

# Physics 521a: Techniques in Nuclear & (Astro-)Particle Physics

Fall 2022

The course meets:

**Tuesdays and Fridays at 3 pm – 4:20 pm**

in **Clearihue A308**

(or, via Zoom at <https://uvic.zoom.us/j/3347938652> if ever required to be online).

**Fearless leader:** [Justin Albert](#)

**Office:** Elliott 213

**Office Phone:** (250) 721-7742

**Cell Phone:** (250) 661-7066

**E-mail:** jalbert AT uvic DOT ca

**Office hours:** Come by my office anytime! — or, chat with me anytime via the above Zoom link, or via Skype (my Skype name is jalbertuvic)! I'll be sure to stay available for an hour after each class, but please just send e-mail or call if you want to be absolutely sure I will be in my office/available at any given time. If I'm in my office but busy I'll let you know a time to come back. Feel free to always try my office though, or phone, or e-mail. Cell phone is (250) 661-7066, feel free to call! (I tend to prefer e-mail to text messaging – and e-mail actually tends to reliably get to me faster than texting.) My lab space is in Elliott 022, so you can often find me there too.

**Course homepage:** <https://bright.uvic.ca/d2l/home/222564>

**Text (suggested):** Donald Perkins, *Introduction to High Energy Physics*. It's useful (but not required) to buy this text, note that I'll provide the couple of chapters you'll actually need from the text on Brightspace, so you don't need to purchase it if you find it too pricey. (It's also available both new and used by Amazon or Abe Books if you want to buy it, though.) Please read the textbook sections provided in Brightspace near the beginning of the week that they are covered!

**Some other sources that I occasionally consult:**

Das & Ferbel, *Introduction to Nuclear and Particle Physics*

Griffiths, *Introduction to Elementary Particles*

Halzen & Martin, *Quarks and Leptons*

Martin & Shaw, *Particle Physics*

**Grade** will be based 50% on the bi-weekly problem sets (which you can find on Brightspace), and 50% on an individual project.

**Please note** UVic's correspondence between percentage points and letter grades: A+: 90 or more; A: 85-89; A-: 80-84; B+: 77-79; B: 73-76; B-: 70-72; C+: 65-69; C: 60-64; D: 50-59; F: below 50.

**Problem sets:** There will be a total of 3 assignments during the term. Answers will be posted the week after each one is due.

You are allowed *one late homework* without penalty, up to a week late (along with the one lowest problem set score that is dropped). **All** other late homeworks count 50% if completed before the answer key is handed out the following week. Afterwards, it counts 10% (there is still a little bit of value in copying over the answers to better understand them). No exceptions (other than death in the immediate family, signed doctor's note). Note that the lowest homework score is dropped, and another homework can be a week late, so that covers cold/flu issues.

*Collaboration on the homework is **at your discretion**.* Each person is responsible for doing his/her share of the work, **writing up her/his own solutions and for listing his/her collaborators on each set.**

*Please let me know anytime if you have any questions!!!*

Below is a brief outline of the topics that will be covered in the course (with approximate durations):

- 1) Introductory remarks, & some major open questions in particle physics (1 week)
- 2) Interaction of particles with matter (2 weeks)
- 3) Particle detection techniques (2 weeks)
- 4) Detector design issues, and case studies (1 week)
- 5) Data acquisition, reconstruction, and computing issues (1 week)
- 6) Cosmic rays and natural radiation (1 week)
- 7) Techniques in astroparticle physics (dark matter & energy, grav. waves) (2 weeks)
- 8) Particle accelerators (and accelerator diagnostic detectors) (1 week)
- 9) Individual project talks (1 week)