Today we’ll look at conventions for capitalization and the use of acronyms in technical writing.

The basic rules of capitalization—proper nouns are capitalized and common nouns are not—generally apply in science writing, except for some special cases. (There are always “special cases” in English and physics.) Today, we’ll look at them.
Adjectives taken from proper names are capitalized, nouns are not

Proper name used as an adjective:
Fermi energy or Fermi–Dirac statistics

New class of things named after a proper name (common nouns):
fermion (particle), fermi (unit)

Capitalize only the name in compound nouns
Bohr radius, Avogadro’s number,
Debye temperature, Newtonian mechanics

Noun exceptions:
Hamiltonian, Lagrangian

If a proper noun is used as an adjective, it’s always capitalized.
For Hamiltonian and Lagrangian, the “function” is implied but unstated, so the “adjective” rule still applies. These are the only two examples that I’ve been able to think of where a word derived from a proper noun is still capitalized when it’s used as a noun, but there are probably others. (Pesky mathematicians!)

Note that only the proper noun (name) is capitalized in a compound noun; the common noun is written lower case (e.g., Compton scattering)

If you’re not sure whether a word should be capitalized or written lower case, consult a scientific dictionary (I recommend The Oxford Dictionary for Scientific Writers and Editors) or the AIP Style Guide, Appendix B, if you can find it. You can buy a good used copy of the Oxford for about $10.

An en dash (think of it as a super-hyphen) is used to join two proper nouns to make a combined adjective. We’ll talk more about dashes later in the semester.
Units of measure are capitalized only when they are abbreviated

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

“Powers” follow the same rule
megawatt (MW), terahertz (THz)
mega-electron-volt (MeV)

Note: “kilo” (1000) is never capitalized:
kV, keV, kg, kA, kHz, kΩ, $100k

And—abbreviations for units are always singular
45 mm, 10 GeV, $3.6 \times 10^7$ m s cm

Even though we think “45 millimeters” when we see “45 mm,” the unit is written as a singular.

And remember, the unit is always abbreviated when it is associated with an exact number (measured or calculated); it is written out as a word only when it refers to an approximate number. Thus: “7 kg” and “a few kilograms”
In general, common nouns are not capitalized when they’re written out as words, but the abbreviations are ALWAYS capitalized—whether they’re units, elements, or acronyms.

Elements, even those derived from proper names (curium, francium), are always written lower case when they are written out as words. Only the abbreviations are capitalized, and just the first letter of the abbreviation is capitalized.

The notation shown for chemical elements is the convention adopted by the International Union of Pure and Applied Physics in the 1970s. While you’ll see “He-3” written in older papers (and by older authors), use $^3$He now.
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

Although not used much by physicists, the names of minerals are never capitalized either, e.g., dolomite, diamond, even when derived from a proper name (fosterite, smithsonite).
Theories are not capitalized
Einstein’s theory of general relativity
quantum chromodynamics
second law of thermodynamics

Phenomena are not capitalized
sonoluminescence
superfluidity
Bose–Einstein condensation

Experimental apparatus and techniques are not capitalized
scanning tunneling microscope
molecular beam epitaxy
Auger electron spectroscopy

except when it’s somebody’s name

In these examples, “Einstein’s,” “Newton’s,” “Bose–Einstein,” and “Auger” are capitalized because they are proper nouns (names) used as adjectives.
Protected brand names are capitalized

- tempered glass
- Plexiglas
- epoxy
- Styceast
- simulation software
- Mathematica

The trademark (™) or registered trademark (®) symbol is not necessary; the capitalization alone indicates that the name is a protected trade name.

If used, the trademark and registered trademark symbol appear immediately after the trade name (no spaces) and are superscripted.
In keeping with current usage, periods are no longer recommended for the abbreviations for academic degrees (more about abbreviations soon).

In general, if a number is associated with the name of something, the resulting compound noun is considered a “title” and is capitalized. (This rule is analogous to the one we learned last week about figure captions—“in the figure” but “in Figure 4.”)
I personally think colons are overused in scientific writing; many times they just provide an excuse for an unwieldy, run-on sentence or title. Colon surgery is highly recommended for such cases.
Ms. P would quibble about this title on general principles, regardless of what is done with the abbreviation. Presumably the “effect” is not “new”—it’s probably been there since the glasses formed, but nobody ever looked before now. A more accurate title would be “Mixed-Alkali Effect Observed in ...”

Some common physics abbreviations are supposed to be written in lower case:
ac (alternating current)
bcc (body-centered-cubic)
cw (continuous-wave)
dc (direct current)
fcc (face-centered-cubic)
ir (infrared)
mp (melting point)
rf (radio-frequency)
rms (root-mean-square)

Consult the *AIP Style Guide* for a complete list of standard abbreviations.

We’ll talk more about abbreviations and acronyms later today.
Different journals have different rules for capitalizing words in a title

PRL: “Observation of Resonance Condensation of Fermionic Atom Pairs”


No rational rules apply; just look ’em up.

There’s no consistency, even among journals published by the same publisher! Just look ’em up.
... and please AvoID ranDom CapiTaLiZation:
“Comments on Likelihood fits with Variable resolution”

Capitalize only the first word of the title (and proper nouns)
“Comments on likelihood fits having variable resolution”
“Comments on likelihood fits using variable resolution”

OR

Capitalize every word except prepositions (e.g., in, with, from, by), conjunctions (e.g., and, or, but), and articles (a, an, the)
“Comments on Likelihood Fits with Variable Resolution”

Double-check your titles for random capitalization. Either capitalize only the first word of the title (and proper nouns), or capitalize every word except prepositions (e.g., in, with, from, by), conjunctions (e.g., and, or, but), and articles (a, an, the).

