Title: Quantum Estimation: Theory and Practice - Welcome

Date: Aug 25, 2008 09:00 AM

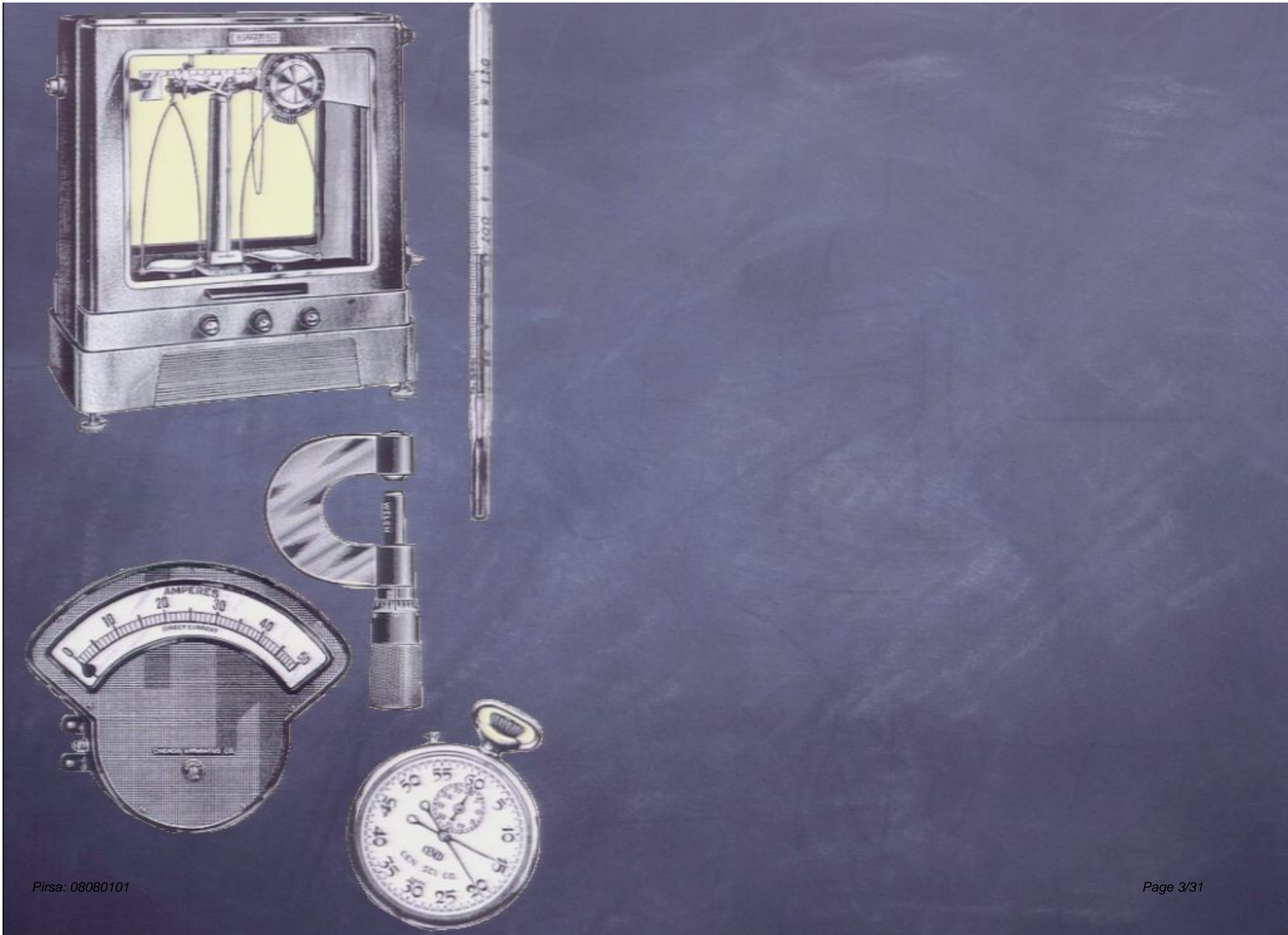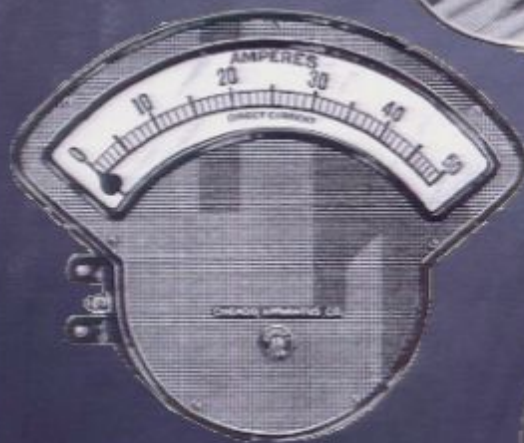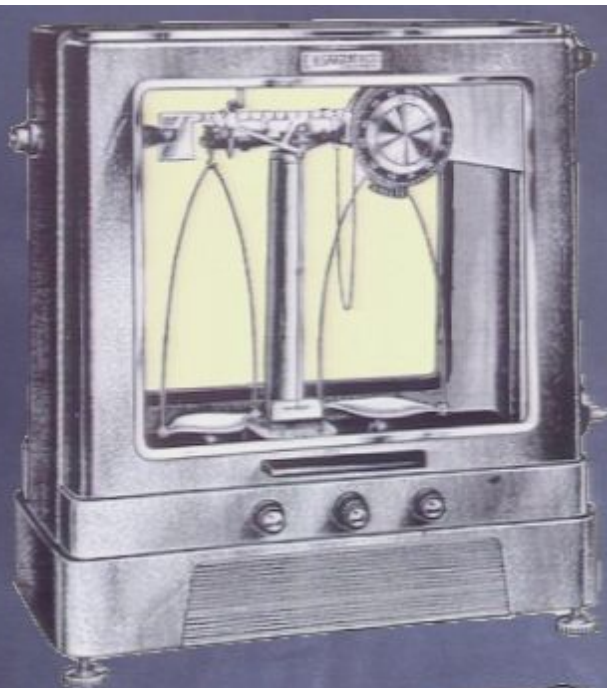URL: http://pirsa.org/08080101

Abstract:

