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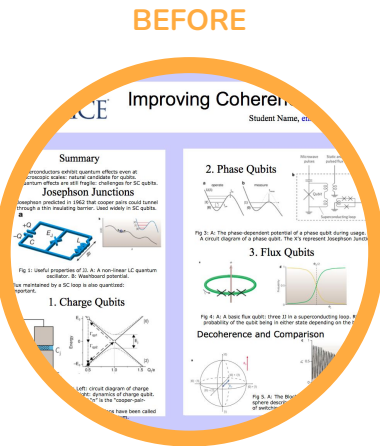
CREATED BY ANNELL JOPLIN & RASHAD BAIYASI 2018

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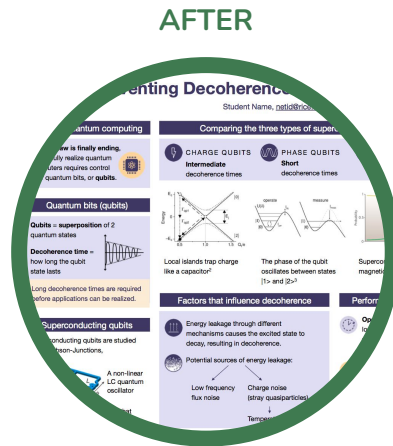
Explore the sample poster before and after revisions

OR

Browse by topic



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Title	Final overview
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Introduction	Project details
Background	
Literature findings	
Discussion	

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Original student poster. Click on the marked locations to read about issues in each section.

Though this poster does demonstrate that the author completed the literature review, it doesn't effectively communicate their findings to the viewer.

This poster includes too many scientific details and too much text. Also, haphazard formatting is distracting and makes the poster feel unprofessional.

Summary

Superconductors exhibit quantum effects even at macroscopic scales: natural candidate for qubits. Quantum effects are still fragile: challenges for SC qubits.

Josephson Junctions

Josephson predicted in 1962 that cooper pairs could tunnel through a thin insulating barrier. Used widely in SC qubits.



Fig 1: Useful properties of JJ. A: A non-linear LC quantum oscillator. B: Washboard potential.

Flux maintained by a SC loop is also quantized: important.

1. Charge Qubits

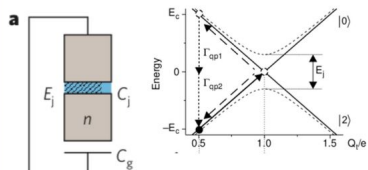


Fig 2: Left: circuit diagram of charge qubit. Right: dynamics of charge qubit. Box labeled "n" is the "cooper-pair-box". More recent variations have been called Transmon and qnantrionium.

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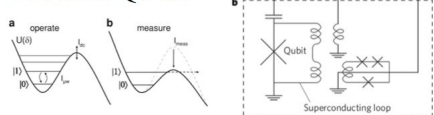


Fig 3: A: The phase-dependent potential of a phase qubit during usage. Right: A circuit diagram of a phase qubit. The X's represent Josephson Junctions.

3. Flux Qubits

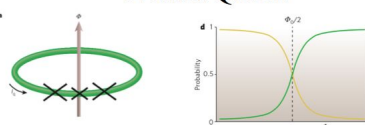


Fig 4: A: A basic flux qubit: three JJ in a superconducting loop. Right: the probability of the qubit being in either state depending on the bias flux.

Decoherence and Comparison

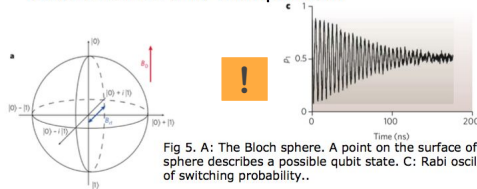


Fig 5: A: The Bloch sphere. A point on the surface of the sphere describes a possible qubit state. C: Rabi oscillations of switching probability.

Final Comparison

Qubit Type	Decoherence Time (μ s)
Charge	10
Phase	0.4
Flux	40

- Flux qubits are best by decoherence times.
- Still worth investigating all three types: quantum computers can be composed of different qubits.
- Charge qubits have e^{-2} explored potential.
- Phase qubits are especially valuable: useful if their short decoherence time can be overcome.

Further Investigation

- Decoherence in flux qubits is most often caused by energy leakage into the environment causing the excited state to decay.
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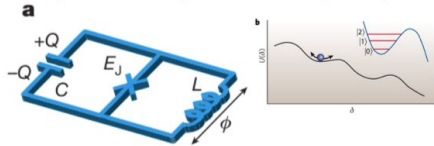


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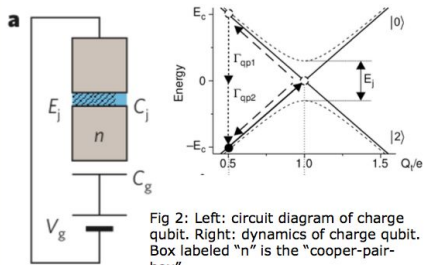


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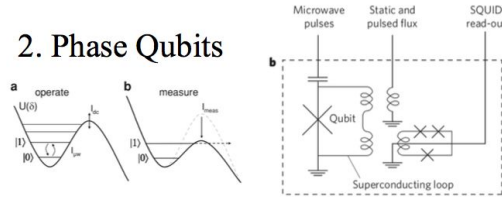


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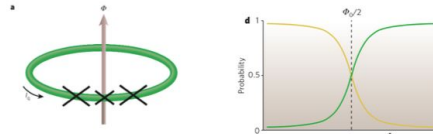


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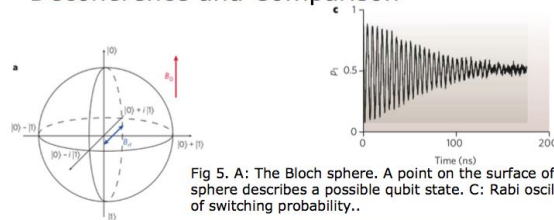


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RICE Preventing Decoherence in Superconducting Qubits

Student Name, netid@rice.edu, Rice University

Towards quantum computing

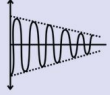
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Quantum bits (qubits)

Qubits = superposition of 2 quantum states

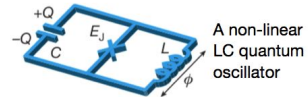
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A non-linear LC quantum oscillator

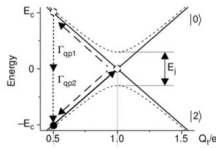
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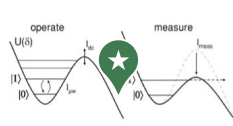
CHARGE QUBITS
Intermediate decoherence times

PHASE QUBITS
Short decoherence times

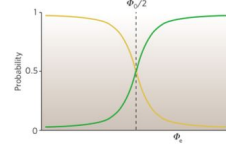
FLUX QUBITS
Long decoherence times



Local islands trap charge like a capacitor?



