BIRS workshop "Systematic Effects and Nuisance Parameters in Particle Physics Data Analyses (23w5096)" 23-28 April 2023

Introduction

Sara Algeri (Minnesota U), Olaf Behnke (DESY), Lydia Brenner (Nikhef), Richard Lockhart (Simon Fraser U) and Louis Lyons (Imperial & Oxford U)
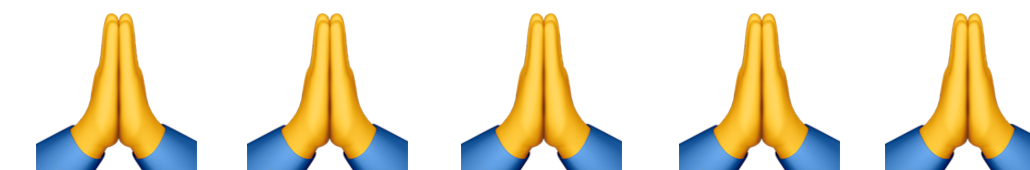
MANDATORY PHOTO CREDIT: TransCanada PipeLines Pavilion. Photo courtesy of The Banff Centre

Motto: "A workshop devoted to the way Systematic uncertainties are incorporated in data analyses in Particle Physics"

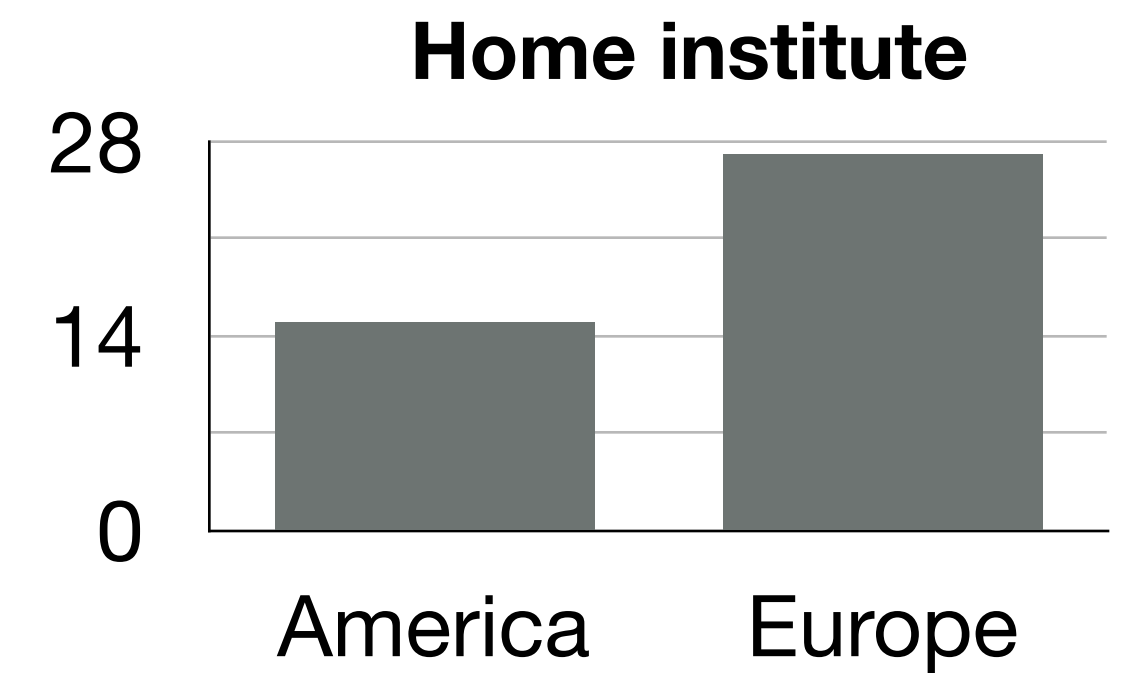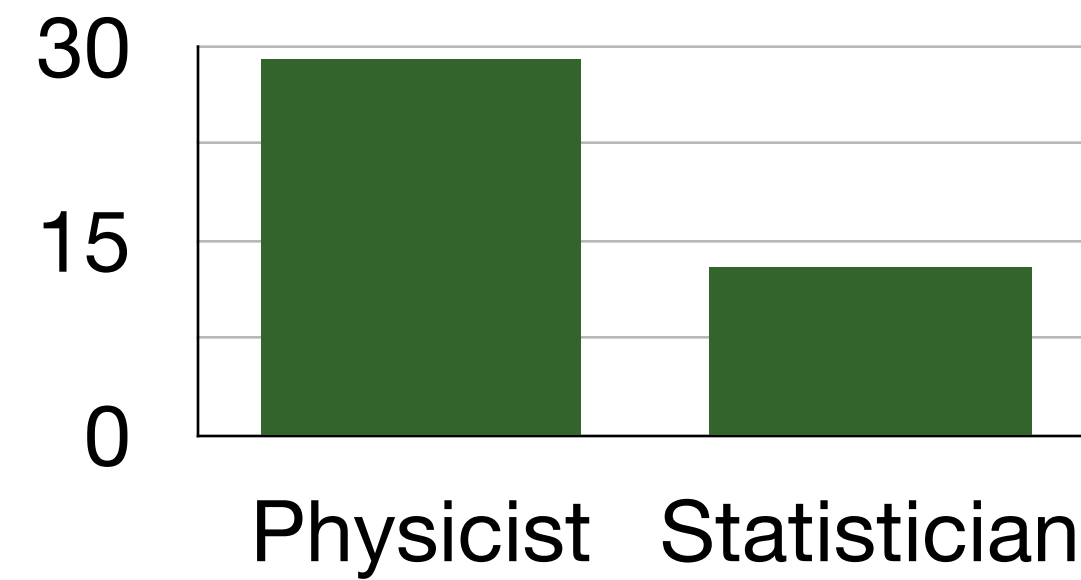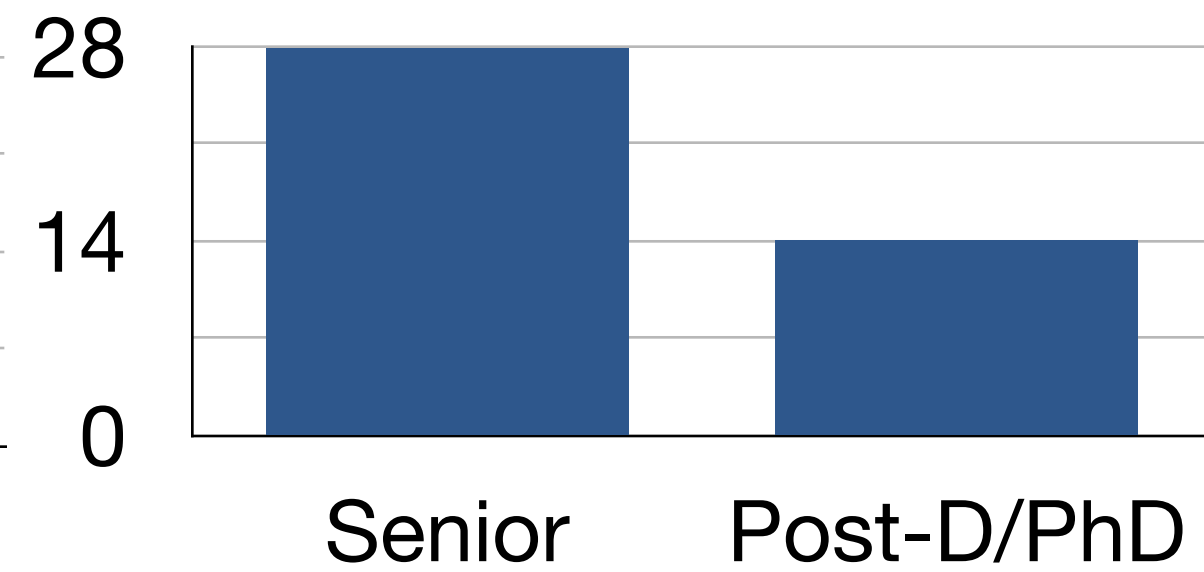Following remote workshop "PHYSTAT-Systematics 1-3 Nov 2021" https://indico.cern.ch/event/1051224/

Thanks to BIRS for hosting us!

