doping • Small transitions, inhomogeneity • Scanning electron microscope: growth particulates present regardless of target doping 	<p>Summary / Future work</p> <p>Summary</p> <ul style="list-style-type: none"> • Consistent barium loss on PLD grown LBCO thin films confirmed by measurements of • Magnetic superconducting transitions • Hall coefficient • Transport in magnetic field • Defects revealed across target doping <p>Future work</p> <ul style="list-style-type: none"> • Reduce barium loss and defect density • Further transport studies • Grow films with intentional doping gradients <p>Acknowledgments</p> <p>Thanks to the support of the University of Illinois at Urbana-Champaign, the National Science Foundation (NSF), and the Office of Naval Research (ONR).</p>

Courtesy Mounir Fizari

Use the visual elements of the poster to tell the story



Tip: Keep all text (total) to <400 words

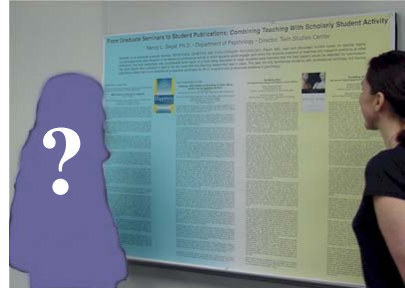
Use the visual elements of the poster to tell the story

Engage the audience

Emphasize main points

Illustrate apparatus,
methods, and results

Summarize numerical data to show trends
or reveal relationships



Tip: People remember pictures, not words

At least half your “story” should be told in pictures

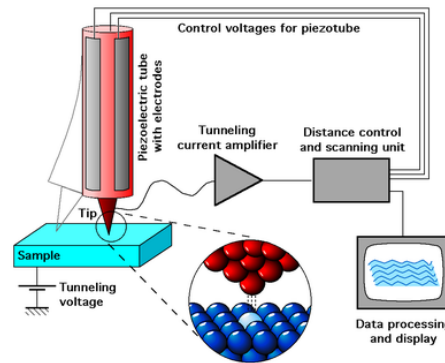
No graphic should be smaller than
5 in × 7 in (13 cm × 15 cm), and most
should be larger

Crop and enlarge photos and simplify
drawings to focus attention on important
details

Scan photos at 300 dpi

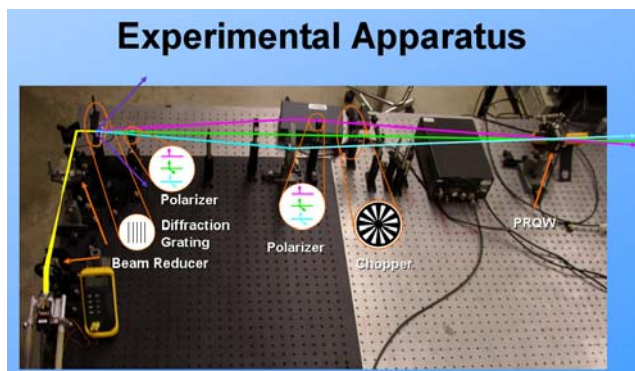
Provide a brief caption for every graphic;
tell people what to look for

Don't use pointless graphics



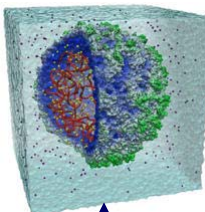
Your project used a scanning tunneling microscope to characterize your thin-film superconducting samples. Which is a better image for your poster?

This excellent graphic shows the apparatus *and* the process

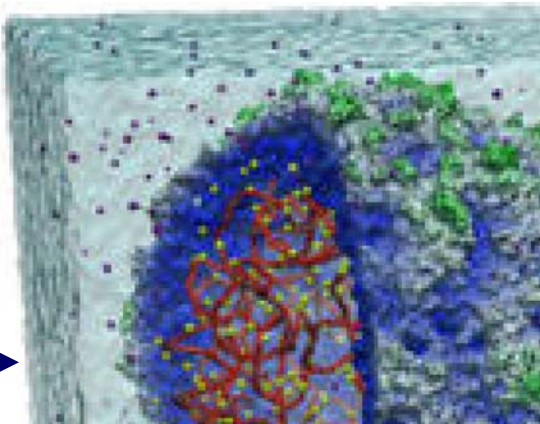


Tip: Show pictures of equipment only if they are related to an important idea that you want to convey

Avoid using graphics taken from the Internet; they're too low-res to print acceptably



Theoretical and Computational Biophysics Group
University of Illinois at Urbana-Champaign




Looks fine on your monitor; looks awful blown up to poster size and printed.