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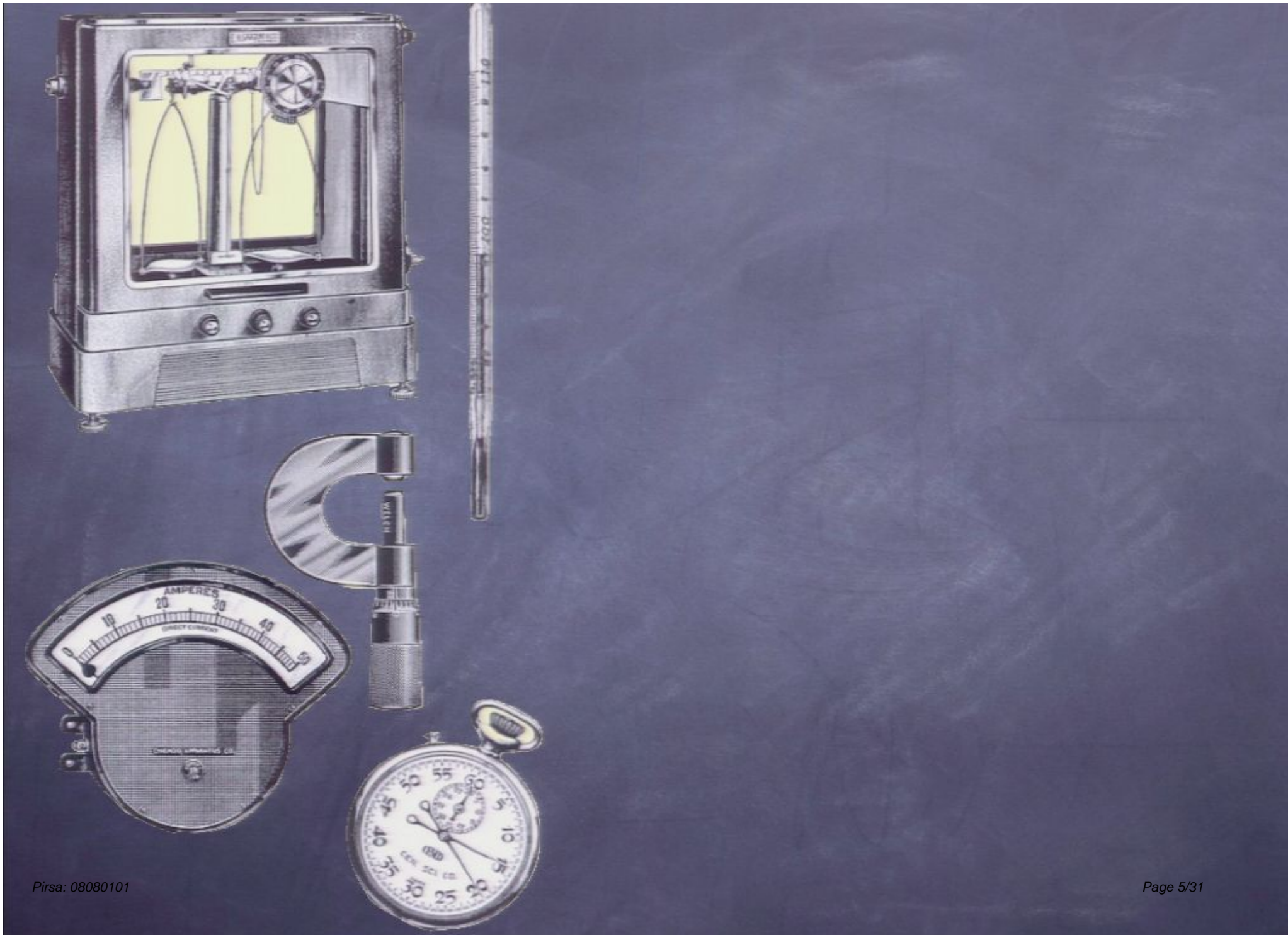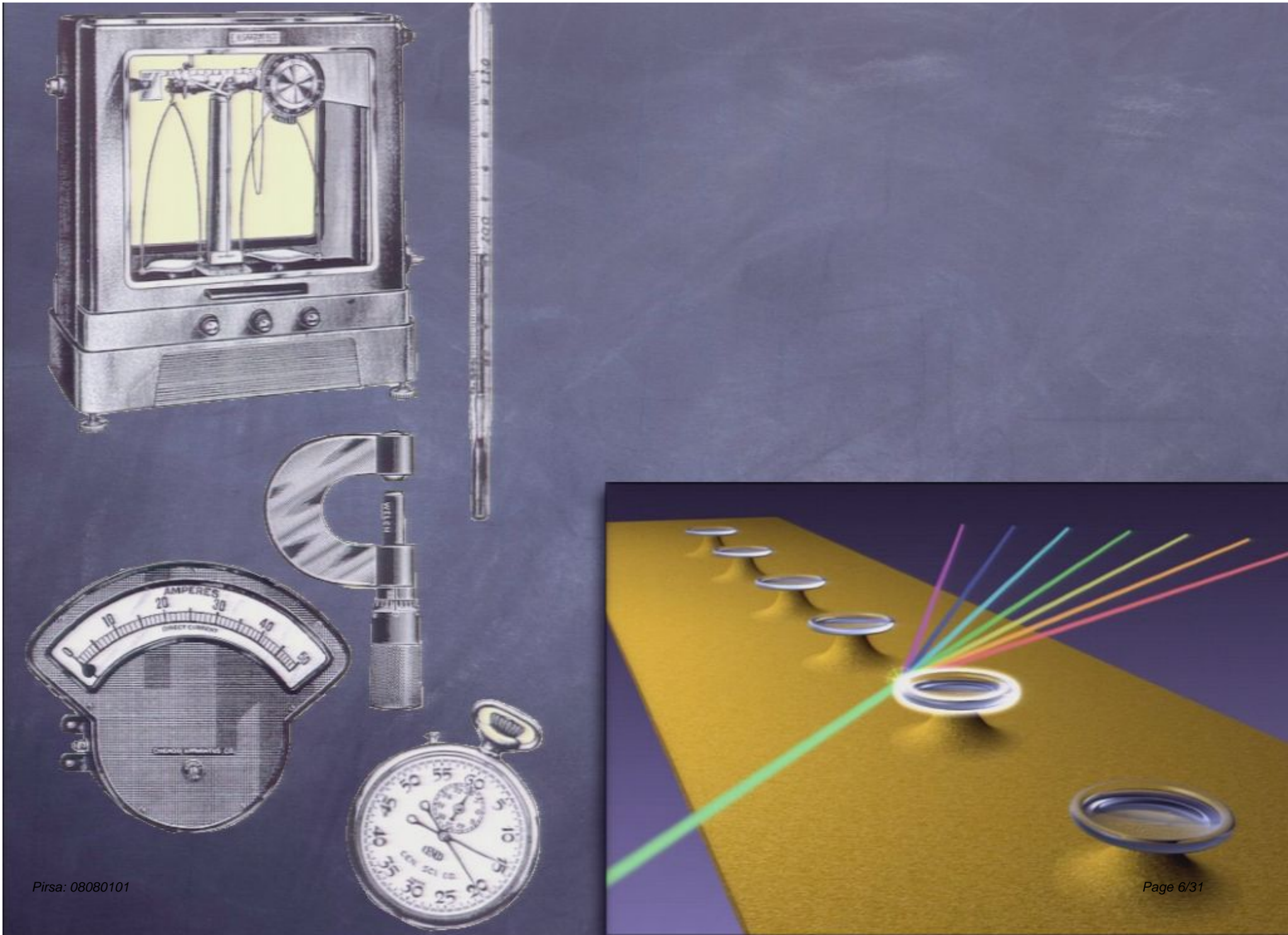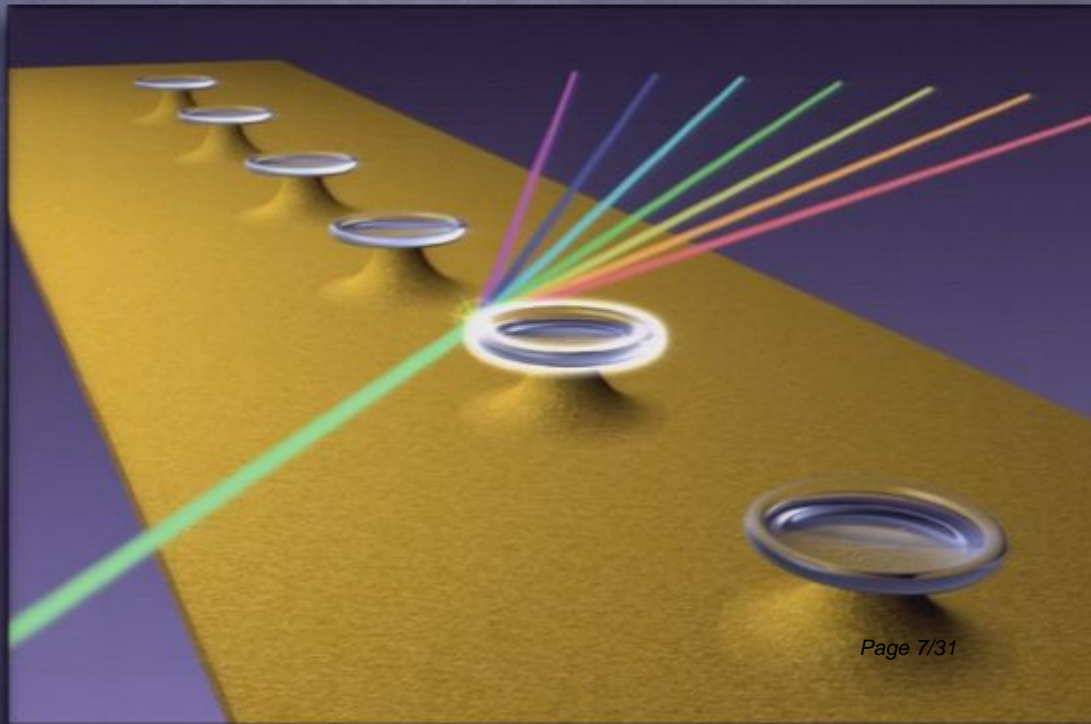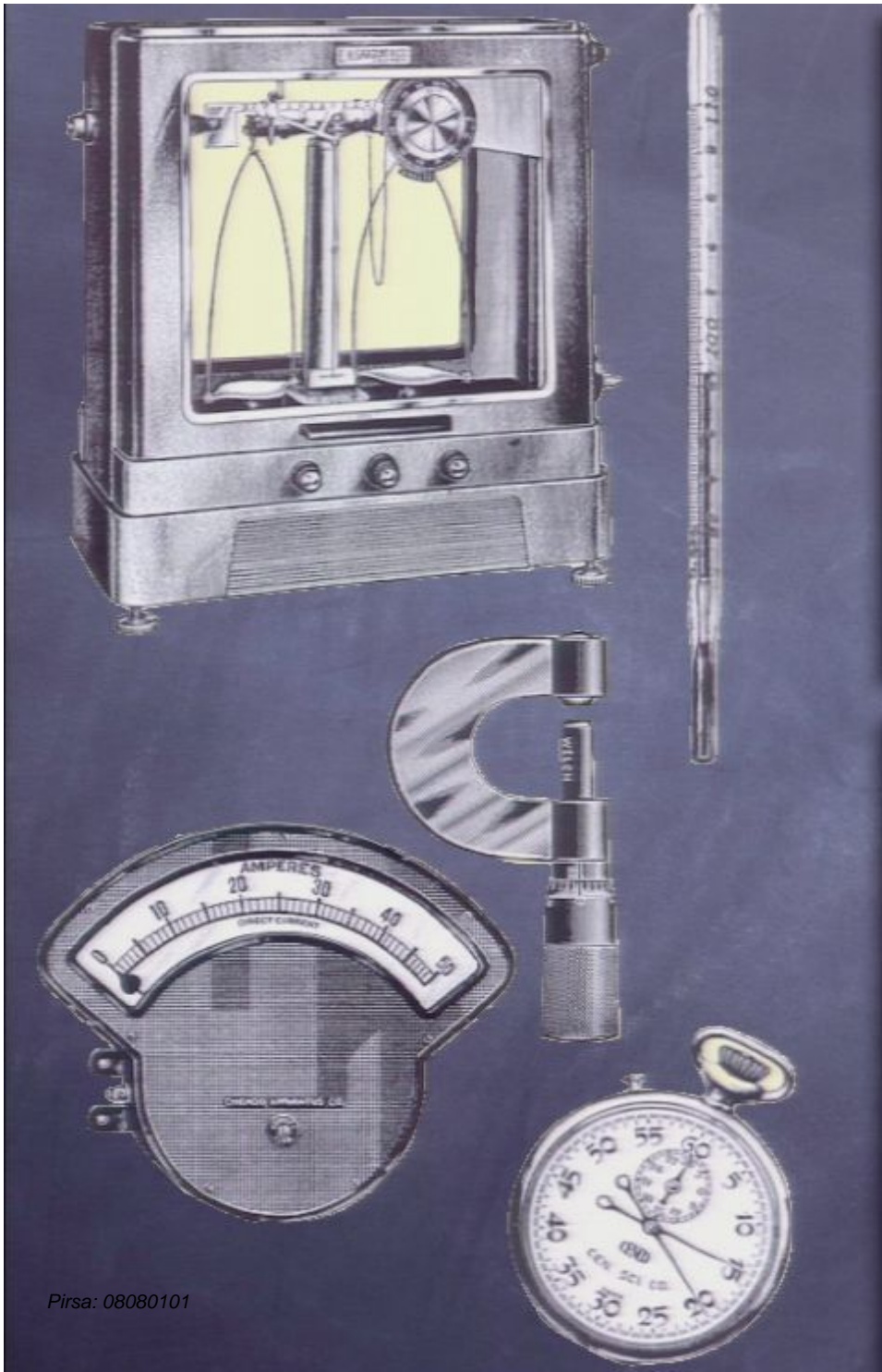