Phys 494–Lecture 2
Nobel Prizes, Titles, Capitalization and Abstracts

w/ Paul A. Wiggins

Scientific Background on the Nobel Prize in Physics 2018

GROUNDBREAKING INVENTIONS IN LASER PHYSICS

OPTICAL TWEEZERS AND GENERATION OF HIGH-INTENSITY, ULTRA-SHORT OPTICAL PULSES

How optical traps work…

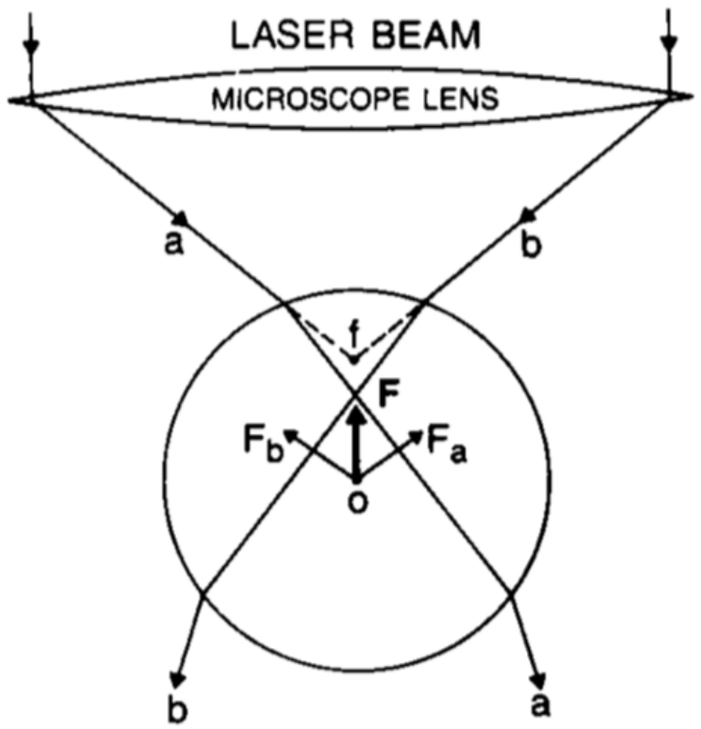
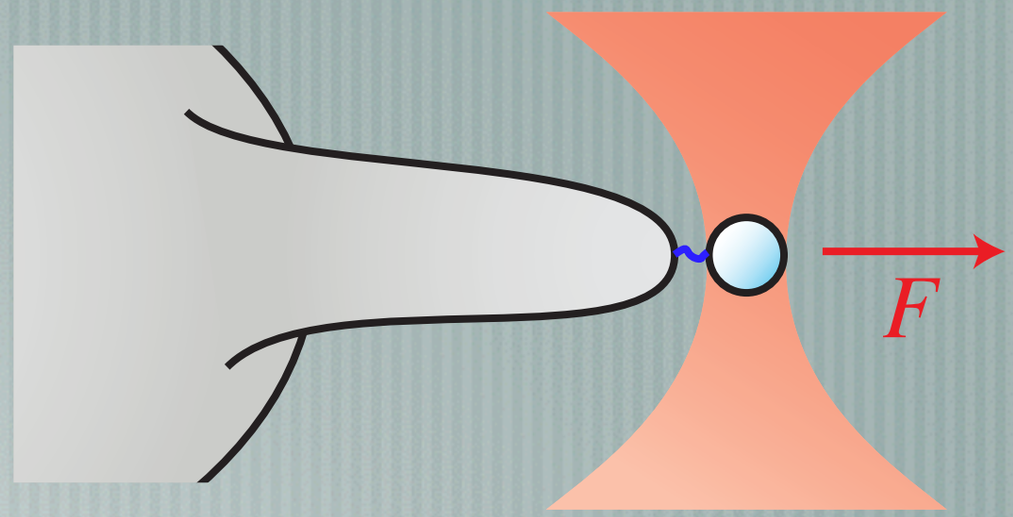
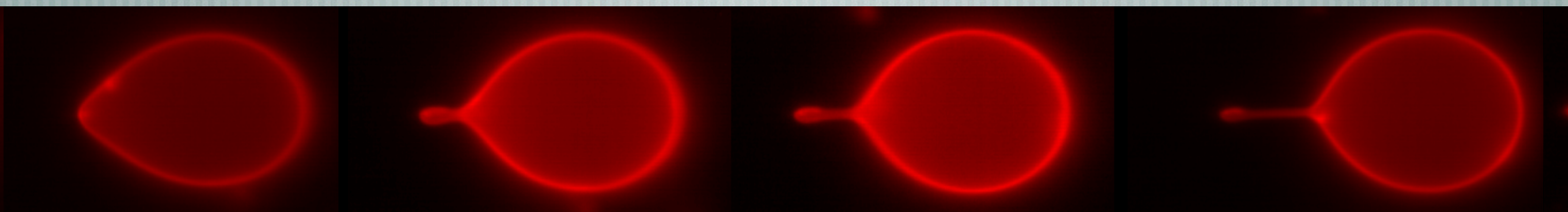