Make every graphic mean something; avoid "eye candy"


Improving the Cooling of Blades and Vanes in Gas Turbine Engines

VT EXCEL

To increase efficiency, gas turbine engines have to run at higher temperatures

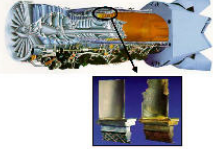


Jet engines

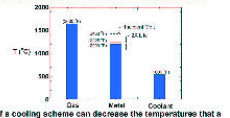


Power turbines

However, higher combustion temperatures reduce the life of the blades and vanes



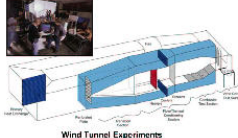
Better cooling schemes can dramatically affect the life of blades and vanes in gas turbines




Component	Temperature (°C)
Disk	~1100
Vane	~1000
Cooling	~500

If a cooling scheme can decrease the temperature that a blade experiences by 20°C, the blade's life will double

Our laboratory studies cooling schemes through experiments and computations

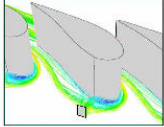



Wind Tunnel Experiments

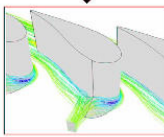


Computational Predictions

Results from our studies are helping sponsors design better gas turbine engines



Without Fillet: Unwanted Vortices



With Fillet: Vortices Reduced

In summary, we are improving the cooling of blades and vanes in gas turbine engines

But you have to have some text...

Schools of Physics and Mechanical Engineering
 Georgia Institute of Technology
 Atlanta, GA 30332-0430

PS Gas Sensor Set-Up

Authors' names have been removed;
 the original poster had no title

Text

Characterization of superconducting $\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ thin films

Mounir Fizari, Adam Weis, and Dale Van Harlingen
 University of Illinois at Urbana – Champaign

<h4>Motivation</h4> <p>Stripe Order</p> <ul style="list-style-type: none"> • Challenge of alternating antiferromagnetic and charge rich lines • Arise in hole-doped Mott insulators • Relationship with superconductivity in cuprates poorly understood <p>$\text{La}_{1-x}\text{Ba}_x\text{CuO}_4$ (LBCO)</p> <ul style="list-style-type: none"> • High-T superconductor: transition temperature T_c varies with barium concentration (hole doping), x • Superconductivity strongly suppressed in stripe order emergence • LBCO thin films used in neutron, X-ray, and transport experiments to study stripe order grown from bulk LBCO targets by pulsed laser deposition (PLD) <p>Research questions: How does film quality change with PLD growth parameters? This question: How does film behavior change with target doping?</p>	<h4>Approach: Characterization</h4> <ul style="list-style-type: none"> • Magneto Effect: Film inserts magnetic field below T_c as test current, counter-reduced with measure gradient • $T_c \rightarrow$ film doping • $T_c \rightarrow$ homogeneity <p>Hall effect: V_H generated perpendicular to both applied field and current</p> <ul style="list-style-type: none"> • Device fabricated using photolithography • R_H vs. sign and density of charge carriers • Measurment approach: new resistance change with field and temperature • Confirms magnetic transition data • n_H vs. (charge carrier) volume 	<h4>Results: Hall effect and magnetotransport</h4> <p>Hall coefficient temperature dependence</p> <ul style="list-style-type: none"> • 7% difference between measured and expected $\frac{1}{4} \frac{R_H}{R_{300K}}$ • R_H nearly linear before onset of ordered phases • $R_H(T < T_c)$ insensitive, fields too weak to fully suppress superconductivity <p>Transport field and temperature dependence</p> <ul style="list-style-type: none"> • Reduced T_c at high field \rightarrow vortex flow • LBCO seems to be most sensitive to field at optimal doping (intercept temperature of super-CD states: layered vortex liquid and layered phase-separated superconductor) • Overdoped film shows largest field sensitivity, consistent with barium loss
<h4>Approach: Growth</h4> <ul style="list-style-type: none"> • Pulsed laser deposition: on substrate laser strikes LBCO target \rightarrow ejected material carried in plasma plume \rightarrow polymer LBCO deposited on LaAlO_3 substrate • Several films grown from each of these bulk LBCO targets (in ~ 0.005 & 0.125 & 0.155) • X-ray and optical profilometry: 60–120 nm film thickness 	<h4>Results: Magnetic transitions</h4> <ul style="list-style-type: none"> • Average T_c's: 1.0% loss of barium concentration at each target doping • Small transitions: inhomogeneity • Scanning electron microscopy: growth particulates present regardless of target doping 	<h4>Summary / Future work</h4> <p>Future Work</p> <ul style="list-style-type: none"> • Reduce barium loss and defect density • Further transport studies • Grow films with intentional doping gradients • Hall coefficient • Transport in magnetic field • Defects: constant across target doping <p>Acknowledgments</p> <p>Thanks to our sponsor (NSF Grant DMR-1507000) and the University of Illinois at Urbana-Champaign for their support. We also thank the following individuals for their helpful discussions: Adam Weis, Dale Van Harlingen, and the members of the Van Harlingen group.</p>

Courtesy Mounir Fizari

Use easy-to-read fonts

Sans-serif fonts usually print well and are easier to read from a distance than serif fonts

Fancy fonts are harder to read

DON'T USE ALL CAPS, EVEN IN THE TITLE
—much harder to read (and proofread!)

