

# Two-Qubit Dynamics with Josephson Qubits

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# History

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Topic of this slide

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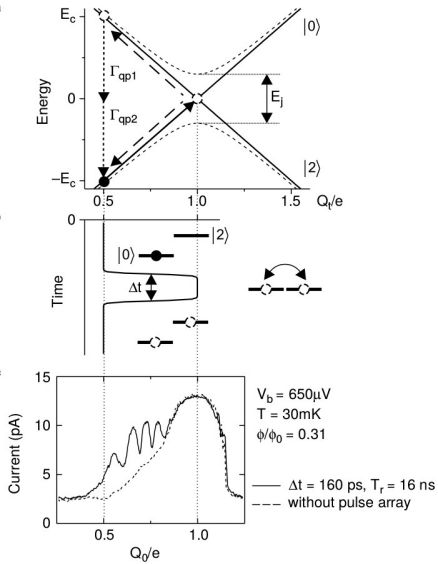


Figure : A simple caption

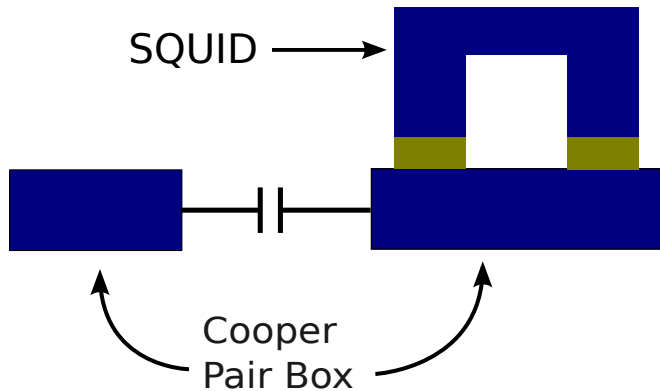
# Coupling of Two Qubits

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## Review

# Coupling of Two Qubits

## Basic Idea





# Coupling of Two Qubits

## The Circuit

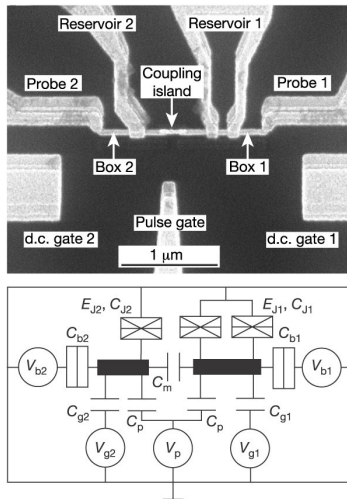


Figure : <http://www.nature.com/nature/journal/v421/n6925/full/nature01365.html>

# Coupling of Two Qubits

## Parameter Measurements

### Charging Diagram of Single-Qubit Case



# Coupling of Two Qubits

## Charging Diagram of Two-Qubit Case

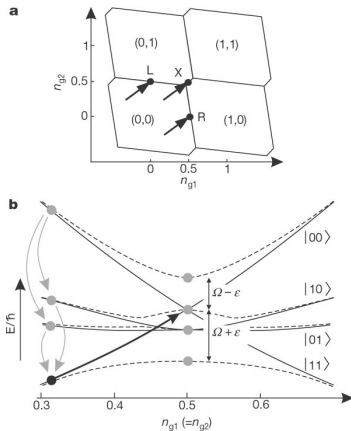


Figure : <http://www.nature.com/nature/journal/v421/n6925/full/nature01365.html>

# Coupling of Two Qubits

## Charging-Energy Diagram

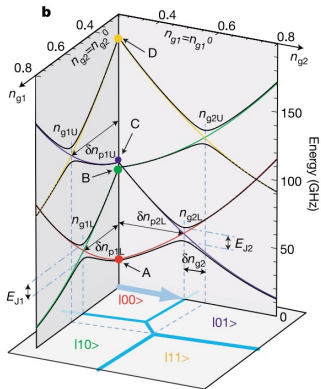
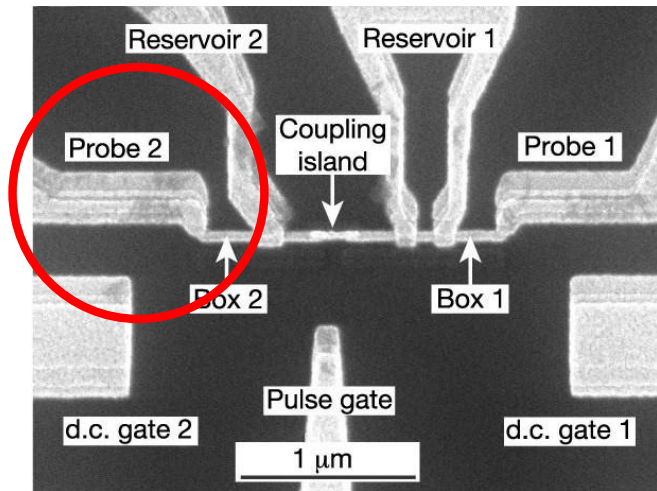