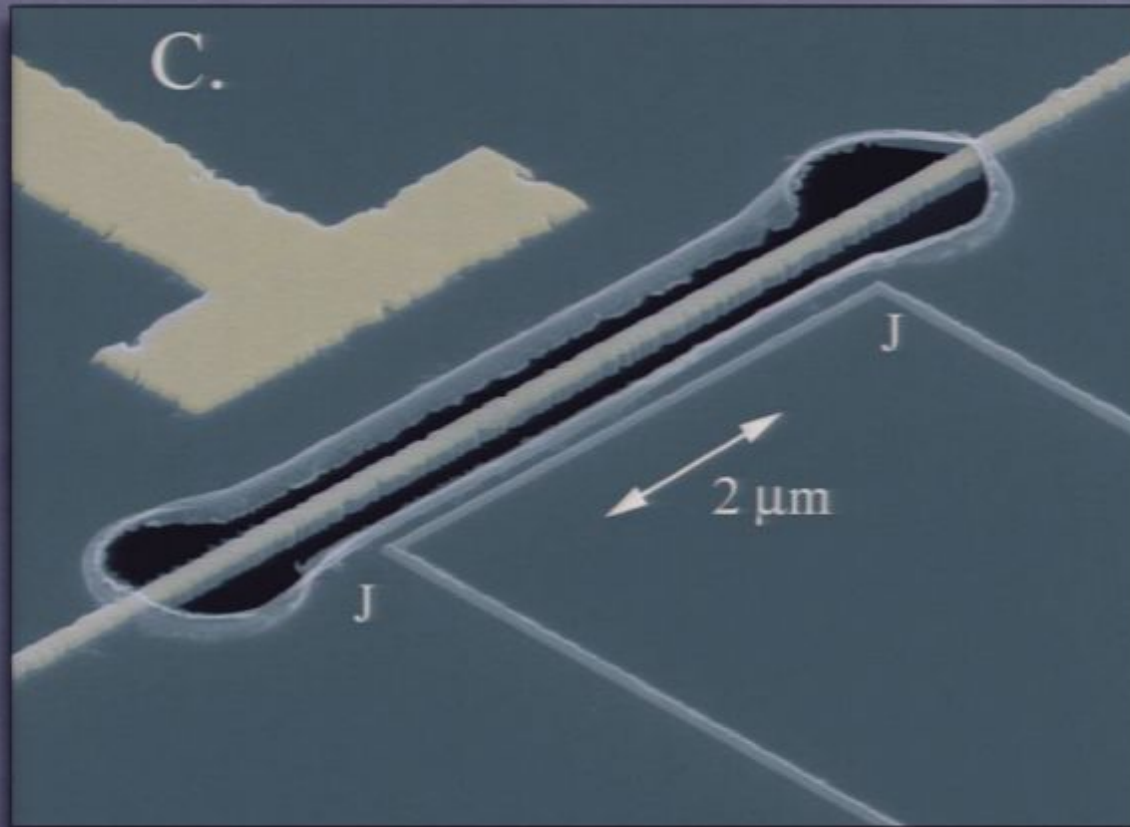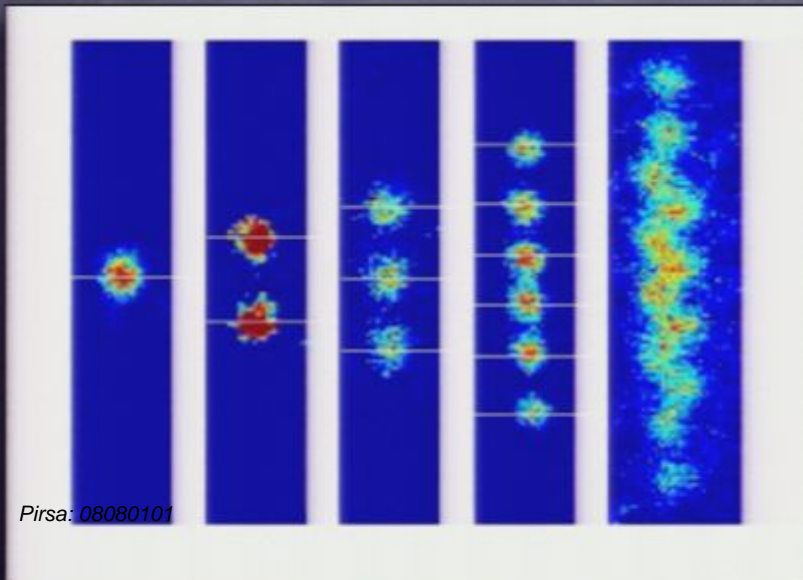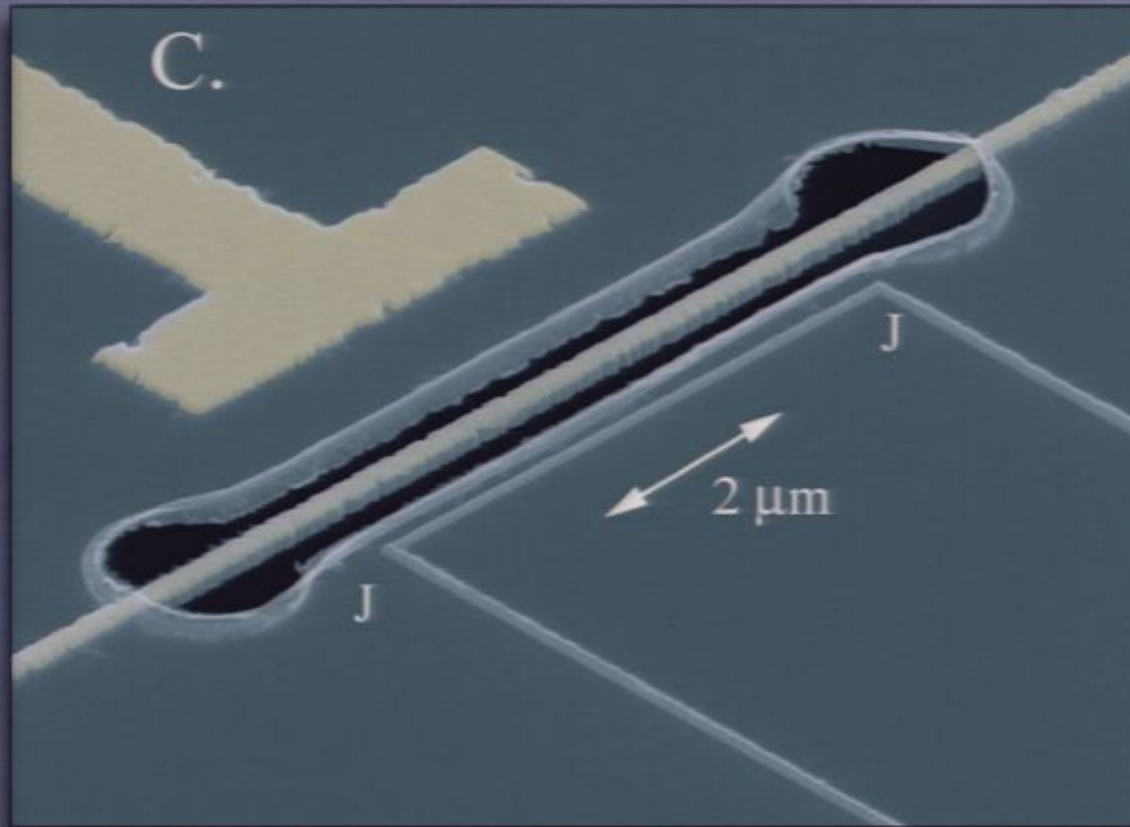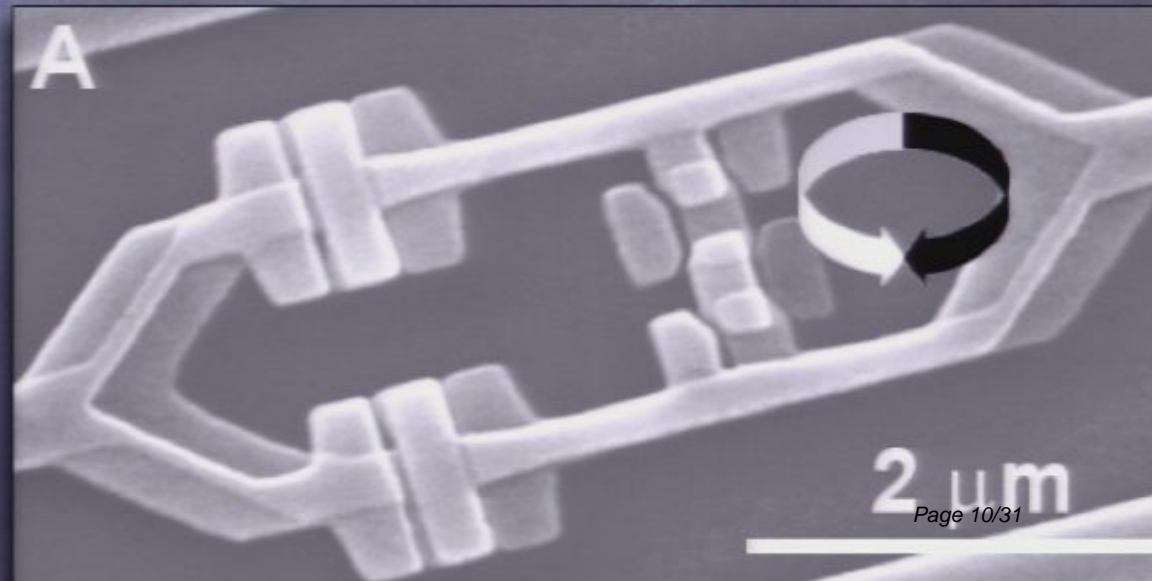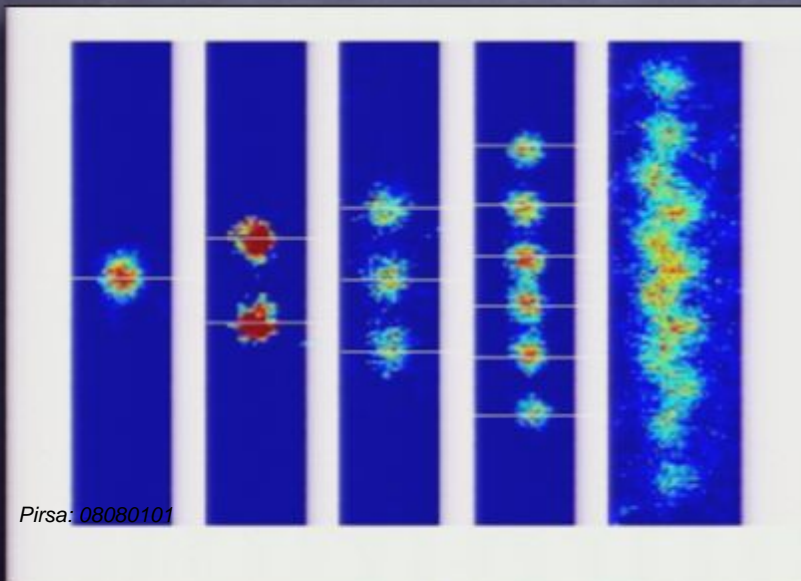