Figure 1: *Qualitative ray optics description of the restoring backward force in an optical tweezers trap, for a dielectric sphere that is located below the focus* **f** *and assumed to be large compared with the wavelength of the light. Rays of light carry momentum and are bent by refraction when passing the dielectric sphere. By conservation of momentum and Newton's second law, the momentum change of the refracted rays results in an oppositely directed force on the sphere. A typical pair of rays,* **a** *and* **b**, *gives rise to a net force* **F** *on the sphere, directed towards the focus* **f**. *In the so-called Rayleigh regime, where the particle is instead small compared with the wavelength, the optical force can be calculated by treating the particle as a point dipole. The force obtained can be decomposed into two forces: a scattering force, which is in the direction of propagation of the beam and is proportional to the intensity, and a gradient force, which is proportional to the intensity gradient and is directed toward higher intensity. Source: reference [21].*

control experiment...

- apply known force
- compute conformational force





control experiment:

Writing Effective Titles

PHYSICAL REVIEW LETTERS

Contents

Articles published 10 January–16 January 2004

VOLUME 92, NUMBER 2 — 16 JANUARY 2004

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Effective titles are *concise, descriptive,* and *interesting*

- Restrict the title to a *maximum of 12 words*
  - - makes it easier to remember
- Put key words *first*
- Accurately reflect the content of the paper
- Avoid unfamiliar acronyms or abbreviations

Worst title I have ever seen:

"Towards the Observation of Signal over Background in Future Experiments"

But not too interesting . . .

Would you take seriously
a paper with the following title:

“Looking from the East at an Elephant Trotting West: Direct CP Violation in B^0 Decays”

Honestly, I did not make this up;
see *http://arxiv.org/abs/hep-ph/0203157*.

A good title determines whether somebody invests the time to read your paper or come to your talk

Busy physicists employ three criteria

- The information conveyed in the title
- The reputation of the author
- The abstract (*ut infra*)

Play fair; don't "trick" people into reading your paper by a misleading title

- Waste of their time
- Ruins your reputation (*ut supra*)

Daily (real) example:

- http://xxx.lanl.gov/list/hep-ph/recent

Good titles are concise and memorable

Original Title	Better Title
Laser-Induced Plasma Phenomena near a Solid Surface at the Incident Intensity in the Range from 10 MW/cm² to 10 GW/cm²	***Laser Plasma—Solid Surface Interaction at 10 MW cm² to 10 GW cm²***
Investigation of Threshold Characteristics of Materials Fracture Under Impact Loads Produced by Pulsed Magnetic Fields	***Threshold Fractures Produced by Pulsed Magnetic Fields***

Second-worst title I have ever seen:

"Report of the Subgroup on Alternative Models and New Ideas"