Title—120 pt

Section headings—60 pt

Figure captions—48 pt

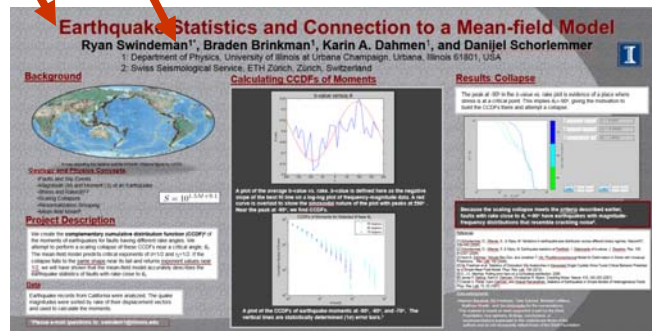
Text—36 pt

Tip: Scale the font with the size of the poster

Every poster must have a “headline” (title) and a “byline” (authors)

Title—<10 words

Your name and affiliation—Ask your adviser **NOW** about co-authors



Tip: If it's important, make it BIG

Present text in lists rather than paragraphs

Figures promote audience interest, provide supporting evidence, help explain complex ideas and relationships quickly, and give the viewer something to remember

Use figures to:

- promote interest
- provide supporting evidence
- explain complex ideas quickly
- show relationships
- give the viewer something to remember

Tip: Lists are easier to process quickly and are easier to remember

Include an “abstract” only if your poster is going to be unattended for lengthy periods*

If you’re standing there explaining the work, nobody’s going to read an abstract anyway

Use the space for something more compelling and visually interesting

If you *must* include an abstract, keep it very brief (<50 words)

*or if your adviser tells you to...

Layout (Navigation)

Characterization of superconducting $\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ thin films

Mounir Fizari, Adam Weis, and Dale Van Harlingen
 University of Illinois at Urbana – Champaign

Motivation

Stripe Order

- Ordering of alternating antiferromagnetic and charge-rich lines
- Arises in hole-doped Mott insulators
- Relationship with superconductivity is currently poorly understood

$\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ (LBCO)

- High-T superconductor: transition temperature T_c varies with barium concentration (hole doping), x
- Superconductivity strongly suppressed as stripe order emerges
- LBCO thin films used in reaction, R_2O_2 and sputtered experiments to study stripe order: growth from bulk LBCO targets by pulsed laser deposition (PLD)

Experimental questions: How does film quality change with PLD growth parameters?
This session! How does film behavior change with target doping?

Approach: Characterization

Motzner Effect: Film exports magnetic field below T_c as field applied. Counter-rotated coils measure gradient

T_c vs film doping
 $T_c \rightarrow$ homogeneity

Hall effect: T_c generated perpendicular to both applied field and current

- Grains fabricated using photolithography
- R_H vs sign and density of charge carriers
- **Magnetotransport:** new resistance changes with field and temperature
- Confirms magnetic transition data

$R_H = \frac{S_H}{I} = \frac{1}{q n}$
 n_H vs charge carriers/ volume

Results: Hall effect and magnetotransport

Hall coefficient temperature dependence:

- 7% difference between measured and expected $\frac{R_H}{R_{300K}}$
- R_H nearly linear before onset of ordered phase
- $R_H(T < T_c)$ inaccessible. Fields too weak to fully suppress superconductivity

Temperature field and temperature dependence:

- Reduced T_c at high field \rightarrow vortex flow
- LBCO known to be most sensitive to field at optimal doping (strongest emergence of superconducting state): neutral vortex liquid and neutral phase-decoupled superconductor
- Overdoped film shows largest field sensitivity, consistent with barium loss

Results: Magnetic transitions

Underdoped: $x_{opt} = 0.092$ **Optimally doped:** $x_{opt} = 0.121$ **Overdoped:** $x_{opt} = 0.153$

Average T_c 's: 1.0% loss of barium concentration at each target doping

- Broad transitions, inhomogeneity
- Scanning electron microscope: growth particulates present regardless of target doping

Summary / Future work

Summary:

- Consistent barium loss on PLD grown LBCO thin films confirmed by measurements of
- Magnetic superconducting transitions
- Hall coefficient
- Transport in magnetic field
- Defects revealed across target doping

Future work:

- Reduce barium loss and defect density
- Further transport studies
- Grow films with intentional doping gradients

Approach: Growth

Pulsed laser deposition: \rightarrow reactive laser excites LBCO target \rightarrow excited material carried in plasma plume \rightarrow excited LBCO deposited on LBCO substrate

- Several films grown from each of three bulk LBCO targets ($x = 0.095, 0.123, \& 0.153$)
- XRD and optical profilometry: 80-130 nm film thickness

Acknowledgments

Thanks to our sponsor, the University of Illinois at Urbana-Champaign, for providing the facilities and equipment for this work. We also thank the following individuals for their helpful discussions: Adam Weis, Dale Van Harlingen, and the members of the Van Harlingen group.