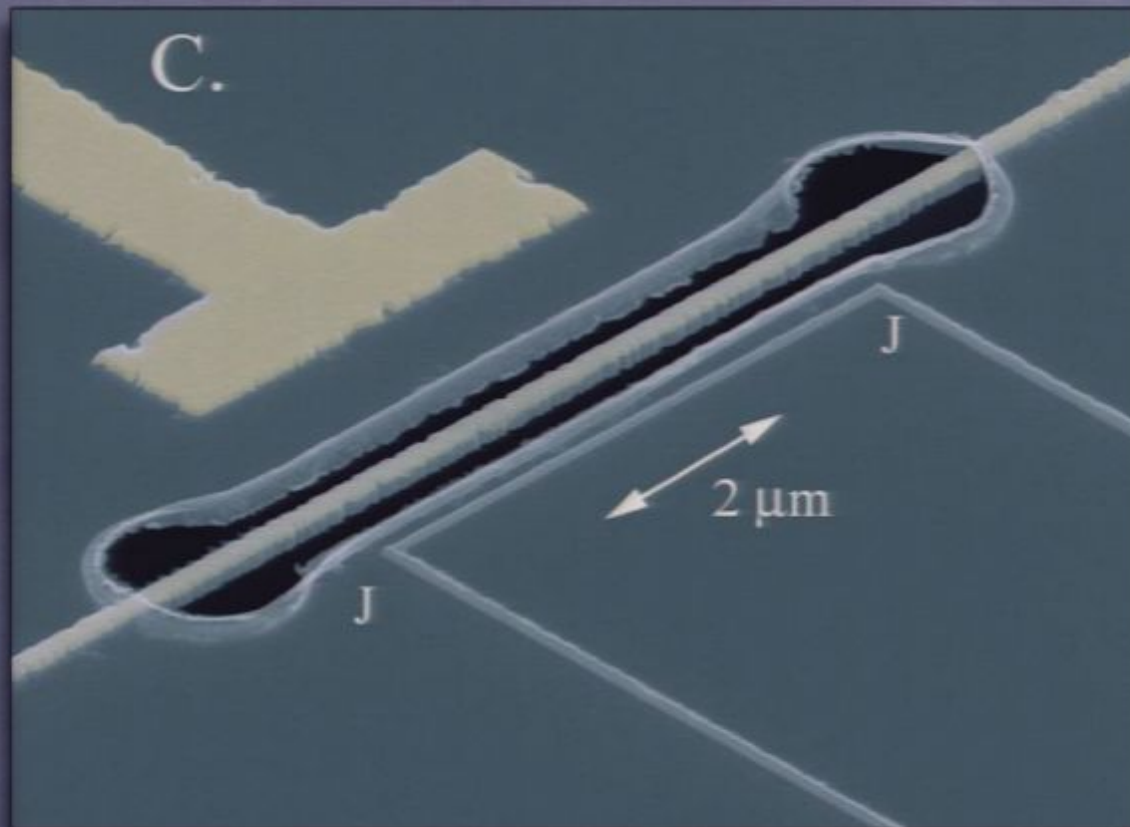
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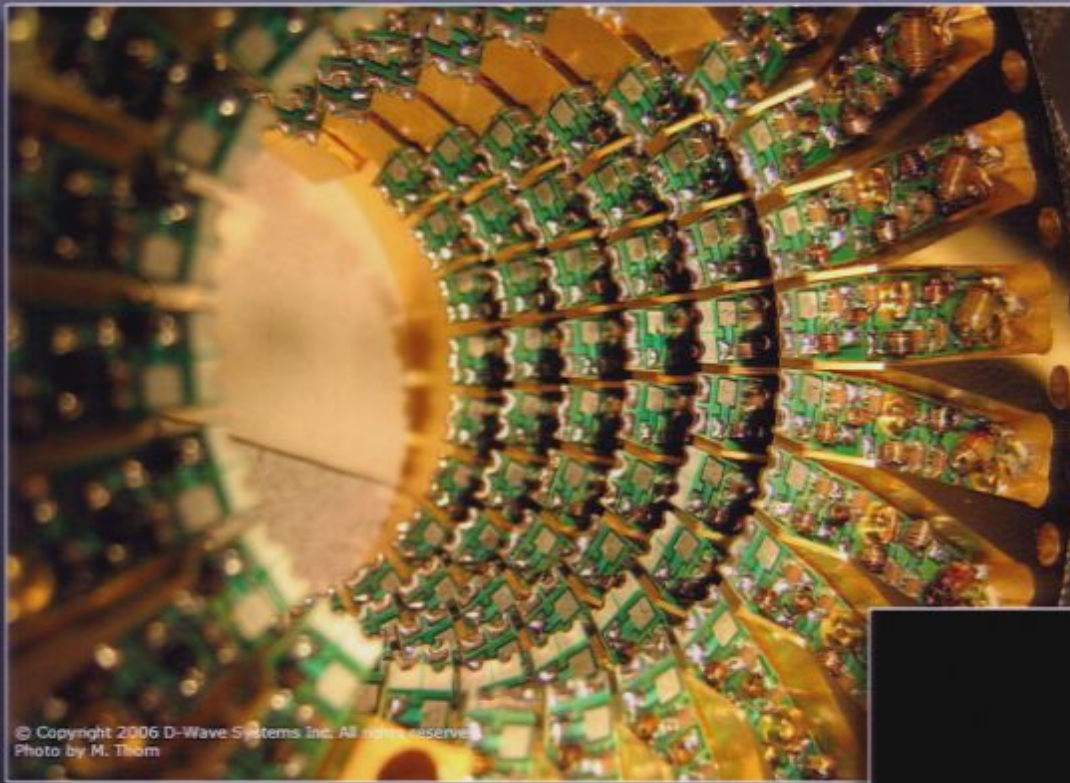
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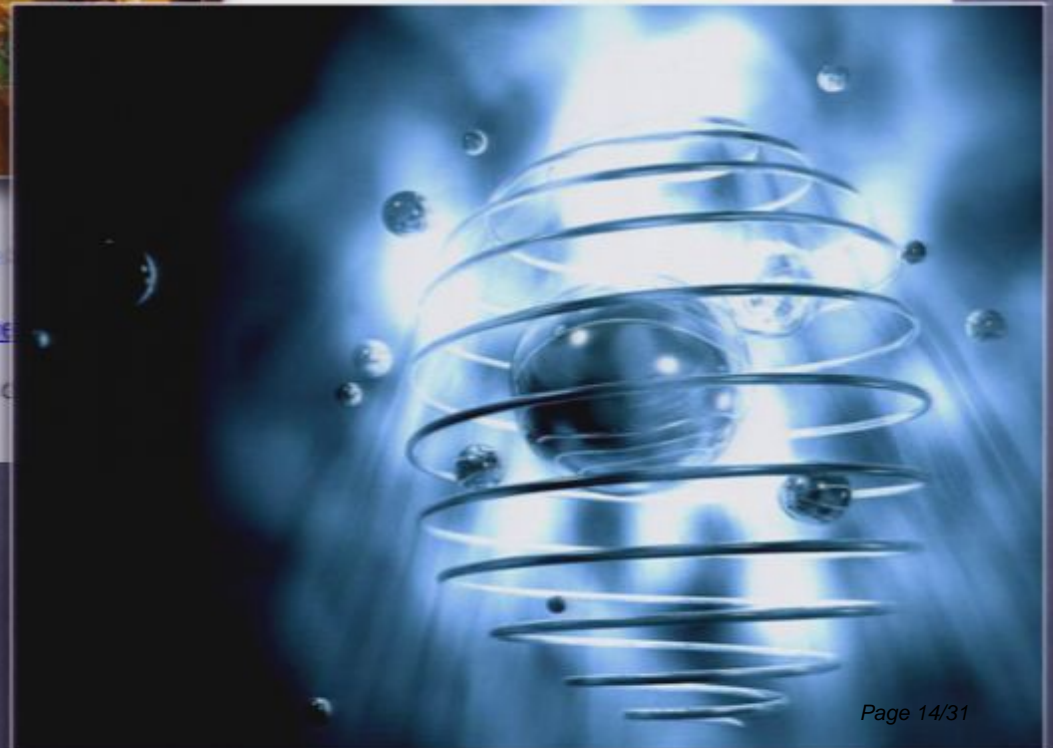