Strive for witless consistency.
Editor’s marks for correcting capitalization

In Einstein’s *Theory of General Relativity*,…  l.c.

The hamiltonian is the operator corresponding to…

Moving right along, now we’ll look at acronyms...

To indicate a word should be written lower case, a technical editor will place a backslash through the offending capital letters and note *l.c.* (lower case) in the margin of the page.

To indicate a word should be capitalized, the editor will place three horizontal lines beneath the letter to be capitalized.
While purists make distinctions among abbreviations, acronyms, and initialisms, we’ll just call them all acronyms for the purposes of this class.

Which is which?

**Abbreviation**—shortened form of word
- average = av
- const = constant
- usually written lower case and without a terminal period (.) in physics

**Acronym**—pronounced as a word
- NASA, MOSFET, LIGO

**Initialism**—pronounced letter-by-letter
- STM, QCD, CMB

“In this class, we use a lot of three-letter acronyms, or TLAs.”
—attributed to Dale Van Harlingen
Acronyms and initialisms (A&Is) must be defined at their first use

Spell out the words first, followed by the acronym in parentheses ( )
- Cosmic Background Imager (CBI)
- density functional theory (DFT)
- $Y_2Ba_4Cu_3O_{7-x}$ (YBCO)

The American Institute of Physics (AIP) lists common physics acronyms that need not be defined
- BCS, emf, NMR, dc, ir, DNA

Tip: When in doubt, write it out!

You can make an acronym out of almost anything that functions as a noun or an adjective in a sentence. Generally, a compound noun or adjective-noun phrase must include at least three words to qualify for acronymization. However, you’ll find some common two-word acronyms (e.g., ac, dc, rf) and some acronyms made out of single, very long words (e.g., magnetohydrodynamics [MHD]).

Some acronyms have become so widely used and recognized that they don’t have to be defined at first use, but most do. Consult Oxford, Scientific Style and Format, or the Chicago Manual of Style to be sure.

When it doubt, write it out.
A sentence may NOT begin with an acronym, even if it has been previously defined

To image the surface of thin films of a superconducting crystal, the group uses a low-temperature scanning tunneling microscope (STM) that they built at Illinois. STM topographic images are correlated with X-ray crystallographic data.

While we’re on the subject, a sentence may not begin with a symbol, chemical formula, equation, or number written in numerals, either.
Three ways to fix this sentence

Orig: “STM topographic images are correlated with X-ray crystallographic data.”

1. Write out “scanning tunneling microscope” again—wordy and redundant
2. Add an article—“The STM topographic images...”
3. Rearrange the sentence—“Topographic images obtained by STM are correlated with X-ray crystallographic data.”

I personally prefer #3, because it emphasizes “topographic images”; the device used is probably of secondary importance.—cme

X-ray or x-ray?? Both are used in US English; just pick one and be consistent. British usage is X-ray.
Most, but not all, acronyms are capitalized. Consult the *AIP Style Guide* for the list; you’ll find some surprises.

The spelled-out words that the acronym is made from are written in caps or lower case, depending on normal capitalization rules. So if the word is a proper noun, it’s capitalized; if the word is a common noun or other part of speech (usually an adjective or adverb), it’s written lower case.
The use of periods (.) in abbreviations is evolving

- US usage has been* to put periods after one-word abbreviations (Dr., Ms.) but not after multi-word abbreviations
  - APS, NASA, LIGO

- British usage is just the opposite
  - Dr, Ms, I.U.P.A.P., N.H.S.

As always, there are exceptions:
- H.c., i.d.

*The CBE Manual for Authors, Editors, and Publishers, 6th ed., now recommends no periods, anywhere


The AIP Style Guide, Appendix D, lists the exceptions to the “no periods” rule.
If you’re not sure, look it up.
If you’re sure, look it up anyway. You will learn humility.
Making acronyms plural? Just add an s

Do not use an apostrophe to make an acronym plural
AFMs, CD-ROMs, PMTs

While I’m on the subject, don’t use an apostrophe to make numbers >9 plural, either expressed in 1000s, Boeing 767s

Do use apostrophes for plurals of single numbers or letters
1’s and 0’s, p’s and q’s

You can review the rules for writing numbers at https://courses.physics.illinois.edu/PHYS496/Lectures/Numbers.pdf.
Select an article (a or an) by the *sound* of the acronym it precedes

Begins with a vowel *sound* → *an*
- an STM

Begins with a consonant *sound* → *a*
- a SQUID
- a USDA-approved pesticide

**What about Si (???)**
- a Si substrate
- a silicon dioxide substrate
- an $\text{SiO}_2$ substrate

How will your reader say the acronym to him- or herself when reading it?
To recap...
Write whole words lower case*; capitalize abbreviations
Capitalize proper nouns when used as adjectives
Don’t capitalize particles, theories, physical phenomena, apparatus and techniques*
Define acronyms at first use
Don’t start a sentence with an acronym, symbol, or number written in numerals
Just add an s to make an acronym plural
When in doubt, write it out!

*unless it’s a proper noun (name of a specific person or place)