The phase of the qubit oscillates between states $|1\rangle$ and $|2\rangle$



Superconducting rings trap magnetic flux¹

Factors that influence decoherence

Energy leakage through different mechanisms causes the excited state to decay, resulting in decoherence.

Potential sources of energy leakage:

Low frequency flux noise Charge noise (stray quasiparticles)

Temperature dependent

Performance metrics

Operation time = how long it takes to read the qubit. Typically on the order of ~ps.

Figure of merit (FOM) = ratio of decoherence time to operation time.

FOM must be at least > 100 for computing purposes

Qubit performance

Qubit type	Charge	Phase	Flux
Decoherence time	10 μ s	0.4 μ s	40 μ s
Tunability			

Flux qubits are best in terms of decoherence time.

Charge qubits have a lot of unexplored potential.

Phase qubits are especially tunable, but decay quickly. Promising if short decoherence times can be overcome.

Future work may focus on reducing operating temperature & decrease charge noise.

References

[1] J. Clarke and F. K. Wilhelm, "Superconducting quantum bits," Nature, vol. 453, no. 7198, pp. 1031–1042, Jun. 2008.
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After Revised poster. Click on the marked locations to review the changes in each section.

The revised version of the poster focuses on the bigger picture, including figures to explain key concepts only.

The revised layout draws the viewer's attention to important sections using color and icons. The research story is also reinforced throughout the poster via more informative section headings.



Towards quantum computing

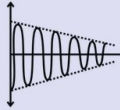
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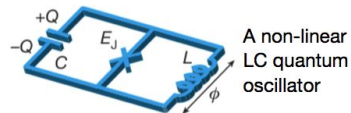
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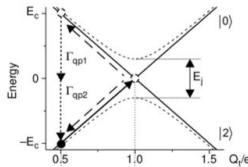
CHARGE QUBITS
Intermediate
decoherence times



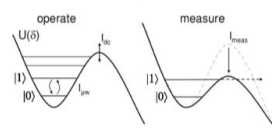
PHASE QUBITS
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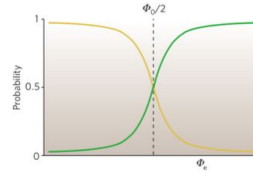
FLUX QUBITS
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Local islands trap charge like a capacitor²



The phase of the qubit oscillates between states $|1\rangle$ and $|2\rangle$ ³



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Improving Coherence in Superconducting Qubits

Student Name, email@rice.edu, Rice University

Title (before)

Ask yourself – What is the central focus of my literature review? How can I summarize the central research question?

Annotated Version

Revised Version

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The title on the original poster isn't unacceptable, but it could be improved because the central discussion of the review actually focuses on decoherence (not coherence).

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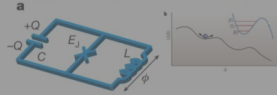


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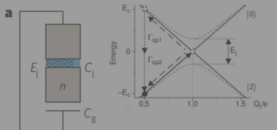


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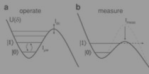


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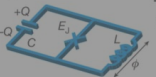


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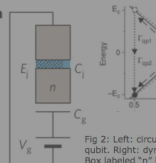


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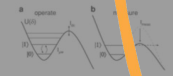


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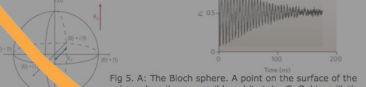


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CHARGE QUBITS	PHASE QUBITS	FLUX QUBITS
Intermediate decoherence times	Short decoherence times	Long decoherence times

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- Annotated Version
- Original Version
- Return to 'After'

The revised title identifies the central topic of the review – decoherence. Repeating the main theme of the review in the title helps the viewer to understand the overall message from first glance.

Shrinking the Rice logo and the author text directs the viewer's gaze to the title, which is the most important element in this section.





Improving Coherence in Superconducting Qubits

Student Name, email@rice.edu, Rice University

Summary

Josephson Junctions

1. Charge Qubits

2. Phase Qubits

3. Flux Qubits

Decoherence and Comparison

Final Comparison

Further Investigation

References

Layout (before)

Ask yourself – Do the sections in my poster follow a clear reading order? Also, does the layout assign the most space to the most important section(s)?

Annotated Version

Revised Version

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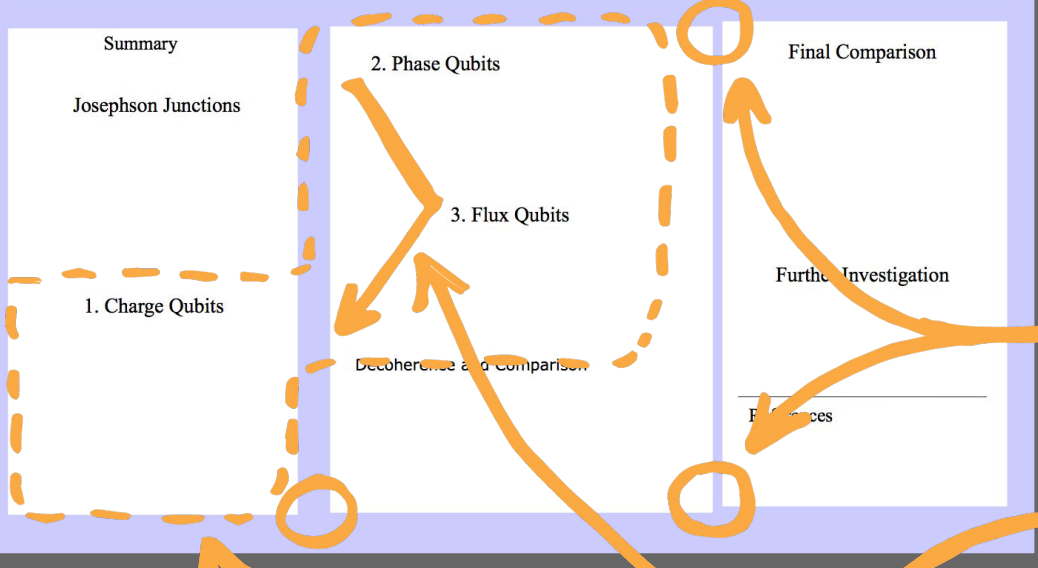
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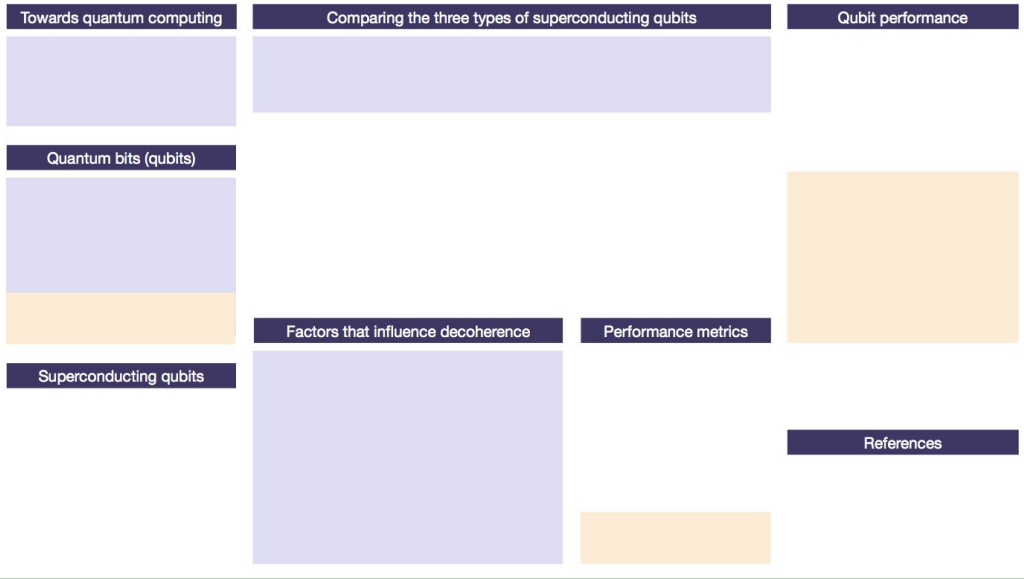
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[Annotated Version](#)