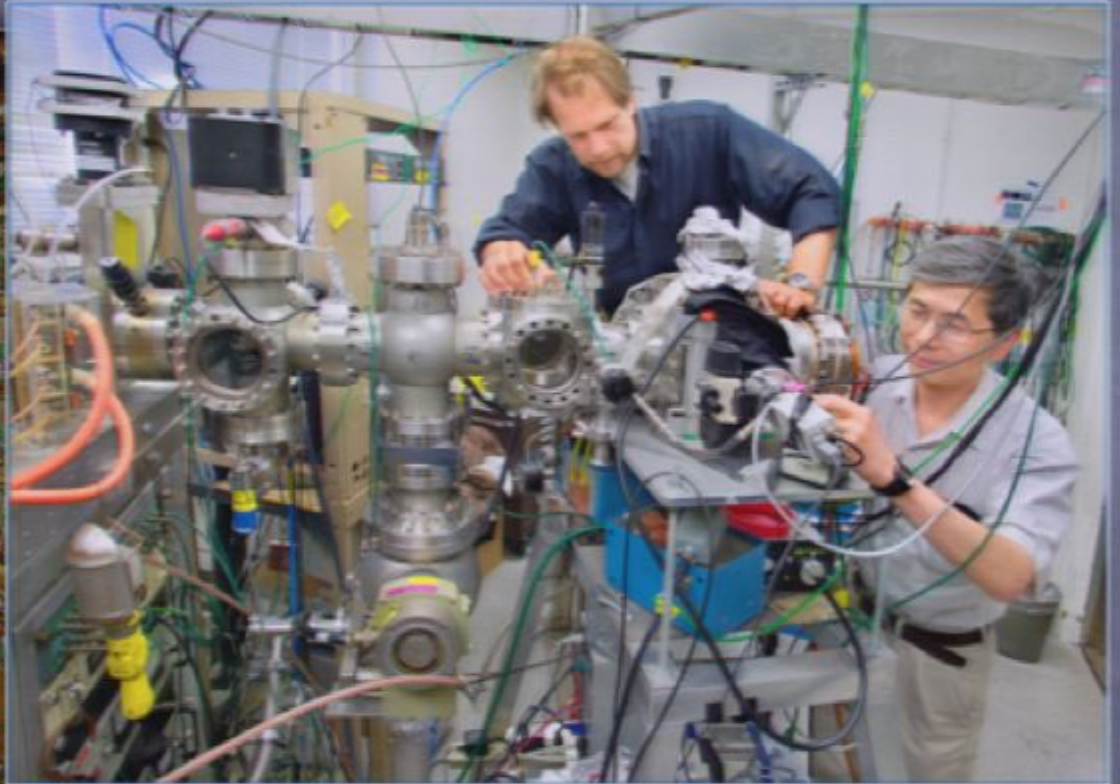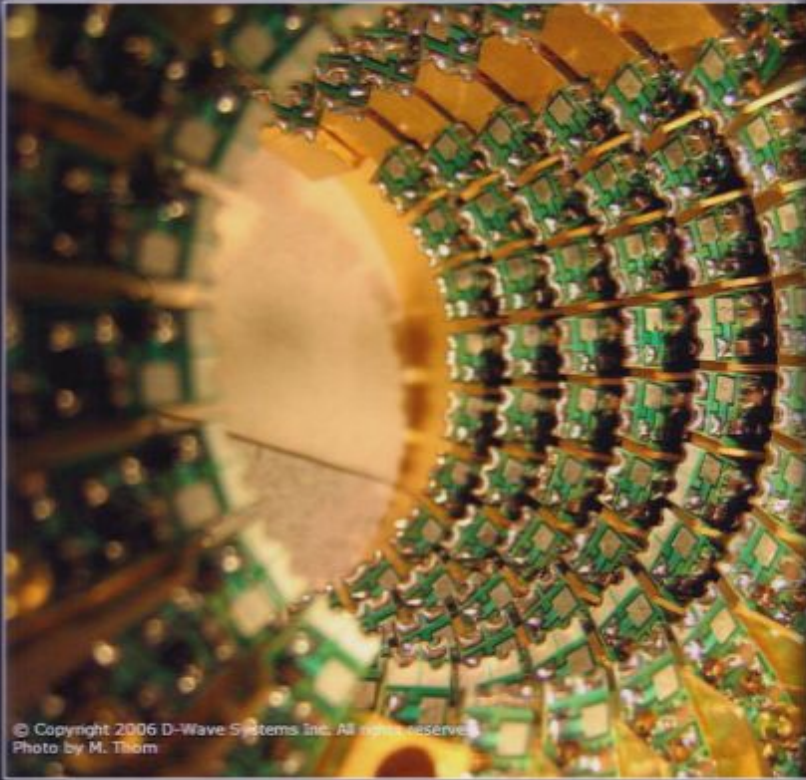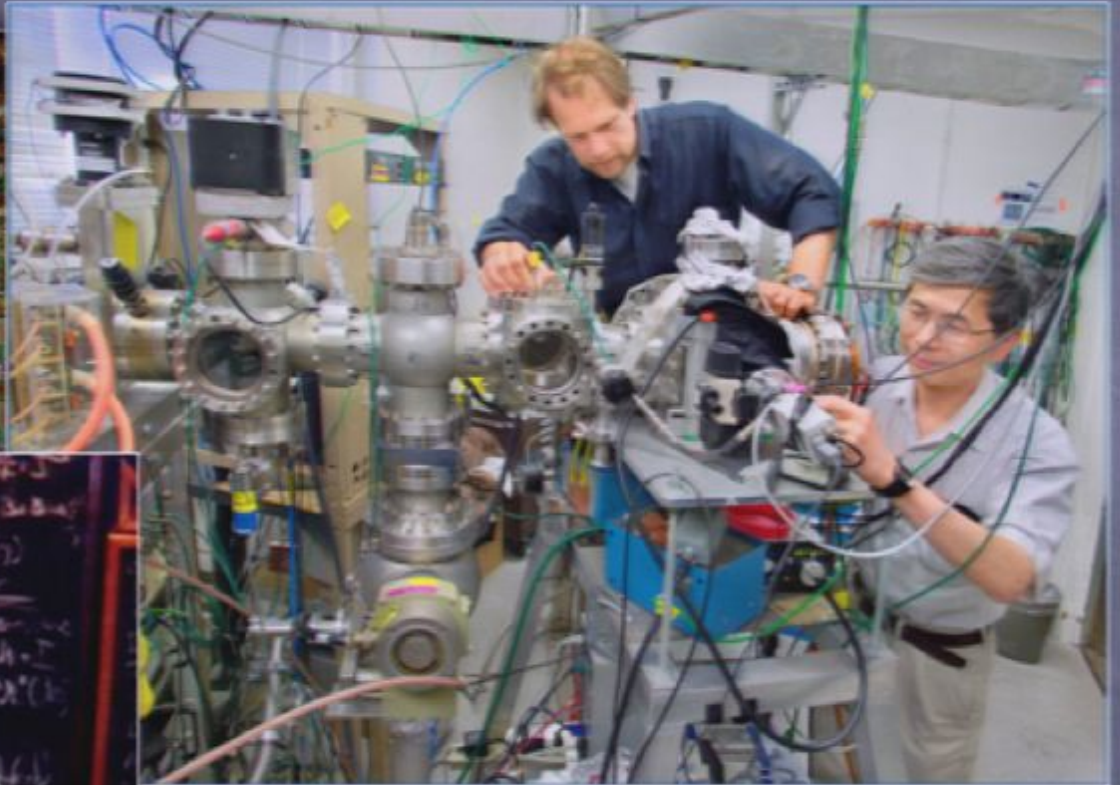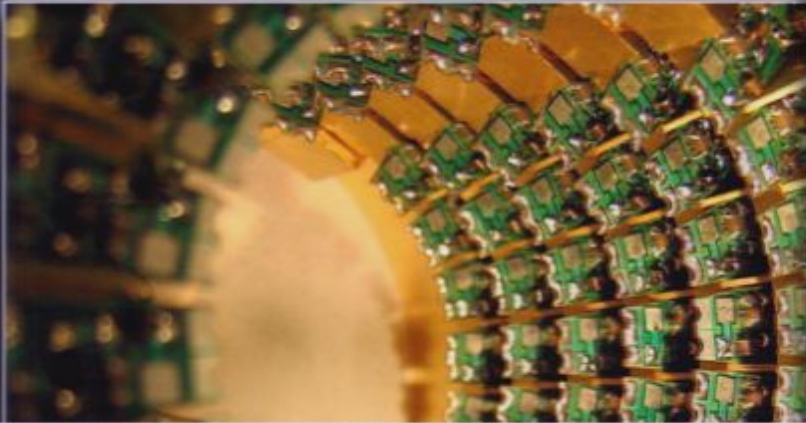
...with due credit to Chris Fuchs...