To capture the busy reader's attention, put keywords first

Original Title	Better Title
Application of the time-dependent local density approximation to conjugated molecules	*Time-dependent local density approximation for conjugated molecules*
A novel approach to estimate the stability of one-dimensional quantum inverse scattering	*New stability estimate for 1D quantum inverse scattering*

Excise throw-away introductory fluff

~~Observation of~~ resonance condensation of fermionic atom pairs

~~Capabilities of~~ parallel analyses of the structure of materials by field ion and scanning probe microscopy

~~Study of the~~ ionic Peierls-Hubbard model using density matrix renormalization group methods

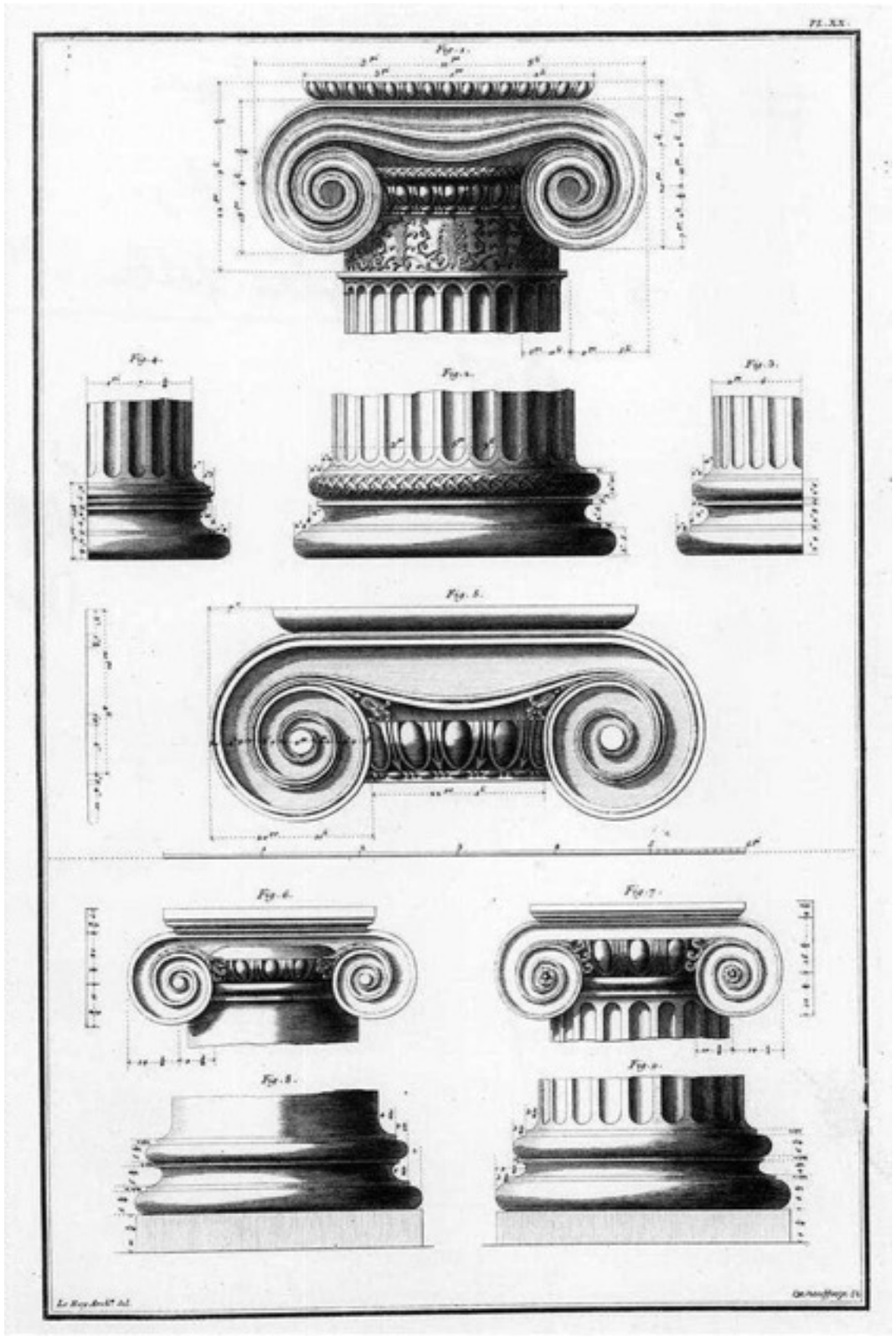
~~On the~~ Electron-Electron Interactions in Two Dimensions