[Original Version](#)

[Return to 'After'](#)

In the revised layout, the central column has been widened to accommodate all three qubit types.

The asymmetric layout moves the viewer through the poster and rectangles of background color highlight important sections.

Consistently formatted section-headings summarize pieces of the story throughout the poster.





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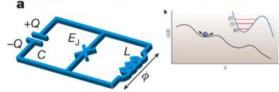


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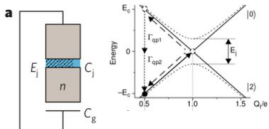


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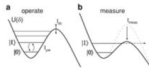
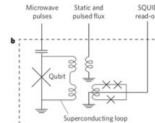


Fig 3: A: The phase-dependent potential of a phase qubit during usage. Right: A circuit diagram of a phase qubit. The X's represent Josephson Junctions.



3. Flux Qubits

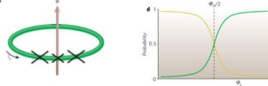


Fig 4: A: A basic flux qubit: three JJ in a superconducting loop. Right: the probability of the qubit being in either state depending on the bias flux.

Decoherence and Comparison



Fig 5: A: The Bloch sphere. A point on the surface of the sphere describes a possible qubit state. C: Rabi oscillations of switching probability..

Final Comparison

Qubit Type	Decoherence Time (μ s)
Charge	10
Phase	0.4
Flux	40

- Flux qubits are best by decoherence times.
- Still worth investigating all three types: quantum computers can be composed of different qubits.
- Charge qubits have a lot of unexplored potential.
- Phase qubits are especially tunable: useful if their short decoherence times can be overcome.

Further Investigation

- Decoherence in flux qubits is most often caused by energy leakage into the environment causing the excited state to decay.
- The source of this leakage is uncertain, as it could be due to low frequency flux noise or due to charge noise (stray quasiparticles).
- One option to investigate is to reduce operating temperature, as charge noise is known to have a strong temperature dependence.

References

Not sure how to format this compactly?

Design (before)

Ask yourself – Is my poster pleasant to look at? If not, what visual clutter can I remove? What visual elements other than journal article figures can I use to communicate my message?

Annotated Version

Revised Version

Return to 'Before'

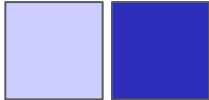
The original poster exhibits many inconsistencies in font, text size, text spacing, and alignment.

Overall, the poster is too text heavy. Long bullet points are difficult to read during a poster session and usually do not invite or engage the viewer.

The poster also uses a Serif font (one with the little feet) which is more difficult to read on screen.

Small formatting details such as panel labels in the journal article figures have been neglected.

Theme colors →



Bonus topic! Click me to learn more about theme colors



Summary

Superconducting quantum effects even at macroscopic scales: natural candidate for qubits. Quantum effects are still fragile: challenges for SC qubits.

Josephson Junctions

Josephson junction: tunneling of Cooper pairs through an insulating barrier. Used widely in SC qubits.



Fig 1: Useful properties of JJ. A: Non-linear LC quantum oscillator. B: Washboard potential.

Flux maintained by a SC loop is also quantized: important.

1. Charge Qubits

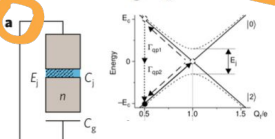


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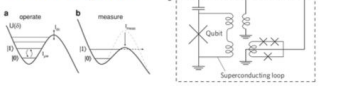


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3. Flux Qubits



Fig 4: Probability of the qubit being in either state depending on the bias flux.

Decoherence and Comparison

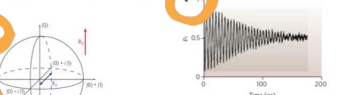


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RICE Preventing Decoherence in Superconducting Qubits


Student Name, netid@rice.edu, Rice University

Towards quantum computing


Moore's law is finally ending, and to fully realize quantum computers requires control over quantum bits, or **qubits**.




Comparing the three types of superconducting qubits



CHARGE QUBITS
Intermediate
decoherence times









PHASE QUBITS
Short
decoherence times



FLUX QUBITS
Long
decoherence times


Qubit performance

Qubit type	Charge	Phase	Flux
			
Decoherence time	10 μ s	0.4 μ s	40 μ s
Tunability			

Quantum bits (qubits)

Qubits = superposition of 2 quantum states

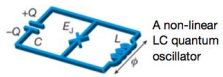
Decoherence time = how long the qubit state lasts



Long decoherence times are required before applications can be realized.

Superconducting qubits

Superconducting qubits are studied in Josephson-Junctions,



A non-linear LC quantum oscillator

which consist of Cooper pairs that tunnel through a thin insulating barrier.

Factors that influence decoherence

Energy leakage through different mechanisms causes the excited state to decay, resulting in decoherence.

Potential sources of energy leakage:

- Low frequency flux noise
- Charge noise (stray quasiparticles)
- Temperature dependent

Performance metrics

Operation time = how long it takes to read the qubit. Typically on the order of ~ps.