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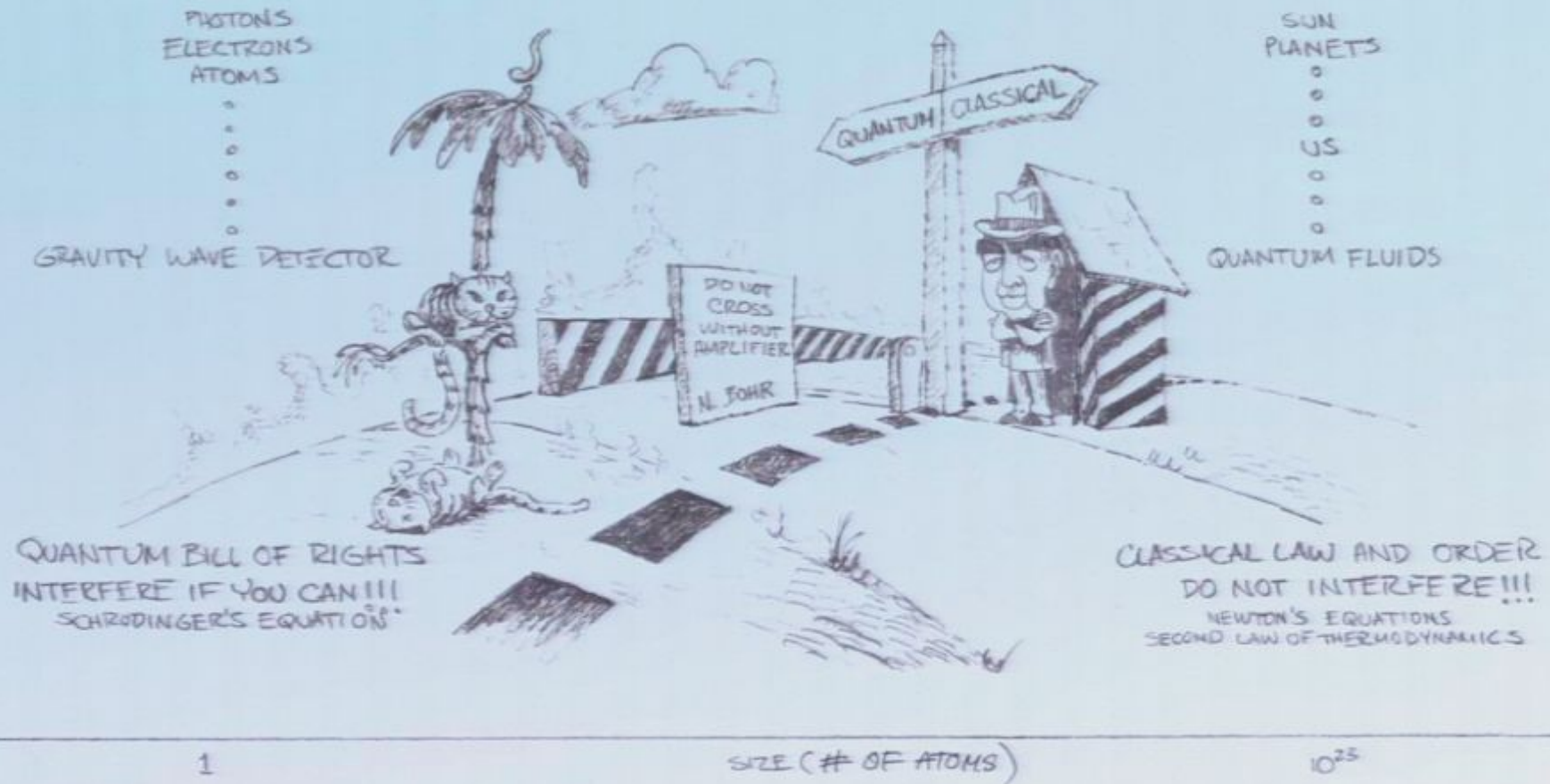
So, this week,