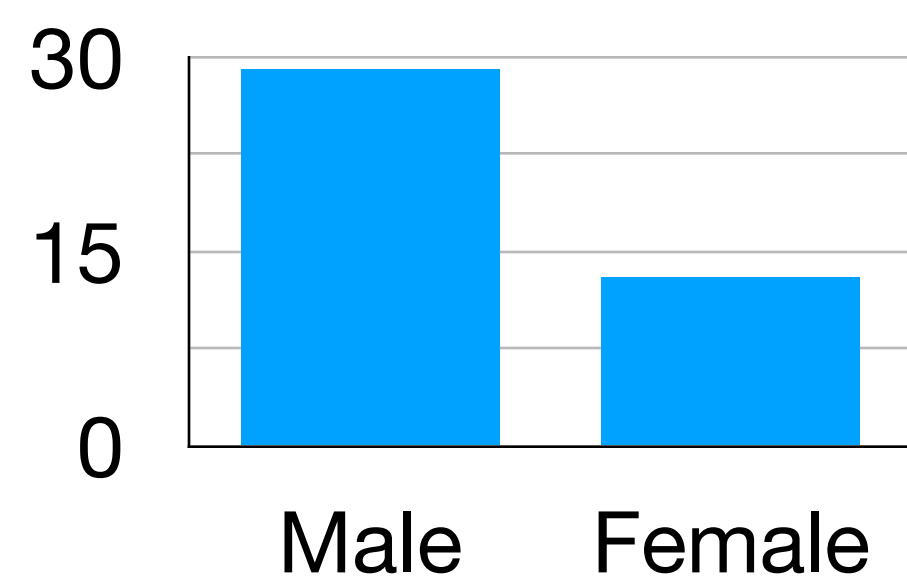🙏 🙏 🙏 🙏 🙏

Participants - some statistics to begin with 😀

Have 42 onsite and 29 remote participants, focus in the following on onsite

Bar chart 1: Male (~29), Female (~13), y-axis 0, 15, 30

Bar chart 2: Senior (28), Post-D/PhD (14), y-axis 0, 14, 28

Bar chart 3: Physicist (~29), Statistician (~13), y-axis 0, 15, 30

Bar chart 4 (Home institute): America (~15), Europe (~28), y-axis 0, 14, 28

Scientific program

Monday

Phystat-Systematics 2021 Review
- Physicist's view N. Wardle (c O. Behnke)
- Statistician's view S. Algeri (c O. Behnke)

Macro Theme 1: Frequentist vs Bayesian
- Marginalize vs profiling R. Cousins, A. Davison (c G. Cowan)
- Bayesian approaches in Astro/Cosmo. F. Capel (c W. Rolke)
- Pragmatic vs Full Likelihood approaches D. Van Dyk (c A. Brazzale)
- Likelihood-free frequentist Inference A. Lee (c L. Heinrich)
- Simulation-based inference of atmospheric Comic-ray showers A. Shen (c. L. Heinrich)

Tuesday:

Macro Theme 2: Modeling uncertainties
- Model Selection C. Shafer (c N. Wardle)
- Background model building L. Kania (c N. Wardle)
- Background and Signal Shapes N. Morange (c S. Williams)
- Template morphing L. Brenner (c H. Gray)
- Optimal transport P. Windischhofer, T. Manole (c R. Lockhart)
- Systematics in MC G. Jones (c T. Junk)
- Theory uncertainties F. Tackmann (C. I. Volobouev)

- Banff Challenge 3. Junk (c. P Leng Tan)

Wednesday:

