



Canadian Association  
of Physicists  
Association canadienne  
des physiciens et physiciennes

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## CAP SAC Contact Info

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## Student Research Highlight

Student name

[your name could be here!](#)

## Announcements

**CAP 2021 Congress:** After some deliberation, it has been decided that [the CAP Congress of 2021](#) will be online from June 6-11.

# The First Issue of the CAP Undergraduate Newsletter

This newsletter aims to provide relevant information on news of current frontier physics research, on upcoming events and workshops, along with some entertainment in the form of some problems – along with a section for the first people to send the correct solution to them!

## Physics News in 2020

2020 is a year that will go down in history for all the wrong reasons, but some good has come from this time. Here is some news from the year 2020 on the physics community:

- **Labs During the Pandemic:** An interesting solution to in-person labs.
- **Laser Turns 60:** We've come a long way from a paper that spanned half a page.
- **ITER:** The future of nuclear fusion as it stands today.

## Labs During the Pandemic

The problem of imparting lab courses has been one of the many hardships brought on by the pandemic. Undergraduates have been deprived of the fostering lab environment by the unfortunate circumstances. Faced with this challenge, some universities resorted to alternate methodologies; for McMaster University, this took the shape of a lab kit mailed to students so they can do them in the comfort of their own home. You can read more about it in this [Physicsworld article](#), or hear about it on [their podcast](#).

## The Laser Turns 60

In May of 1960, the first laser was created. 60 years later, it's hard to conceive of a reality without them! The uses of the laser are incredible and have now a ubiquity that was hard to imagine back when it was first invented; in fact, in its infancy, the laser was criticized as being a "solution seeking a problem" [by its own inventor, Theodore Maiman](#). You can check out the original paper [here!](#)



**Figure 1.** Maiman & the first laser (HRL Labs, LLC)

## ITER

Among the things that COVID has delayed is one of the soon to be major achievements of human endeavor; the first nuclear fusion device that produces net energy. Although originally launched for 2016, the ITER was later delayed to 2020, blissfully ignorant to the future events that would further the delays even more. [But work still proceeds as the construction picks up after a short pause during the peak of the pandemic.](#)



**Figure 2.** The Tokamak Complex at the ITER Site (from [iter.org](http://iter.org))

## Quote of The Issue

"Nobody ever figures out what life is all about, and it doesn't matter. Explore the world. Nearly everything is really interesting if you go into it deeply enough." — Richard P. Feynman

## Student Research Highlight

### 1 Purpose

This section has as its purpose to highlight student research! We want to encourage, embolden and give a platform for students to be vocal about the things that they work on – and this might also provide inspiration to other students who are still figuring out what they want to do for thesis work! Our hope is to pick three (3) projects from a list of submissions to showcase; a short description of the work being done, what the end goal is, and what consequence this work will have. We would also like to say a little something about the students; after all, we all know that research doesn't do itself!

### 2 PSI Master's Program

This newsletter issue, we will dedicate this section to research opportunities available to students. Although most opportunities for the summer have long past their due date, you can always prepare for when they come around next year; the first being the *Perimeter Institute PSI Master's Program*. This is a one year

master's course (or more specifically, 10 months, as indicated in their web page) designed for exceptional students in theoretical physics. "Taught by some of the world's most brilliant physicists, students at PSI are fully integrated into the unique international culture and dynamic research atmosphere of a leading centre, Perimeter Institute for Theoretical Physics, while earning a Master of Science from the University of Waterloo in Ontario, Canada." The program has been called "a boot camp for theoretical physics". Check the link for more information

### 3 Canada Graduate Scholarships

Regardless of your Master's plans, Canada might have a scholarship for you! Through NSERC, you can apply for a **graduate scholarship** if you are:

- A Canadian citizen.
- Are in, have applied for or **will apply** for full-time admission to a graduate program at the master's (or doctoral) level at a Canadian institution.

Some restrictions apply, check the link for more details.

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## Background

Here we'd like to put some information on the students:

1. Where they study, what they research, links to possible websites and some other detail about their academic career.
2. Talk about their plans post project and the implications the results might have.
3. Anything else that might be interesting and worth mentioning!

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## Winners of last issue's problems

Every issue we'll highlight the first people to send in correct solutions to each problem. We will also have honorable mentions for creative solutions we may encounter. In this issue, we announce the winners of the CAP SAC Problems Competition that took place at the beginning of Fall 2020:

- Robert Beda, Annicka MacKenzie, Rio Weil
- Conner Dailey
- Simaya Rosenbloom
- William Rettie

Check out the [website SAC](#) for some honorable mentions! [Back to Contents](#)

## This Issue's Challenge Problems

To start off the Newsletter Challenge Problems, we'll do some classics of first year – which you might have encountered these problems already in your academic career, along with other non-standard problems.

### Problem 1 (Mechanics): Loop-the-loop

As always, in a very idealistic, friction-less world, we aim to create a roller-coaster with a loop of radius  $r$ . How tall must a hill before the loop be such that the cart makes it through the loop by gravity alone?

### Problem 2 (Mechanics): Streaming Services

When you run a faucet, the stream of water narrows the further it falls away from it. Why is this? Neglecting friction and assuming the velocity of the fluid in the pipe is given by  $v(x) = v_0(1 - (x/a)^2)$  (which is actually close to realistic in laminar flow), where  $a$  is the diameter of the pipe, what is the radius of the stream after it leaves the faucet as a function of  $v_0$ ,  $a$  and height  $y$  ( $y = 0$  at the faucet)?

### Problem 3 (Mechanics): Loop-the-loop 2.0.

Say you're building another roller coaster and the roller coaster consists of a sphere in which the person is placed into (the person is always upright by some mechanism, not rolling with the sphere – just to make it a bit more rider-friendly). If the roller coaster is powered by gravity only past the hill (and ignoring friction, of course), how tall does the hill before the loop have to be? Hint: you have to consider the angular momentum of the system. Assume the sphere has constant density  $\rho$ .

send solutions or problem suggestions to [bnewling@unb.ca](mailto:bnewling@unb.ca)

## Student Opportunities

In the future, the student opportunities will go here!