~~Theory of~~ traveling filaments in bistable semiconductor structures

Avoid all but the most common* acronyms in the title

Original Title	Better Title
One-dimensional SPH method	*Smoothed-particle hydrodynamics 1D method for gas dynamics applications*
Application of CVS filtering to mixing in two-dimensional homogeneous turbulence	*Coherent-vortex-simulation filtering applied to mixing in 2D homogeneous turbulence*

*Refer to the *AIP Style Manual*



Capitalization in Physics

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Adjectives taken from proper names are capitalized, nouns are not

Proper name used as an adjective:

Fermi energy or Fermi–Dirac statistics

en dash

New class of things named after a proper name:

fermions, fermi (unit)

Noun exceptions:

Hamiltonian, Lagrangian

Units of measure are never capitalized when written in words, only when they are abbreviated

Examples: **watt (W), joule (J), tesla (T), volt (V)**

Note: **"kilo" (1000) is *never* capitalized:**

kV, keV, kg, kA, kHz, kΩ, $100k

And: abbreviations for units are always singular

45 mm, 10 GeV, 3.6×10^{7} n s cm

Names of elements are never capitalized when written as words, only when they are abbreviated

argon (Ar) silicon (Si)

curium (Cm) californium (Cf)

And while we're on the subject of elements…

^{60}C	mass number
$^{14}N_2$	number of atoms in molecule
Ca^{2+}	state of ionization
$^{110}Ag^{m}$, $^{14}N^{*}$	excited state

Particle names are always written lower case:

quarks, muons, neutrinos

…even when they are derived from proper names

fermions, bosons

…except when the proper name is used as an adjective

Higgs boson

… and please AvoID ranDom CapiTaLiZation:

"Comments on Likelihood fits with variable resolution"

Lower case symbols and abbreviations are never capitalized in titles, headings, or the beginnings of sentences

This title is okay—

New Mixed Alkali Effect in the ac Conductivity of Ion-Conducting Glasses

This sentence is not—

ac conductivity measurements of ion-conducting glasses revealed a new mixed alkali effect.

Recast it as—

Measurements of ac conductivity in ion-conducting glasses revealed a new mixed alkali effect.

Single words or phrases following a colon are not capitalized

“Values were obtained for two parameters: the quantum cyclotron radius and the Debye shielding radius.”

Full sentences may be capitalized

“The experimental results led to one conclusion: The fast electron mode represents an unloading of excess excitons formed during excitation.”

but they look kind of stupid

Theories are not capitalized

Einstein's theory of general relativity
quantum chromodynamics
second law of thermodynamics

Phenomena are not capitalized

high-temperature superconductivity
sonoluminescence

Experimental apparatus and techniques are not capitalized

scanning tunneling microscope
secondary ion mass spectrometry
Auger electron spectroscopy

Protected trade names must be capitalized

Plexiglas
tempered glass
stainless steel
Manet steel

Different journals have different styles for capitalizing words in a title

PRL: "Observation of Resonance Condensation of Fermionic Atom Pairs"

Phys. Rev. B: "Spin-orbit coupling and intrinsic spin mixing in quantum dots"

Writing Effective Abstracts

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Be aware of two immutable rules for abstracts

1. **Every article submitted to a journal or a conference *must* have an abstract**

2. **The quality of your abstract determines whether or not anybody actually *reads* your paper or comes to your talk**