Figure of merit (FOM) = ratio of decoherence time to operation time.

FOM must be at least > 100 for computing purposes

References

[1] J. Clarke and F. K. Wilhelm, "Superconducting quantum bits," *Nature*, vol. 453, no. 7198, pp. 1031–1045, Jun. 2008.

[2] Y. Nakamura, et al., "Coherent control of macroscopic quantum states in a single-Cooper-pair box," *Nature*, vol. 398, no. 6730, pp. 786–788, Apr. 1999.

[3] J. M. Martinis, "Superconducting phase qubits," *Quantum Inf Process*, vol. 8, no. 2–3, pp. 81–103, Jun. 2009

[4] Icons created for The Noun Project, thenounproject.com

Design (after)

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Annotated Version

Original Version

Return to 'After'

In the revised poster, text blocks have been reduced and text spacing has been increased to make it more pleasant to read.

Font, text size, alignment, and spacing are all consistent in the revised version.

The revision also incorporates icons that help to establish a visual theme.

The revised poster utilizes a complementary color scheme with muted violet as the main color and peachy orange as the accent color.

Theme colors →



Bonus topic! Click me to learn more about theme colors





Improving Coherence

Student Name, et al.

Summary

Superconductors exhibit quantum effects even at macroscopic scales: natural candidate for qubits. Quantum effects are still fragile: challenges for SC qubits.

Josephson Junctions

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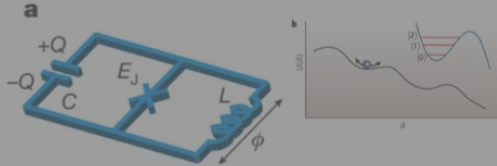
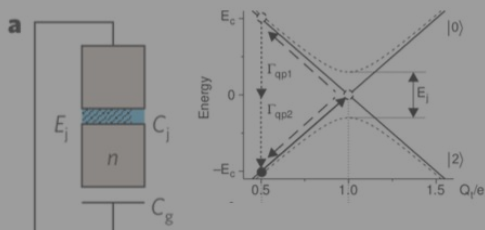


Fig 1: Useful properties of JJ. A: A non-linear LC quantum oscillator. B: Washboard potential.

Flux maintained by a SC loop is also quantized: important.

1. Charge Qubits



2. Phase Qubits

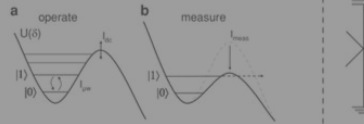


Fig 3: A: The phase-dependent potential of a phase qubit. B: A circuit diagram of a phase qubit. The X's represent Josephson junctions.

3. Flux Qubits

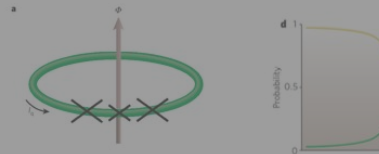
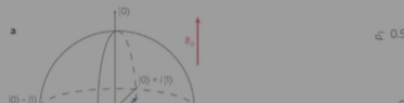


Fig 4: A: A basic flux qubit: three JJ in a superconducting loop. B: Plot of the probability of the qubit being in either state.

Decoherence and Comparison



Introduction (before)

Ask yourself – Who is the audience? What background information will they need to understand my review? How can I summarize the big picture?

Annotated Version

Revised Version

Return to 'Before'

The original poster includes a short paragraph as the introduction, but the text is awkward and difficult to read.

The section-heading, "Summary," is too vague and doesn't communicate a specific message to the viewer.

This section is crowded by the section below it and lacking white space.





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Student Name, em

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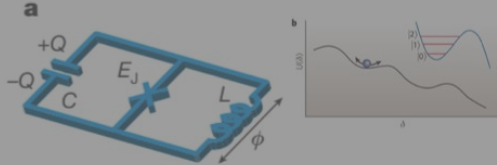
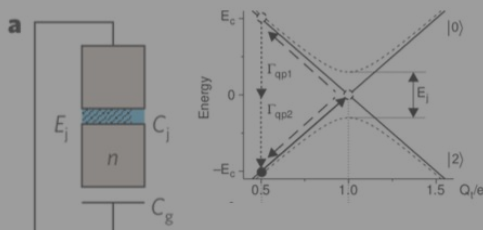


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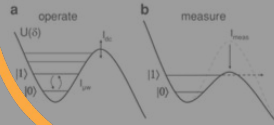


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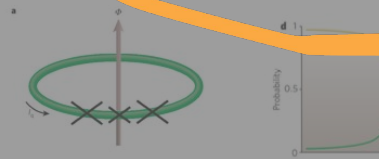
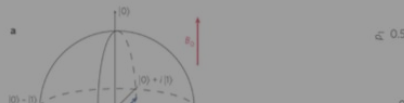


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Decoherence and Comparison



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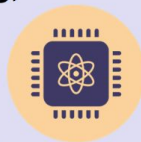
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Towards quantum computing

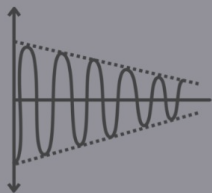
Moore's law is finally ending, and to fully realize quantum computers requires control over quantum bits, or **qubits**.



Quantum bits (qubits)

Qubits = superposition of 2 quantum states

Decoherence time = how long the qubit state lasts

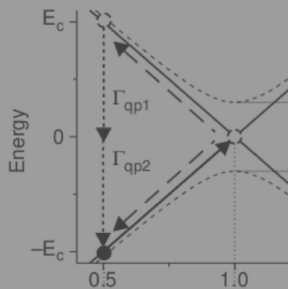


Long decoherence times are required before applications can be realized.

Com



CHARGE
Intermedia
decoheren



Local islands trap
like a capacitor²

Factors th

Introduction (after)

Ask yourself – Who is the audience? What background information will they need to understand my review? How can I summarize the big picture?

Annotated Version

Original Version

Return to 'After'

The revised introduction begins by explaining a potential motivation for this type of research.

Though a paragraph is still used, the text is spaced out and important words are highlighted so that the viewer can easily follow along.

An icon is used to represent the general idea of quantum computing, adding a much needed visual element.





Improving Coherence

Student Name, et al.

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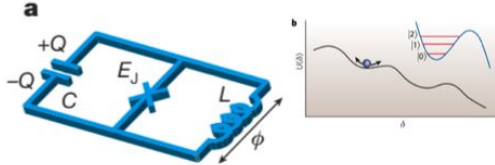
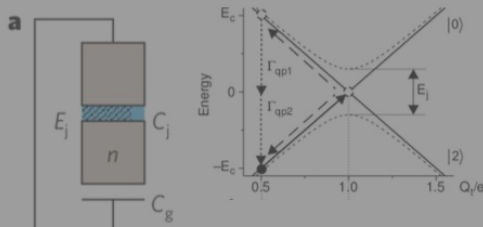


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Flux maintained by a SC loop is also quantized: important.