Courtesy Mounir Fizari

Remember that people will be looking at your poster while standing, not sitting

Tip: Don't put important points in tiny print at the bottom

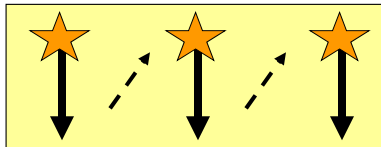
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Most viewers will start at the upper left corner of the poster and read down and across

Break up your story into columns (think “newspaper”)

Put important points at the top of each column



Tip: Keep lines of text <20 words long—people’s eyes don’t easily track strings of text longer than that, even at 30 pt

How is the viewer going to navigate through this poster?



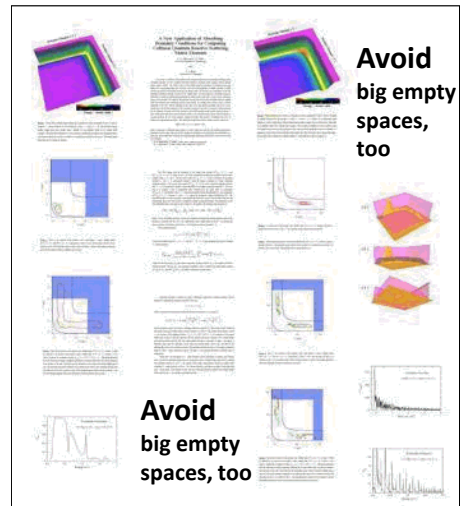
The poster is titled "Prospects for ϕ meson production at ALICE" and is divided into several sections. At the top left, it says "ALICE 2017: The ALICE experiment at the LHC". The main text discusses the production of ϕ mesons in heavy-ion collisions and the role of the ALICE detector. It includes a diagram of the ALICE detector and a table of parameters. The poster also features a large 3D visualization of a particle collision and several smaller plots and graphs. The bottom of the poster includes the ALICE logo and the text "ALICE 2017: Prospects for ϕ meson production at ALICE".

Use headings to guide the viewer through the poster

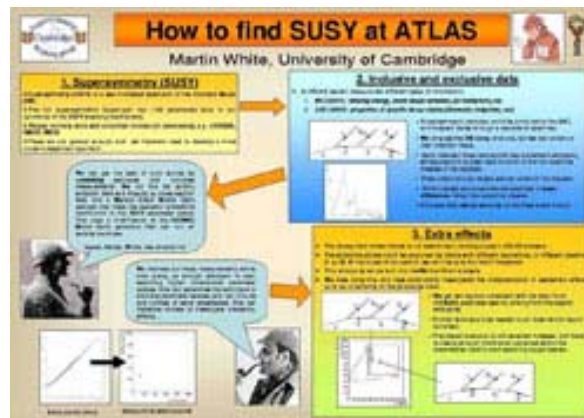
Make your key points immediately recognizable

Use headings to help viewers locate what interests them

- Motivation
- Methods
- Results
- Conclusions



If navigation is not *immediately* obvious, number the elements or use arrows to guide the viewer through the poster.



The center of the poster should feature the methods and results

Problem statement, motivation, objectives

Methods

Results

Applications or future work

Sources of additional information

Acknowledgments

Tip: Visually represent the relative importance of text elements

Position your important points strategically

Production of Δ Particles from Σ^* Decays at HERMES
Cynthia Chiang, University of Illinois at Urbana-Champaign

Background

- Examine spin transfer through fragmentation process
- Study spin structure of Δ particles produced in deep-inelastic scattering (DIS) events

The HERMES experiment

- Major physics experiment for studying spin structure of particles
- Located at the Deutscher Elektronen Synchrotron (DESY) in Hamburg, Germany
- Longitudinally polarized 27.5 GeV positron beam
- Gas target (operated by the various beamline experimental groups)

The problem

SIGMA CONTAMINATION!

- Contribution between theory and background?
- Three values models
- Three conventional models that attempt to model σ -dependence or an ignorance of σ
- Possible problem: σ can also be produced in decay product of another Particle, such as Σ^*
- Can σ contribute to either the discrepancy between theory and experiment?

The hunt for Σ^*

- Step 1: Identify events in data containing Σ^* candidates
- Step 2: Develop methods for identifying Σ^* by examining Particle Correlations
- Step 3: Find Σ^* in data (events containing Σ^* candidates) from Particle Correlation
- Step 4: Use Monte Carlo to determine fraction of Σ^* particles produced in decay
- Step 5: Use results to develop model for the longitudinal spin transfer process

Results

- Multiple identified Σ^* candidates in the data
- Can Σ^* particles appear in events that are not identified as Σ^* particles in the data?
- Data and Monte Carlo do not match: bug in analysis code or does Monte Carlo weighting?

Future plans

- Identify and Monte Carlo mis-identifications
- Contribution not only from Σ^* , but also from Σ : develop code for identifying Σ candidates in the data
- Find fraction of Σ particle production σ \rightarrow decay products
- After σ contribution is determined, it will be possible to correctly interpret spin transfer data

Courtesy H. Chiang

Tip: Position important information above the midline and in the center

Use of Color

Characterization of superconducting $\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ thin films

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$\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ (LBCO)

- High-T superconductor: transition temperature T_c varies with barium concentration (hole doping)
- Superconductivity strongly suppressed as stripe order emerges
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Experimental questions: How does film quality change with PLD growth parameters?
This session: How does film behavior change with target doping?