Answer four simple questions to create a perfect abstract

1. **What problem did you study and why is it important?**
2. **What methods did you use?**
3. **What were your main results?**
4. **What conclusions can you draw from your results?**

Make your sentences as *specific* and *quantitative* as possible

Control the length of your abstract by the length of your answers to the four questions

Short abstract? one-sentence answers
Longer abstract? several sentences
One-page abstract? one-paragraph answers

Don’t omit answers or add superfluous answers

Use this checklist to critique your abstract:

- ✓ Subject of the paper is stated immediately
- ✓ Scope and objectives of the work are described
- ✓ Methods and operational ranges are specified
- ✓ Significant findings are summarized
- ✓ Results are emphasized

Follow these style conventions:

- ✓ **All abbreviations, acronyms, mathematical expressions, and special symbols are defined**
- ✓ **Only simple (linear) equations are used**
- ✓ **No figures or tables are included**
- ✓ **The abstract stands alone**
  - **No mention is made of figures, tables or equations used in the main text**
  - **No references are cited**

Define acronyms and initialisms (A&Is)

Write out the words first, followed by the acronym in parentheses ( )

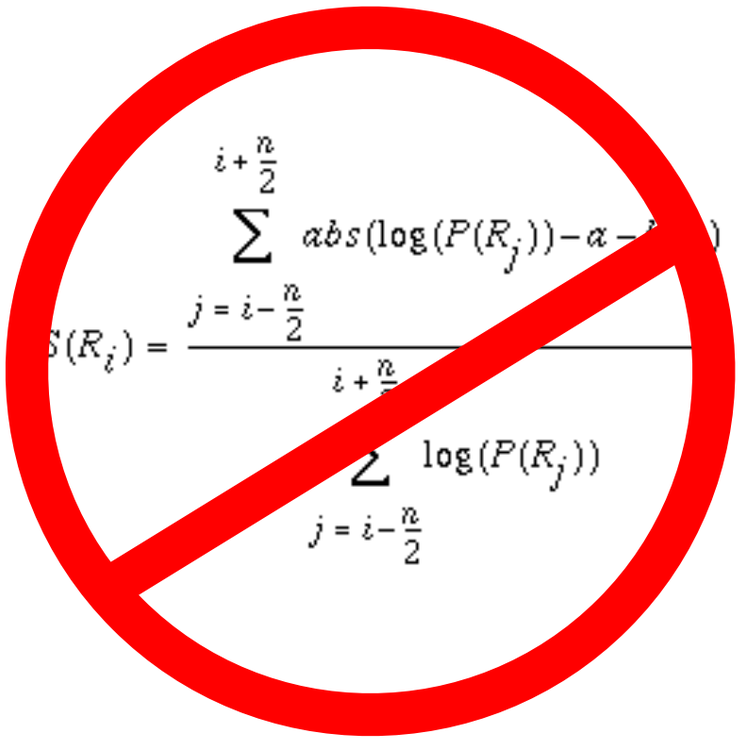
Rossi X-ray Timing Explorer (RXTE)
superconducting quantum interference device (SQUID)

The AIP lists common physics acronyms that need not be defined

BCS (Bardeen–Cooper–Schrieffer)
emf (electromotive force)
NMR (nuclear magnetic resonance)
dc (direct current)
DNA

Any equations in an abstract must be simple enough to be rendered linearly

$$\tau = 2^{-1/1}(t+z), \quad \mathcal{Z} = 2^{-1/1}(t-z)$$



Abstract: We examine the formal foundations of quantum electrodynamics in the infinite-momentum frame. We interpret the infinite-momentum limit as the change of variables **tau =2/sup -1/1/(t+z), Z=2/sup -1/1/(t-z)**, thus avoiding limiting procedures…

Read your abstract critically

- ✓ Ideas are expressed clearly and concisely
- ✓ Language is familiar and precise
- ✓ Standard nomenclature and notation are used
- ✓ Stylistic conventions are observed
- ✓ Text is free of typographical errors