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2. Phase Qubits

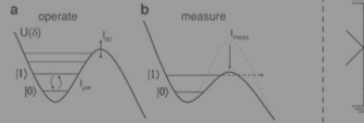


Fig 3: A: The phase-dependent potential of a phase qubit. B: A circuit diagram of a phase qubit. The X's represent qubits.

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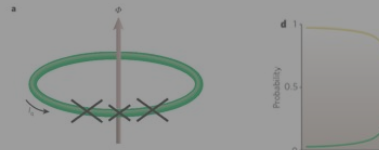
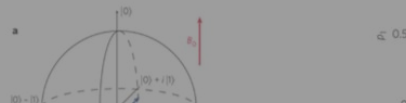


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Decoherence and Comparison



Background (before)

Ask yourself – What information does my audience need to know before they can understand the importance of these findings? Are there any terms I should define?

Annotated Version

Revised Version

Return to 'Before'

The background section begins with a discussion of Josephson junctions, but doesn't explain why they are relevant to the review topic.

The text relies heavily on scientific jargon and fails to define basic terms.

Also, this is an obvious example of inconsistent panel labels. Ideally, these labels would be removed by cropping the images or covering them up with a white box.





Improving Coherence

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Summary

Superconductors exhibit quantum effects even at macroscopic scales: natural candidate for qubits. Quantum effects are still a major challenge for SC qubits.

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Josephson junctions (JJ) are Cooper pairs tunneling through a thin insulating barrier. Used widely in SC qubits.

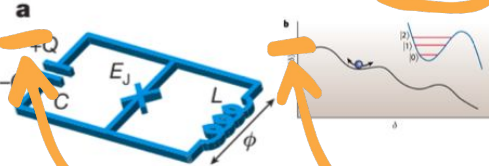
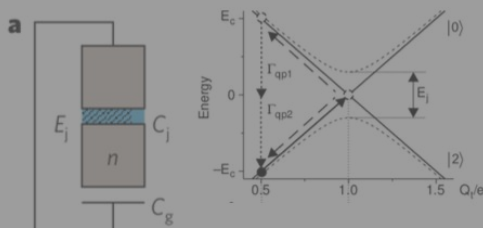


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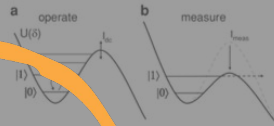


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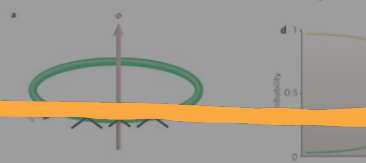
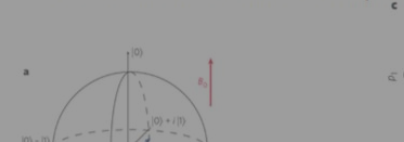


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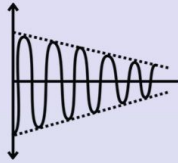
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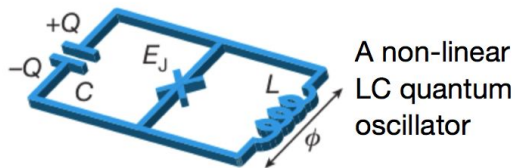
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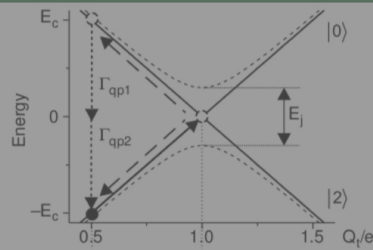
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Local islands trap charge like a capacitor²

Factors that influence



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Potential sources of energy

Low frequency flux noise

Charge (str)

Ter

Background (after)

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Annotated Version

Original Version

Return to 'After'

The revised poster introduces basic terms first and then briefly describes Josephson-Junctions.

The revision also introduces a simple visual icon to better explain the concept of decoherence.

More specific section-headings remind the viewer of the main message.

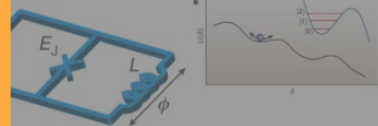


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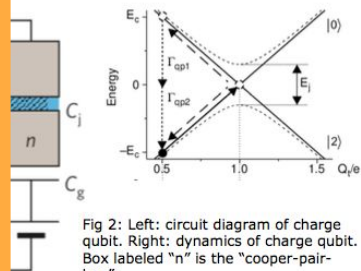


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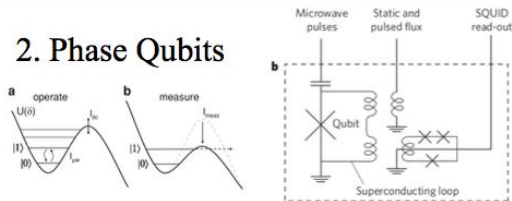


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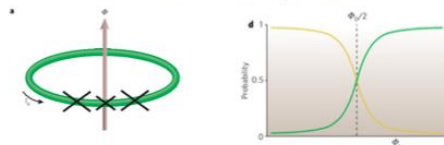


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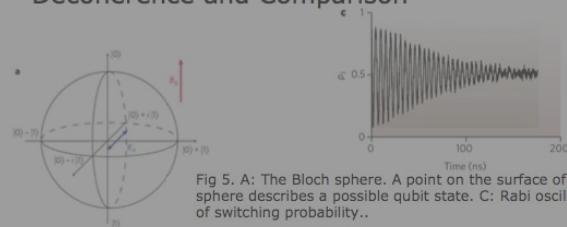


Fig 5: A: The Bloch sphere. A point on the surface of the sphere describes a possible qubit state. C: Rabi oscillation of switching probability.

Literature findings (before)

Ask yourself – What are the central topics of my literature review? Which references are necessary to the main message of my review?

Annotated Version

Revised Version

Return to 'Before'

The literature findings should be the central focus of the poster, but they are spread out over awkwardly two columns.

Rearranging the content so that the types of qubits are close to one another will help the viewer to group information.

There is no explanatory text telling the story. Right now these sections include formal figure captions, but captions aren't required for this assignment and they occupy valuable space.