Approach: Characterization

Motson Effect: Film exerts magnetic field below T_c

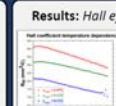
- at field applied, counter-rotated coils measure gradient
- T_c in film doping
- T_c in homogeneity

Hall effect: V_H generated perpendicular to both applied field and current

- Grown fabricated using photolithography
- R_H in sign and density of charge carriers
- **Magnetoresistance:** new resistance changes with field and temperature
- Confirms magnetic transition data
- ρ_{xx} in charge carriers/ volume

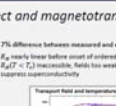
Results: Hall effect and magnetotransport

Real current temperature dependence



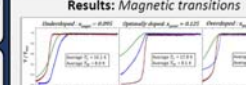
- 7% difference between measured and expected ρ_{xx}
- R_H nearly linear before onset of ordered phase
- $R_H(T < T_c)$ inaccessible, fields too weak to fully suppress superconductivity

Temperature field and temperature dependence



- Reduced T_c at high field \rightarrow surface flow
- LBCO known to be most sensitive to field at ordered doping (strongest emergence of super-2D states: layered vortex liquid and layered phase-decoupled superconductor)
- Overdoped films shows largest field sensitivity, consistent with barium films

Results: Magnetic transitions



- Average T_c 's: 1.0% loss of barium concentration at each target doping
- Small transitions, inhomogeneity
- Scanning electron microscopy: growth particulates present regardless of target doping

Approach: Growth

Pulsed laser deposition: no reactive laser gases (LCO target \rightarrow oxidized material carried in plasma plume \rightarrow optimal LCO deposited on LSCO substrate)

- Several films grown from each of three bulk LSCO targets ($x = 0, 0.05, 0.12, 0.15$)
- XRD and optical profilometry: 80-120 nm film thickness

Summary / Future work

Summary:

- Consistent barium loss in PLD grown LBCO thin films confirmed by measurements of
- Magnetic superconducting transitions
- Hall coefficient
- Transport in magnetic field
- Defects revealed across target doping

Future work:

- Reduce barium loss and defect density
- Further transport studies
- Grow films with intentional doping gradients

Acknowledgments

Thanks to the people who helped with this project: ...

Courtesy Mounir Fizari

Choose colors carefully

Colors affect how easily your poster can be read

Use a high contrast between background and text

“Warm” colors are more visible, but don’t overpower with orange (even Illini orange)

Avoid using red/green or red/blue


Tip: Gradient backgrounds that look great on your monitor may not print properly

Energy and Water Savings Design for WOODLAW TOWERS III

Design Team: Amber Lesch, Michael Troop & Emily Wassman, Advisor: Dr. Warren Strain

Problem Statement

To provide energy and water savings strategies to building in Guelph, ON.



Solutions

- Double Glazed Argon Filled Windows
- Thermal efficiency of the windows were investigated to determine if double window types would yield a desirable value solution.
- Insulation on Exterior Ducts
- The problem of condensation on exterior ducts on the roof was investigated to determine if the interior and exterior energy controls be more efficient.
- Drain Water Heat Exchanger
- The device transfers heat from the outgoing hot water to incoming cold water heating, offsetting the hot water heating. These energy savings were determined.
- Low Flow Showerheads, Efficient Toilet Flush Dams
- Toilets and showerheads use a significant amount of household water. The actual water savings for each was determined.

Survey

A survey was distributed to the residents to evaluate their energy and water-saving measures were already in place.

Alternatives

- Solar Power
- Geothermal Power
- Wind Power
- Efficient Windows
- Drain Water Heat Exchanger
- Tankless Water Heater
- Heat Insulation
- Efficient Shower/Flush Dams
- Efficient Showerheads
- Low-flow Toilet
- Efficient Lighting

Economic Summary

Measure	Capital Cost	Payback Period	Payoff
Windows	\$20,000	12 yr	\$2,500
Insulation	\$10,000	10 yr	\$1,000
Heat Exchanger	\$5,000	1.5 yr	\$300
Showerheads	\$1,000	2.2 yr	\$100
Toilet Dams	\$1,000	1.5 yr	\$100
Low-flow Showerheads	\$1,000	4.4 yr	\$100
Efficient Showerheads	\$1,000	4.4 yr	\$100

Assuming 100% Participation and Repayment: the Annual Savings would be approximately \$3,200.00

