Communicating your Research <u>Briefly</u> … and Effectively

1. The written abstract

2. The “elevator” talk

The “Abstract”

- An **abstract is a summary** of your research.

  [An abstract is **NOT** an introduction to your research.]

- **Length:** most often 100-ish words (sometimes longer).

- The abstract should convey the **specifics** of the research and its **broader goals**.

Abstract: key content

The abstract should answer the following questions:

1. What is your research, what are you presenting (in <u>one sentence</u>)?
2. What is the **broader scientific objective/purpose** of your research?
3. What did you **specifically** measure, build, study, or calculate?
4. **How** did you measure, build, study, or calculate?
5. **Why** is this research important? What are <u>applications</u> of your research?

… The title is a summary of the abstract → keep it short-ish.

Abstract: additional tips

- Don’t explain, just state/assert.

- Minimize, suppress, eliminate caveats.

- Useful sentences:

  “We report progress on …”

  “We present measurements/calculations/simulations/a study …”

  “This thesis/report presents …”

- The first half should be understandable to any scientist (audience dependent) … Avoid jargon.

Example 1

External Cavity Diode Laser for Ultra-cold Atom Experiments

This thesis describes the design, construction and characterization of an external cavity diode laser (ECDL) within the context of AMO research -- specifically, ultracold rubidium experiments. The main benefit over other forms of laser light is the ECDL's low cost and narrow linewidth. Having a more narrow linewidth allows us to affect specific electron states, such as for laser cooling, more precisely than broader alternatives.

We find that building such a laser in house is feasible with scan range up to 4 GHz. We also note that attention to external noise, through mechanical vibrations, but more importantly through temperature drifts, is necessary to produce an ECDL with a stable optical frequency.

(Senior thesis abstract, B. Halkowski)

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Example 2

Microwave Forces and Potentials with Atom Chips

We report on the successful observation of the AC Zeeman force produced by a microwave near-field on an atom chip. We have verified both its spin-dependence and bipolar nature using ultracold ^{87}Rb atoms. In principle, AC Zeeman forces can confine any spin state at arbitrary magnetic fields and can simultaneously target qualitatively different potentials to individual states. Atom chips are ideal platforms for producing these traps since they can produce strong near-field potentials and gradients. Notably, the potential roughness associated with atom chip micro-magnetic traps is expected to be strongly suppressed in AC Zeeman chip traps. These microwave potentials are well suited for studies of one-dimensional quantum gases with tunable interactions and spin-dependent trapped atom interferometry.

(Conference talk abstract, Aubin group)

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Example 3

Parity violation in laser-cooled atomic francium at TRIUMF

Parity violation is a unique identifying signature for the weak interaction and thus provides a powerful probe of the weak force in the presence of electromagnetic and strong nuclear interactions. Atomic parity non-conservation (PNC) experiments use parity-forbidden optical transitions for unique high-precision tests of the electroweak sector of the standard model at very low energies. Alternatively, microwave measurements of spin-dependent atomic PNC can determine the nuclear anapole moment, a parity-violating electromagnetic moment induced by the weak interaction between nucleons.

We present progress on the FrPNC collaboration's apparatus for measuring atomic PNC and the nuclear anapole moment in a string of laser-cooled francium isotopes at TRIUMF. Recent measurements and analysis of the hyperfine anomaly in a series of isotopes identify a favorable set ($^{207\text{-}213}$Fr) with a relatively simple nuclear structure for the valence nucleons; these nucleons are thought to play a key role in generating the anapole moment.

(Colloquium talk, S. Aubin for FrPNC collaboration)

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tie-in to objective 2

(Colloquium talk, S. Aubin for FrPNC collaboration)

Abstract Worksheet

- Fill out worksheet (5 minutes).
- Find a skeptical/critical/inquisitive neighbor.
- Briefly explain your thesis project to this neighbor.
- Answer inquisitive questions from neighbor.

Communication in Science

- The best ideas/theories in science win out … eventually.
  (because they are correct)

- In the short term, the good ideas/theories of the **best communicators** generally win out.
  (because they are easy understand or interesting)

- Science ideas, theories, and results are generally communicated **visually**.
  i.e. sketch, diagram, figure, plot, table, equation … video.

The 2-minute “Elevator” Talk

1. Descriptive but short title.

2. Focus on the broad scientific motivation, the big picture, the question you are trying to answer (~ 50%).

3. State/explain how your project fits into this larger scientific endeavor.

4. State/explain what your project will achieve.

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Visuals: Use figures to support your statements.

Text: Avoid paragraphs. Use single sentence bullet points.

Format: A single sheet of paper (2 sides) for use on the overhead camera. [no PowerPoint]

Physics level: Your family, friends should understand all or most of your talk.

Talk Worksheet

- Sketch a figure(s) that describes your project [5 minutes].
  (diagram, plot, table, equation, etc …)
- Re-engage your skeptical/critical/inquisitive neighbor.
- Use your figure to explain your thesis project to neighbor.
- Answer inquisitive questions from neighbor.

A Useful Exercise

A good way to *organize your thoughts* and *evaluate the importance* of various aspects of your research is to …

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… **imagine a scenario where your project has been a complete and total success.**

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What would you include (information and figures) in a ***press conference/release*** announcing your successful results?