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Original Version Revised Version Return to 'Before'

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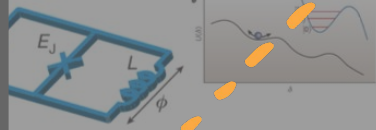
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Useful properties of JJ. A: A non-linear LC quantum oscillator. B: Washboard potential. The phase of a superconducting loop is also quantized:

1. Charge Qubits

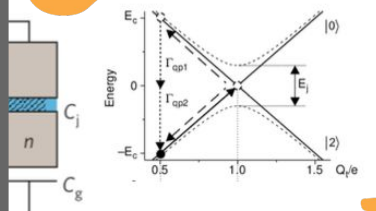


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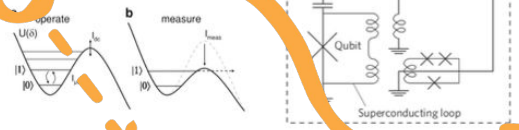


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3. Flux Qubits

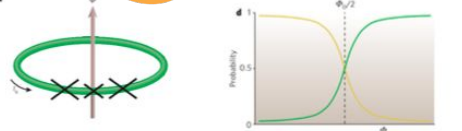


Fig 4: A: A basic flux qubit: three JJ in a superconducting loop. Right: the probability of the qubit being in either state depending on the bias flux.

Decoherence and Comparison



Fig 5. A: The Bloch sphere. A point on the surface of the sphere describes a possible qubit state. C: Rabi oscillation of switching probability..



Quantum Decoherence in Superconducting

Student Name, netid@rice.edu, Rice University

Comparing the three types of superconducting qubits



CHARGE QUBITS

Intermediate
decoherence times



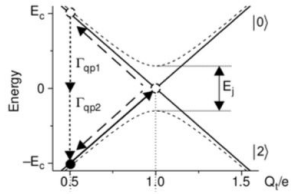
PHASE QUBITS

Short
decoherence times

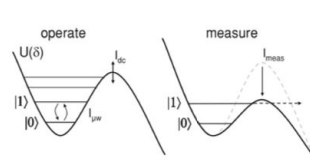


FLUX QUBITS

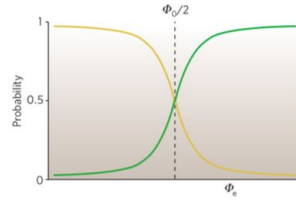
Long
decoherence times



Local islands trap charge like a capacitor²



The phase of the qubit oscillates between states $|1\rangle$ and $|2\rangle$ ³



Superconducting rings trap magnetic flux¹

Factors that influence decoherence



Energy leakage through different mechanisms causes the excited state to decay, resulting in decoherence.



Potential sources of energy leakage:

Performance metrics



Operation time = how long it takes to read the qubit. Typically on the order of \sim ps.



Figure of merit (FOM) = ratio of decoherence time to operation time

Literature findings (after)

Ask yourself – What are the central topics of my literature review? Which references are necessary to the main message of my review?

Annotated Version

Original Version

Return to 'After'

In the revised arrangement, all three qubit types are discussed in the same section.

One important figure was selected for each qubit type, shifting the focus away from technical details.

Icons are used to represent each qubit type. These icons act as a visual shorthand that is repeated throughout the rest of the poster.



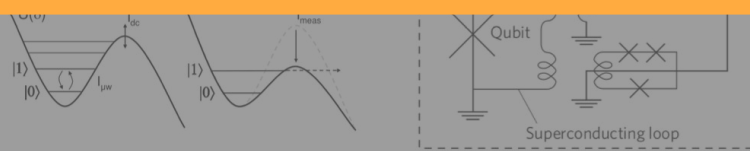


Fig 3: A: The phase-dependent potential of a phase qubit during usage. Right: A circuit diagram of a phase qubit. The X's represent Josephson Junctions.

3. Flux Qubits

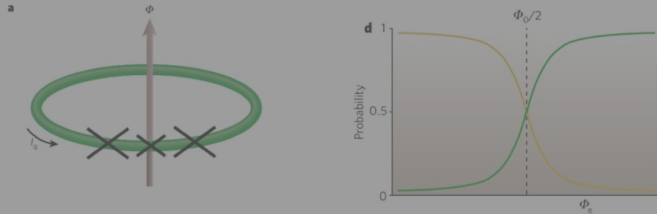


Fig 4: A: A basic flux qubit: three JJ in a superconducting loop. Right: the probability of the qubit being in either state depending on the bias flux.

Decoherence and Comparison

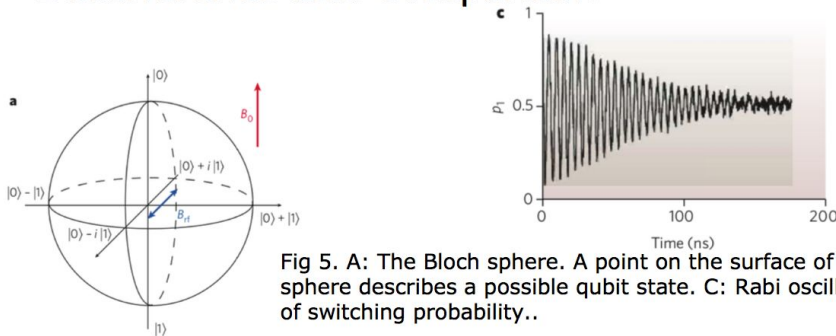


Fig 5: A: The Bloch sphere. A point on the surface of the sphere describes a possible qubit state. C: Rabi oscillations of switching probability..

Discussion (before)

Ask yourself – What themes appear in multiple articles? What scientific questions are being answered? What are the current challenges?

Annotated Version

Revised Version

Return to 'Before'

The heading is not informative and no subheadings are provided to guide the viewer.

Figures in this section seem random and aren't aligned.

This experimental figure could probably be replaced with a simple visual that illustrates the same idea.



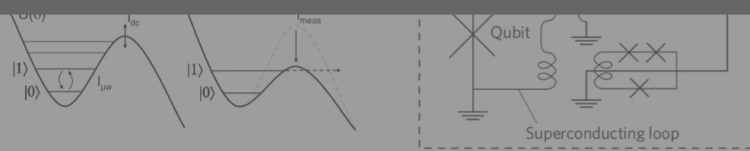


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3. Flux Qubits

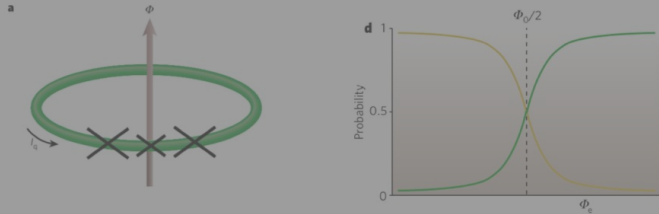


Fig 4: A: A basic flux qubit: three JJ in a superconducting loop. Right: the probability of the qubit being in either state depends on the bias flux.