School of Engineering

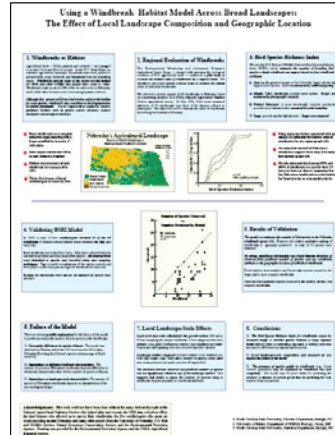
UNIVERSITY OF GUELPH

Special Thanks to Blair Wilson and the Board of Directors of Woodlawn Towers III

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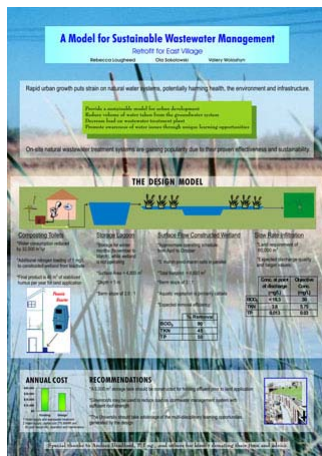
15

Use color to highlight, separate, or associate information visually



Tip: People expect color to mean something; don't use color randomly

Choose neutral backgrounds with high-contrast text and images



Leave adequate “white space”

Effective posters look uncluttered

Use white space to isolate and emphasize important details

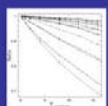
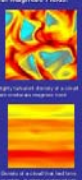
Leave at least 1.5 in (4 cm) of white space between columns

Balance elements on the page

Tip: Leave at least 0.5-in (1.25-cm) margins on all sides of your poster; no plotter prints to the very edge of the paper

“White space” doesn’t have to be white

Radiative Transfer in Turbulent Interstellar Clouds
Charles Hansen: University of Illinois at Urbana Champaign

Motivation	Monte Carlo Radiative Transfer	Optical Depth and Turbulence	Results
<p>Radiative Transfer</p> <p>Goal: To study the radiative transfer properties of turbulent interstellar clouds.</p> <p>The Clouds:</p> <ul style="list-style-type: none">High density, molecular.Typical sizes of many parsecs.High numbers easily swallow the radiative transfer.Non-equilibrium, correlationally suspensive.Uniform density assumed previously. <p>Astrophysical Chemistry</p> <p>Light levels within a cloud can significantly affect the ionization and temperature of a cloud and give rise to interesting chemical compositions.</p> <p>Ambipolar Diffusion</p> <ul style="list-style-type: none">Clouds (strongly magnetized) are held together.Magnetic field is turbulent.Diffusion is strong in ambipolar diffusion.Magnetic fields are controlled by magnetic fields.	<p>Monte Carlo Method</p> <ul style="list-style-type: none">Many photons integrated through a cloud.Directions chosen “randomly”.The primary equation being solved. $\frac{dI}{ds} = -I(\kappa_{\text{absorption}} + \kappa_{\text{scattering}})$ <p>Integration produces an incoming flux and outgoing flux.</p> <p>The fluxes yield an effective optical depth, τ.</p> <p>Simulated Clouds</p> <ul style="list-style-type: none">Simulated with ZEUS algorithm.Isothermal.Compressive ideal magnetohydrodynamic.Sweep over mesh number and magnetic field strength.	<p>Optical Depth and Turbulence</p> <ul style="list-style-type: none">Increased turbulence \rightarrow Decreased τ.Light goes through “light tubes” of low density.More turbulence \rightarrow More light tubes.τ can go as low as 50% with smooth density value. 	<p>Results</p> <p>Anisotropy</p> <ul style="list-style-type: none">Light tubes align with magnetic fields.Clouds more transparent in direction of light tubes.$\sim 10\%$ difference with κ_{eff} relation. <p>Alignment of Light Tubes with Magnetic Fields</p>  <p>Light tubes align with magnetic fields.</p> <p>Visualizations of a simulated turbulent interstellar cloud, showing the alignment of light tubes with magnetic fields.</p> <p>Light Tubes</p> <p>The quantities observational data has a wide, but not all of them more relevant (parameter space).</p> <p>Acknowledgements</p> <p>The project was supported by NASA's Gemini with funding from NSF grant AST 00-50001.</p>

Courtesy Charles Hansen

Acknowledgments

Characterization of superconducting $\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ thin films
Mounir Fizari, Adam Weis, and Dale Van Harlingen
University of Illinois at Urbana – Champaign

Motivation

- Ordering of alternating antiferromagnetic and charge d_xd_y layers
- Arises in hole-doped Mott insulators
- Relationship with superconductivity is cooperative, poorly understood

Approach: Characterization

- **Motson Effect:** Film exerts magnetic field below T_c
- at field applied, counter-rotated coils measure gradient
- T_c is film doping
- T_c is homogeneity

Results: Hall effect and magnetotransport

- 7% difference between measured and expected ρ_{xx}
- R_H nearly linear before onset of ordered phases
- $R_H(T < T_c)$ inaccessible, fields too weak to fully suppress superconductivity

Results: Magnetic transitions

- T_c vs x plot
- T_c vs x plot
- T_c vs x plot

Approach: Growth

- **Pulsed laser deposition:** no receiver laser
- La_2CuO_4 target \rightarrow excited material carried in plasma plume \rightarrow excited La_2CuO_4 deposited on LaNiO_3 substrate
- Several films grown from each of three bulk La_2CuO_4 targets ($x = 0, 0.05, 0.12, 0.15$)
- XRD and optical profilometry 80–120 nm film thickness