So, this week,
let us transgress boundaries,
for fun and profit.
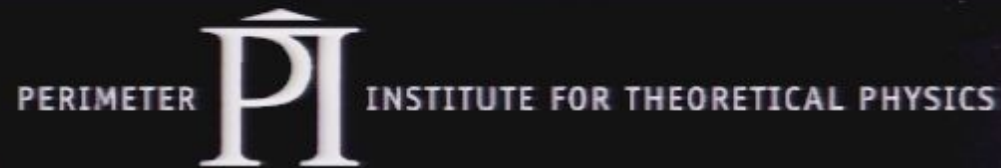
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Quantum Estimation: Theory and Practice

Countdown

Starts 9am 25/8/2008

robin

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Welcome!

Submitted by **alexei** on Sat, 08/02/2008 - 01:11.

Here you can propose sessions for the workshop, these could be impromtu talks, discussions or what ever you like. You can vote on the sessions you prefer and we will schedule in the top voted sessions.

There is also a general fofum for discussion and you can add coments to most pages including attaching files. Please participate to change the workshop into what you want.

NB The website is still in the process of getting configured so parts of it may change.

Alexei

Proposed Sessions

Random selection of proposed sessions. **Vote here.**

- **Francesco De Martini: "Entanglement and nonlocality in microscopic - macroscopic systems"**
- **Bayesian methods versus Maximum-Likelihood**
- **Two qubit visualisation**
- **How to characterise large systems?**
- **How to avoid zero eigenvalues in MLE, via hedging.**
- **The Principle of Maximum Entropy (more generally: the role of information-theoretic ideas in foundations)**

Tip: Extra

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Note that the program may change to accomodate proposed sessions.