Decoherence and Comparison

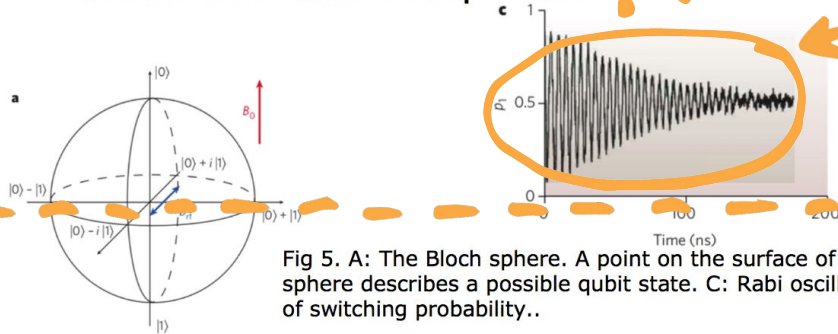


Fig 5: A: The Bloch sphere. A point on the surface of the sphere describes a possible qubit state. C: Rabi oscillations of switching probability..

Discussion (annotated)

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Original Version

Revised Version

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Comparing the three types of superconducting qubits



CHARGE QUBITS

Intermediate
decoherence times



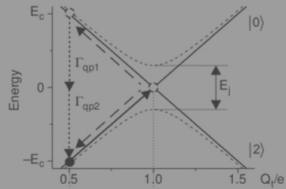
PHASE QUBITS

Short
decoherence times

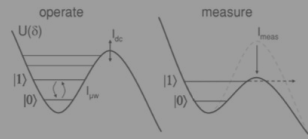


FLUX QUBITS

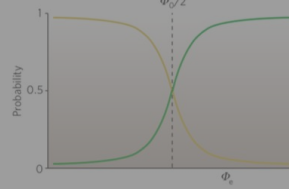
Long
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Local islands trap charge like a capacitor²



The phase of the qubit oscillates between states $|1\rangle$ and $|2\rangle$ ³



Superconducting rings trap magnetic flux¹

Factors that influence decoherence



Energy leakage through different mechanisms causes the excited state to decay, resulting in decoherence.



Potential sources of energy leakage:

Low frequency flux noise

Charge noise (stray quasiparticles)

↓
Temperature dependent

Performance metrics



Operation time = how long it takes to read the qubit. Typically on the order of ~ps.



Figure of merit (FOM) = ratio of decoherence time to operation time.

FOM must be at least > 100 for computing purposes

Discussion (after)

Ask yourself – What themes appear in multiple articles? What scientific questions are being answered? What are the current challenges?

Annotated Version

Original Version

Return to 'After'

The revised poster expands the discussion of qubit types with an overview of decoherence and performance.

Icons are used to visually summarize each concept discussed.

Orange is used to draw attention to the figure of merit, which is the parameter most relevant to future applications in quantum computing.

[1] Nat
[2] que
no.
[3] Pro
[4]



Final Comparison

Qubit Type	Decoherence Time (μs)
Charge	10
Phase	0.4
Flux	40

- Flux qubits are best by decoherence times.
- Still worth investigating all three types: quantum computers can be composed of different qubits.
- Charge qubits have a lot of unexplored potential.
- Phase qubits are especially tunable: useful if their short decoherence times can be overcome.

Further Investigation

- Decoherence in flux qubits is most often caused by energy leakage into the environment causing the excited state to decay.
- The source of this leakage is uncertain, as it could be due to low frequency flux noise or due to charge noise (stray quasiparticles).
- One option to investigate is to reduce operating temperature, as charge noise is known to have a strong temperature dependence.

References

Final overview (before)

Ask yourself – What major themes emerged from the articles I read? How can I synthesize and summarize the overall conclusions from several key articles at once?

Annotated Version

Revised Version

Return to 'Before'

This section contains most of the needed content, but is very difficult to read because of poor formatting.

The table stands out awkwardly because the blue is very bright and the text is larger in the table than in the rest of the poster.

The bullet points are too long. They read like a paragraph instead of a skimmable list.



Final Comparison

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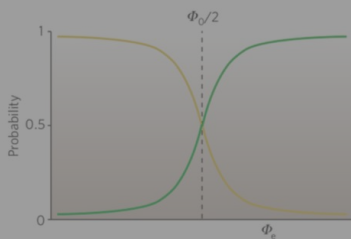


Superconducting qubits



FLUX QUBITS

Long decoherence times



Superconducting rings trap magnetic flux¹

Performance metrics



Operation time = how long it takes to read the qubit. Typically on the order of ~ps.

Qubit performance

Qubit type	Charge	Phase	Flux
Decoherence time	10 μ s	0.4 μ s	40 μ s
Tunability			

Flux qubits are best in terms of decoherence time.

Charge qubits have a lot of unexplored potential.

Phase qubits are especially tunable, but decay quickly. Promising if short decoherence times can be overcome.



Future work may focus on reducing operating temperature to decrease charge noise.

References

Final overview (after)

Ask yourself – What major themes emerged from the articles I read? How can I synthesize and summarize the overall conclusions from several key articles at once?

Annotated Version

Original Version

Return to 'After'

The revised version summarizes qubit performance with a visually appealing table.

The overall conclusions reconnect with the motivation by focusing on potential for future computing applications.

The revised version also includes a brief perspective about possible next steps without going into excessive experimental detail.



Phase	0.4
-------	-----

Flux	40
------	----

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References

Not sure how to format this compactly?

References (before)

Ask yourself – What are the main articles I refer to on the poster? Where did I obtain images from? Do I need to cite anything else?

Annotated Version

Revised Version

Return to 'Before'

The original references section is obviously incomplete.

Format references compactly by limiting the number of papers discussed on the poster and by using a smaller font size (even 8 or 9 pt is fine).

If you don't have room still, remove article titles and replace author names past the first author with "et al."



Phase	0.4
Flux	40

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References

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why?

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Superconducting rings trap magnetic flux¹

Performance metrics

Coherence time = how long it takes to read the qubit. Typically on the order of ~ps.

Figure of merit (FOM) = ratio of coherence time to operation time.

Must be at least **> 100** for computing purposes



Flux qubits are best in terms of decoherence time.



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Future work may focus on reducing operating temperature to decrease charge noise.

References

- [1] J. Clarke and F. K. Wilhelm, "Superconducting quantum bits," *Nature*, vol. 453, no. 7198, pp. 1031–1042, Jun. 2008.
- [2] Y. Nakamura, et al., "Coherent control of macroscopic quantum states in a single-Cooper-pair box," *Nature*, vol. 398, no. 6730, pp. 786–788, Apr. 1999.
- [3] J. M. Martinis, "Superconducting phase qubits," *Quantum Inf Process*, vol. 8, no. 2-3, pp. 81–103, Jun. 2009
- [4] Icons created for The Noun Project, thenounproject.com

References (after)

Ask yourself – What are the main articles I refer to on the poster? Where did I obtain images from? Do I need to cite anything else?