Summary / Future work

- Consistent barium loss in PLD grown La_2CuO_4 thin films confirmed by measurements of
- Magnetic superconducting transitions
- Hall coefficient
- Transport in magnetic field
- Defects revealed across target doping

Acknowledgments

Courtesy Mounir Fizari

You must have an “acknowledgments” section on your poster

First, get it spelled correctly—no *e* following the *g* in the US English spelling of *acknowledgment*

(Don’t believe me?—look at the acknowledgment page of any book published by a US publisher)

British English spells it with the “e,” but we colonials have our own rules

Some wimpy dictionaries may accord “acknowledgement” alternative status, but we have higher standards in physics

Acknowledge research contributions by people other than the authors

**Persons who gave scientific guidance,
participated in discussions, or shared
unpublished results, data, or samples**

Persons who provided facilities or equipment

**Assistants or students who helped do the
work**

Technicians at user facilities or labs

**Tip: Make it a simple statement of thanks,
not a testimonial or dedication**

Acknowledge by name only

**Do not use titles, honorifics, positions, or
awards**

Paul G. Kwiat

NOT

**Professor Paul G. Kwiat,
Bardeen Chair in Physics**

Anthony J. Leggett

NOT

Sir Dr. A.J. Leggett, Nobel Laureate

Always acknowledge financial support of the research—always

Give the name of the funding agency and grant or contract number

“This material is based upon work supported by the National Science Foundation under Grant No. ____.”

On posters, the following disclaimer must be included for NSF-funded research:

“Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.”

What about logos?

Federal funding agencies may allow you to use their logos, but obtain a high-resolution image and follow their guidelines

The University has explicit rules about the use of the I-mark

Companies are aggressive about protecting their brands and trademarks; just because you can grab a logo off a website does *not* mean you can use it with impunity



Follow the logo rules!

Rules for using the NSF logo:

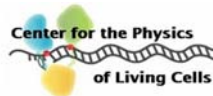
<http://www.nsf.gov/policies/logos.jsp>

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The U.S. Department of Energy says you may NOT use their logo without explicit permission

(<http://energy.gov/management/office-management/employee-services/graphics/doe-logo-seal-and-word-mark>)



Where to put the acknowledgments?

Machine Learning and Cosmological Simulations
Harshil M. Kamdar, Matthew J. Turk, Robert J. Brunner
University of Illinois at Urbana-Champaign

Introduction & Motivations

- What is the influence of dark matter?
- Dark structure on galaxy evolution?
- Can we study this relationship by using machine learning (ML)?
- Current galaxy formation techniques are expensive to run, however dark matter only simulations are not.
- ML offers a solid framework to mimic hydrodynamical simulations for these reasons: computational efficiency, relative simplicity, and ability to learn highly complex relationships.

Lighting up Dark Sky

Galaxies in clusters

Specific star formation rate

Color

Conclusions

- The ML simulated galaxies in the Dark Sky simulation are numerically, physically, and statistically robust.
- From the ML simulated galaxies alone by certain fundamental observational constraints, further building confidence in our approach.
- ML technique approximately mimics a full-down hydrodynamical simulation inside a DDT only simulation only six orders of magnitude faster.

Future Work

- Creating full mock galaxy catalogs using ML with different cosmological parameters to compare with observations in the matter of minutes.
- Comparing different hydrodynamical simulation codes to see how different feedback parameters and resolution techniques affect structure formation in a hydrodynamical simulation.

References

- Kamdar, H., Turk, M., Brunner, R., 2015a, MNRAS, Accepted
- Kamdar, H., Turk, M., Brunner, R., 2015b, MNRAS, Submitted
- Kamdar, H., Turk, M., Brunner, R., 2015c, MNRAS, in press

NSF and UIUC are supported by NSF grant AST-131415. MJT is supported by the Moore Foundation grant GBMF4561. HMK is also supported by the LAS honors council, NCSA/Blue Waters, and OFSA at UIUC.

Courtesy Harshil Kamdar

**Smaller font
At the bottom
Lower right corner**

HMK and RJB are supported by NSF grant AST-131415. MJT is supported by the Moore Foundation grant GBMF4561. HMK is also supported by the LAS honors council, NCSA/Blue Waters, and OFSA at UIUC.

Presenting

Characterization of superconducting $\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ thin films

Mounir Fizari, Adam Weis, and Dale Van Harlingen
 University of Illinois at Urbana – Champaign