Figure : <http://qudev.ethz.ch/content/courses/QSIT09/pdfs/Yamamoto2003.pdf>

# Coupling of Two Qubits

## State Readout



# Coupling of Two Qubits

## Frequency Responses

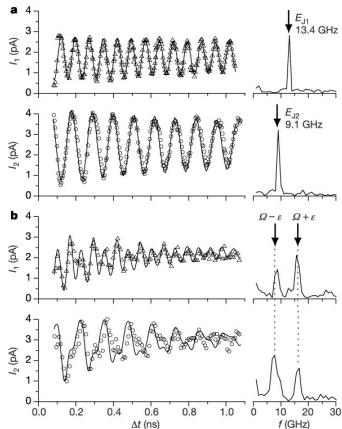


Figure : <http://www.nature.com/nature/journal/v421/n6925/full/nature01365.html>

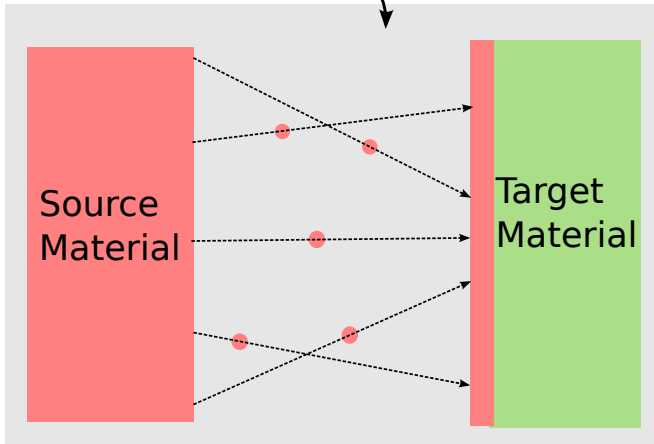
# Fabrication Techniques



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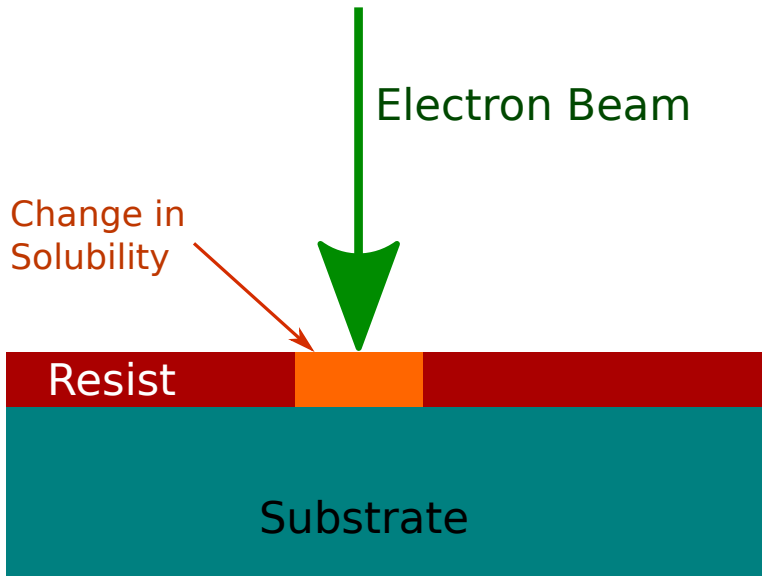
## Evaporation (Deposition)

Vacuum and Heat



# Fabrication Techniques

## Electron Beam Lithography (EBL)



# Fabrication Techniques

## Etching

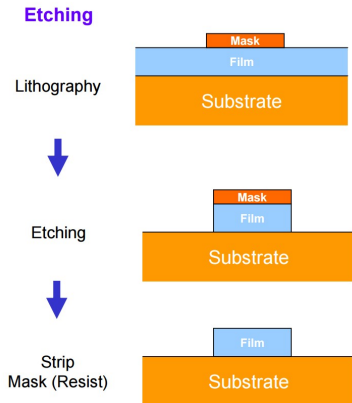


Figure : <http://www.mrsec.harvard.edu/education/ap298r2004/Erli%20chen%20Fabrication%20III%20-%20Etching.pdf>

# Fabrication Techniques

## Lift-off

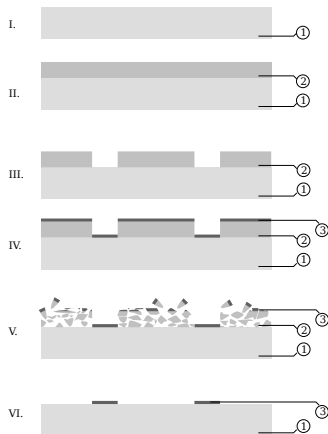


Figure : [http://en.wikipedia.org/wiki/Lift-off\\_%28microtechnology%29](http://en.wikipedia.org/wiki/Lift-off_%28microtechnology%29)

# Fabrication Techniques

SEM image of a SQUID qubit

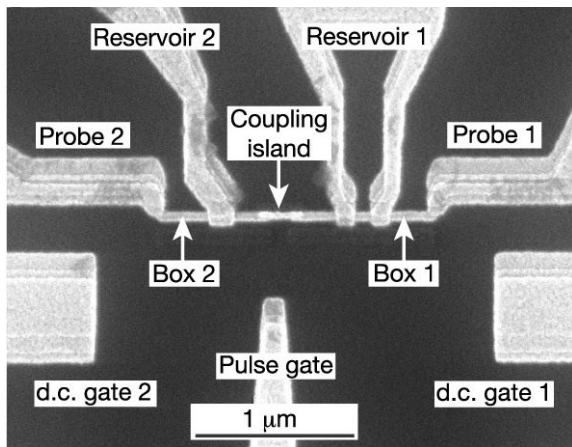


Figure : <http://www.nature.com/nature/journal/v421/n6925/full/nature01365.html>

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## Reference Papers

<http://www.nature.com/nature/journal/v421/n6925/full/nature01365.html>

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.193.5098&rep=rep1&type=pdf>

(Figures cited individually)