Annotated Version

Original Version

Return to 'After'

The revised poster includes references for three main articles – one for each type of qubit.

An expanded reference list would be included in the written report.

Starting components for icons on the revised poster were obtained from the Noun Project, so this website (www.thenounproject.com) is also included in the reference list.



Colors

The colors you use contribute to the overall feel of your poster. Color can also be used strategically to visually emphasize key information.



Basics of
color theory



How to combine
colors



How to select
pleasing colors



Basics of color theory

Understanding color theory is the first step to meaningful and effective color choices. Here are some basic terms to remember.

Hue = the actual color



Value = light to dark



Shade = color + black



Tint = color + white

Saturation = color strength



Return to [Color](#)

Return to [Design](#)



How to combine colors

The color wheel outlines standard color schemes.
Use a standard color combination as a starting point for your color scheme.

[Next page →](#)

Color wheel



Some examples of standard color schemes



Monochromatic



Analogous



Complementary



Split complementary



Triadic



Tetradic

[Return to Color](#)

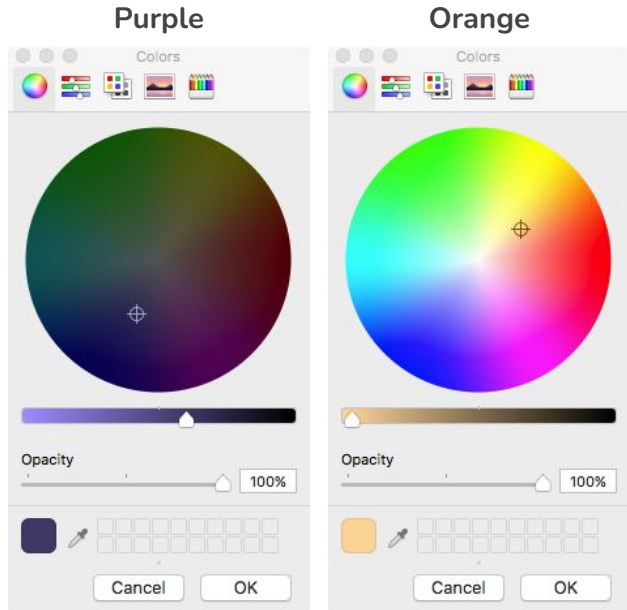
[Return to Design](#)



How to combine colors

The color wheel outlines standard color schemes.
Use a standard color combination as a starting point for your color scheme.

← Previous page



The revised poster uses a complementary color scheme.

Tints and shades of purple are used as the main colors.

Orange is used as an accent color that draws the viewer's attention to key elements on the poster.

RICE Preventing Decoherence in Superconducting Qubits

Student Name, netid@rice.edu, Rice University

Towards quantum computing

Moore's law is finally ending, and to fully realize quantum computers requires control over quantum bits, or **qubits**.

Comparing the three types of superconducting qubits

Qubit type	Charge	Phase	Flux
Decoherence time	10 μ s	0.4 μ s	40 μ s
Tunability	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Quantum bits (qubits)

Qubits = superposition of 2 quantum states

Decoherence time = how long the qubit state lasts

Long decoherence times are required before applications can be realized.

Superconducting qubits

Superconducting qubits are studied in Josephson-Junctions,

A non-linear LC quantum oscillator

which consist of Cooper pairs that tunnel through a thin insulating barrier.

Factors that influence decoherence

Energy leakage through different mechanisms causes the excited state to decay, resulting in decoherence.

Potential sources of energy leakage:

- Low frequency flux noise
- Charge noise (stray quasiparticles)
- Temperature dependent

Performance metrics

Operation time = how long it takes to read the qubit. Typically on the order of μ s.

Figure of merit (FOM) = ratio of decoherence time to operation time.

FOM must be at least > 100 for computing purposes

Qubit performance

Future work may focus on reducing operating temperature to decrease charge noise.

References

[1] J. Clarke and F. K. Wilhelm, "Superconducting quantum bits," Nature, vol. 453, no. 7180, pp. 1031-1038, Jun 2008.

[2] Y. Nakamura, et al., "Coherent control of macroscopic quantum bits in a single-Cooper-pair box," Nature, vol. 398, no. 6735, pp. 786-788, Apr 1998.

[3] J. M. Martin, "Superconducting phase qubits," Quantum Inf Process, vol. 8, no. 2-3, pp. 81-103, Jun 2009

(4) Icons created for The Noun Project, thenounproject.com

Return to Color

Return to Design



Selecting pleasing colors

Use natural, muted, or neutral colors for most applications. Don't use a bright color unless you intend to attract the viewer's attention.



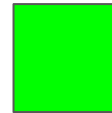
Consider colors in nature for inspiration.

Natural colors are much more muted than pure hues and are more pleasing to the eye.

Yes



No



Avoid bright colors except for emphasis.

Bright colors demand the viewer's attention, so make sure to use them wisely. Overuse bright colors and they lose their meaning.

Return to **Color**

Return to **Design**



Project details

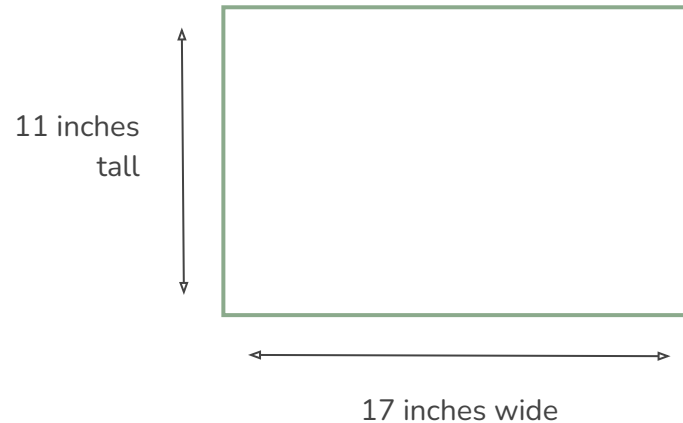
This poster will be presented electronically so the suggested formatting is slightly different than your normal poster.

Goal

This poster should outline the main points in your literature review.

Don't get bogged down in technical details, instead focus on general themes and how the articles relate to one another.

Slide size



Recommended font sizes

Title

28 - 40 pt

Section-headings

16 - 22 pt

Body text

12 - 16 pt

References

8 - 10 pt