<p>Motivation</p> <p>Stripe Order</p> <ul style="list-style-type: none"> • Challenge of obtaining antiferromagnetic and charge dW lines • Arises in hole-doped Mott insulators • Relationship with superconductivity is currently poorly understood <p>$\text{La}_{2-x}\text{Ba}_x\text{CuO}_4$ (LBCO)</p> <ul style="list-style-type: none"> • High-T superconductor. Transition temperature T_c varies with barium concentration (hole doping), x • Superconductivity strongly suppressed as stripe order emerges • LBCO thin films used in reaction, R_2O_2 and sputtered experiments to study stripe order. grown from bulk LBCO targets by pulsed laser deposition (PLD) <p>Research objectives: How does film quality change with PLD growth parameters? This session!!! How does film behavior change with target doping?</p>	<p>Approach: Characterization</p> <ul style="list-style-type: none"> • Motsoner Effect: Film exports magnetic field below T_c • at field applied. counter-rotated coils measure gradient <p>T_c vs film doping</p> <p>T_c vs homogeneity</p> <p>• Hall effect: V_H generated perpendicular to both applied field and current</p> <ul style="list-style-type: none"> • Grown fabricated using photolithography • R_H vs sign and density of charge carriers • Magnetoresistance: new resistance changes with field and temperature • Confirms magnetic transition data <p>$R_H = \frac{V_H}{I B} = \frac{1}{q n v_d}$</p> <p>$v_d$ is charge carrier velocity</p>	<p>Results: Hall effect and magnetotransport</p> <p>Hall coefficient temperature dependence</p> <ul style="list-style-type: none"> • 7% difference between measured and expected $\frac{R_H}{R_{2D}}$ • R_H nearly linear before onset of ordered phases • $R_H(T < T_c)$ inaccessible. Fields too weak to fully suppress superconductivity <p>Temperature dependent R_H and R_{2D}</p> <ul style="list-style-type: none"> • Reduced T_c at high field \rightarrow vortex flow • LBCO known to be most sensitive to field at optimal doping (strongest emergence of super-2D states). Inverted vortex liquid and several phase-decoupled superconductors • Overdoped films shows largest field sensitivity, consistent with barium films
<p>Approach: Growth</p> <ul style="list-style-type: none"> • Pulsed laser deposition: no reactive laser gases. LBCO target \rightarrow excited material carried in plasma plume \rightarrow excited LBCO deposited on substrate • Several films grown from each of three bulk LBCO targets ($x = 0.095, 0.125, 0.155$) • High and optical profilometry: 80–130 nm film thickness 	<p>Results: Magnetic transitions</p> <p>Superconducting transition temperature T_c vs barium concentration</p> <ul style="list-style-type: none"> • Average T_c's: 1.0% loss of barium concentration at each target doping • Broad transitions, inhomogeneity • Scanning electron microscopy: growth particulates present regardless of target doping 	<p>Summary / Future work</p> <p>Summary:</p> <ul style="list-style-type: none"> • Consistent barium loss in PLD grown LBCO thin films confirmed by measurements of • Magnetic superconducting transitions • Hall coefficient • Transport in magnetic field • Defects revealed across target doping <p>Future work:</p> <ul style="list-style-type: none"> • Reduce barium loss and defect density • Further transport studies • Grow films with intentional doping gradients <p>Acknowledgments</p>

Courtesy Mounir Fizari

Find out *before* your session . . .

The location and time by which your poster is to be displayed

What kind of surface your poster will be mounted on

Whether you need to provide your own tape, thumbtacks, Velcro strips...

Whether other needed equipment will be provided (electrical outlet, table, easel)

Tip: Don't expect the meeting organizers to supply you with anything other than space

Be prepared to mount your poster on any surface

Your poster-hanging toolkit should include:

- Push pins or thumbtacks
- Straight pins or drawing pins
- Plastic mounting putty
- Velcro® strips and glue
- Clear PCV tape or masking tape
- Scissors



Have a permanent marker the color of your text for emergency typo corrections

Have a small notebook and pen handy for notes

Rehearse your “stump speech”

Should be 1–2 min.

Think about what the audience wants to know

Briefly state

1. What you studied and why it's important
2. What methods you used
3. What your principal results are
4. What you think they mean
5. What you're going to do next

Prepare two versions—one for experts and one for novices

Be prepared to be interrupted with questions; rehearse possible answers

Convey your enthusiasm for your research project

Greet people as they walk up to your poster

By your stance and expression, invite them to approach you and ask questions

First ask them if they're familiar with your topic, so you know which version of your stump speech to give

Maintain eye contact

Tip: Relax, lean forward, and smile



PHYS 499 Posters, October 2012; James Antonaglia

Rules for answering questions:

Always be respectful

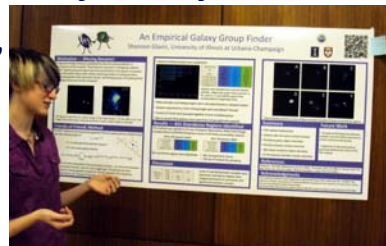
If you don't understand the question, ask for clarification

If you don't know the answer, just say so

If the question is off-topic, redirect

Don't ever argue with a questioner—you'll just look bad

Don't read your poster, use it as a visual aid to explain your work



PHYS 499 Posters, October 2012; Shannon Glavin

References and further guidance...



Edward R. Tufte,
The Visual Display of Quantitative
***Information*, Graphics Press (2001)**

<http://www.personal.psu.edu/drs18/postershow/>

<http://www.soe.uoguelph.ca/webfiles/agalvez/poster/>

<http://www.ncsu.edu/project/posters/>

<http://www.writing.engr.psu.edu/posters.html>



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