	30min talk
	45min talk
	60min talk
	focused discussion period

Mon 25	
8:30-9:00	Coffee
9:00-9:30	WELCOME
9:30-10:30	Mauro D'Ariano, *A new approach to Quantum Estimation: Theory and Applications*
10:45-11:15	Coffee
11:15-11:45	Christian Roos, *Quantum state and process estimation in trapped ion experiments*
12:00-2:00	LUNCH
2:00-2:30	Koenraad Audenaert, *Quantum Tomographic Reconstruction with Error Bars: a Kalman Filter Approach*
2:45-3:15	Nathan Langford, *Quantum state tomography in the real world: the search for rigor by an increasingly confused experimentalist*
3:30-4:15	Coffee
4:15-4:45	Andrew Scott, *Optimal linear tomography of quantum states and processes with tight POVMs*
5:30-7:00	Reception in Black Hole Bistro (cash bar)

Tue 26	
8:30-9:00	Coffee
9:00-10:00	Scott Aaronson, *Pretty Good Tomography*
10:15-10:45	Coffee
10:45-11:15	Peter Turner, *Continuous variable two designs*

Random selection of proposed
sessions. **Vote here.**

- **Peculiarities of Particular Systems**
- **How to characterise large systems?**
- **The Principle of Maximum Entropy** (more generally: the role of information-theoretic ideas in foundations)
- **Francesco De Martini:** "Entanglement and nonlocality in microscopic - macroscopic systems"
- **Tomography on the Sphere**
- **How to avoid zero eigenvalues in MLE, via hedging.**

Tip: *Start a discussion*

Start a new discussion in the **discussion forum**

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low to avoid zero eigenvalues in
1LE, via hedging. (Session)

Welcome (Session)

More ...

Start a new discussion in the
discussion forum

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Time	Event
2:45-3:15	search for rigor by an increasingly confused experimentalist
3:30-4:15	Coffee
4:15-4:45	**Andrew Scott**, *Optimal linear tomography of quantum states and processes with tight POVMs*
5:30-7:00	Reception in Black Hole Bistro (cash bar)

Tue 26	
8:30-9:00	Coffee
9:00-10:00	**Scott Aaronson**, *Pretty Good Tomography*
10:15-10:45	Coffee
10:45-11:15	**Peter Turner**, *Continuous variable two designs*
11:30-12:00	**Alex Lvovsky**, *A continuous-variable approach to process tomography*
12:15-2:15	LUNCH
2:15-2:45	**Scott Glancy**, *Diagnosis of Pulsed Squeezing in Multiple Temporal Modes*
3:00-3:30	**Juan-Pablo Paz**, *TBA*
3:45-4:15	Coffee
4:15-5:00	
Evening	

Wed 27	
8:30-9:00	Coffee
9:00-9:45	**Robert Kosut**, *Quantum Estimation via Convex Optimization*
10:00-10:30	Coffee
10:30-11:00	**Rob Adamson**, *Improving Quantum State Tomography with Mutually Unbiased Bases*
11:15-12:00	
12:00-2:00	LUNCH
2:00-2:30	**Joe Altepeter**, *Linear Optics Quantum Process Tomography*
2:45-3:30	
3:30-4:00	**John Calsamiglia**, *Phase Estimation and Quantum Benchmarks for Phase-covariant States*
4:15-5:00	
7:00-9:00	Banquet

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(Submitted by **aephraim** on Sat, 08/23/2008 - 15:00.)

Peculiarities of Particular Systems

Speaker/Convener: ,
Type of session: Panel Discussion,
Rating: 15,

Theorists tend to think about estimation in the abstract -- e.g., "To do tomography, you make some measurements, and then you analyze the outcomes." Each individual system, however, poses unique challenges! For instance, in measuring photon polarization you can't distinguish "no photon" from "photon got absorbed by my polarizer," so you generally don't know the overall normalization of the beam. When measuring a SQUID, it's hard to know what basis you're actually measuring. In NMR, you can't do projective measurements at all... etc, etc.

Your rating:

| 5 ▾ |

Average: 3.8 (4 votes)

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(Submitted by **robin** on Thu, 08/21/2008 - 22:22.)

Tomography on the Sphere

Speaker/Convener: Lynden (Krister) Shalm,
Type of session: Talk,
Rating: 13,

I hope Krister would like to give a short presentation about his work characterizing triphoton states via Wigner functions on the Poincaré sphere.

Your rating:

| Cancel rating ▾ |

Average: 4.3 (3 votes)

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low to avoid zero eigenvalues in
1LE, via hedging. (Session)

Velcome (Session)

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dischmination of memory channels [arXive:0808.1172]. This also leads to a new notion of distance for channels with memory. Using the theory of quantum testers the optimal tomography schemes are derived---both state and for channel tomography---for arbitrary prior ensemble and arbitrary representation [arXive:0803.3237]. Finally, using the method of generalized pseudo-inverse for optimal data-processing [PRL. 98 020403 (2007)], we derived two improved data-processing for quantum tomography: Adaptive Bayesian and Frequentist [arXive:0807.5058].

(Submitted by **dariano** on Fri, 08/15/2008 - 09:55.)

Mon 25 11:15 am

Christian Roos: Quantum state and process estimation in trapped ion experiments

The experimental realization of entangled states requires tools for characterizing the produced states as well as the processes used for creating the entanglement. In my talk, I will present examples of quantum measurements occuring in trapped ion experiments aiming at creating high-fidelity quantum gates.

(Submitted by **christian** on Tue, 08/12/2008 - 11:20.)

Mon 25 02:00 pm

Koenraad Audenaert: Quantum Tomographic Reconstruction with Error Bars: a Kalman Filter Approach

- Koenraad Audenaert, **koenraad.audenaert@rhul.ac.uk** Dept. of Mathematics, Royal Holloway, University of London, Egham, Surrey TW20 0EX, UK.
- Stefan Scheel, **s.scheel@imperial.ac.uk**
  Quantum Optics and Laser Science, Blackett Laboratory, Imperial College London, Prince Consort Road, London SW7 2AZ, UK.

We present a novel quantum tomographic reconstruction methodbased on Bayesian inference via the Kalman filter update equations.The method not only yields the maximum likelihood/optimal Bayesian reconstruction, but also a covariance matrix expressing the measurement uncertainties in a complete way. From this covariance matrix the error bars on any derived quantity can be easily calculated. This is a first steptowards the broader goal of devising an omnibus reconstruction method that could be adapted to any tomographic setup with little effort and that treats measurement uncertainties in a statisticallywell-founded way. We restrict ourselves to the important subclass of tomography based on measurements with discrete outcomes (as opposed to continuousones), and we also ignore any measurement imperfections (dark counts, less than unit detector efficiency, etc.), which will be treated in further work. We illustrate the general theory on two real tomography experiments of quantum

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Quantum Estimation: Theory and Practice

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Discussion

- **Post new forum topic.**

Topic	Replies	Created	Last reply ▾
✉ **Any comments or problems with this site?**	1	1 week 3 days ago by **alexei**	3 days 17 hours ago by **berihu**
✉ **Collaborative book on quantum estimation**	0	1 week 11 hours ago by **alexei**	n/a

Proposed Sessions

Random selection of proposed sessions. **Vote here.**

- **Two qubit visualisation**
- **The Principle of Maximum Entropy** (more generally: the role of information-theoretic ideas in foundations)
- **Peculiarities of Particular Systems**
- **How to characterise large systems?**
- **Bayesian methods versus Maximum-Likelihood**
- **How to avoid zero eigenvalues in MLE, via hedging.**

Tip: *Start a discussion*

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Overview | Quantum Estimation: Theory and Practice

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Proposed Sessions

SCORE	TITLE	CONVENER	TYPE
35	Bayesian methods versus Maximum-Likelihood	robin	Panel Discussion
28	How to characterise large systems?	alexei	Discussion
24	How to avoid zero eigenvalues in MLE, via hedging.	robin	Talk
19	Two qubit visualisation	joe	Talk
16	The Principle of Maximum Entropy (more generally: the role of information-theoretic ideas in foundations)		Talk and/or discussion
15	Peculiarities of Particular Systems		Panel Discussion
13	Tomography on the Sphere	krister	Talk
13	Francesco De Martini: "Entanglement and nonlocality in microscopic - macroscopic systems"		Talk