Macro Theme 3: Nuisance Parameters
- Asymmetric uncertainties R. Barlow (c I. Volobouev)
- Error on error E. Canonero (c N. Wardle)

- Systematics in Neutrino Physics Analyses E. T. Atkins (c R. Cousins)

Thursday:

Macro Theme 4: Machine Learning
- Machine Learning M. Kagan (c L. Heinrich)
- ML for reducing systematic uncertainties T. Dorigo (c H. Gray)
- Systematics in ML model independent searches   N. Morange (c I. Ochoa)
- Semi-supervised classifiers P. Chakravarti (c P. Windischhofer)

- Systematics in selected flavour physics topics S. Stefkova (c. K. Tackmann)

- Systematics in unfolding M. Stanley, Richard Zhu (c. G. Cowan)

Friday:

Thoughts on meeting
- Physicists view A. David (c L. Lyons)
- Statistician's view M. Kuusela (C. L. Lyons)
- All (C. L. Lyons)

Session handling and communication

1 Intro talks:

Asking questions during talks:

- Encouraged (in particular if something is unclear)
- Should avoid longer interruptions of talk flow

Talk length (without questions):

≤ 25 min	😄
26-27 min	😊
27-30 min	😐
31+ min	🥵

Total time for questions during talks:

0-10 min	😁
11+ min	😐

3 Remote participants in ZOOM:

During intro talks:

- Write your question or comments into chat box (we might interrupt the speaker)

During Discussion Sessions:

- Raise your hand (we will call you) and/or write your question or comments into chat box

2 Talk uploads:

https://files.birs.ca:4430/sharing/c2m7dijqN.   **Password: 23w5096**

The slide uploads will be transferred to the workshop website every hour, on the hour. Please make sure that you enter at least your last name when prompted. Please upload slides well in advance of your session!

5 Birs Code of Conduct:

https://www.birs.ca/about/code-of-conduct
http://www.birs.ca/app//webroot/files/EDIB/BIRS-Code-of-Conduct.pdf

Excerpt:

1. All persons are to be treated with respect and dignity.

2. Harassment is a form of misconduct that undermines the integrity of BIRS's activities and mission.

3. All persons are responsible for their part in creating a welcoming environment.

4. All persons are empowered to speak out.

4 Further scientific discussions with Slack:

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https://join.slack.com/t/birssystemati-3ar4108/shared_invite/zt-1sz98nr1j-zZTln4i0kJcAC_xhWo4HMQ
[join.slack.com]
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Slack communication channels: general and per session - see next slide
Feel free to use this at your discretion
Thanks to Sara Algeri for setting this up! 🙏

Communication via Slack

Documentation of workshop

- Slide files
- Video recordings - include all intro talks + discussion sessions
- Testimonials
- …

→ https://www.birs.ca/events/2023/5-day-workshops/23w5096

CERN Courier Article
- thanks to R. Barlow for volunteering to write it 🙏

Social events

Monday

| 13:00 - 13:30 | Guided Tour of The Banff Centre ↓ (TCPL 201) |
| 13:30 - 13:40 | Group Photo ↓ (TCPL Foyer) |

Wednesday

| 13:30 - 17:30 | Free Afternoon (Banff National Park) |

Thanks to Jake for his recommendations for Bars/sightseeing & free afternoon:

My primary suggestion for a downtown bar is Banff Ave. Brewery; another on-site option is Maclab Bistro. There are upscale options at the Fairmont Banff Springs — but the price is quite high (really depends on your group).

The Sulphur Mountain Gondola and Upper Hot springs are popular local attractions that can be reached easily by public bus.

Free afternoon: Hiking is unpredictable this time of year as snow is still a possibility. Mud is less of an issue as the terrain here is arid/dry but ice can be an issue for hikes with elevation. If you plan to take a hike with elevation gain we suggest renting ice cleats that can be attached to your hiking shoes.

Backtrax is a popular place to rent ice cleats:
https://snowtips-bactrax.com/more-winter-adventures/
(403) 762-8177
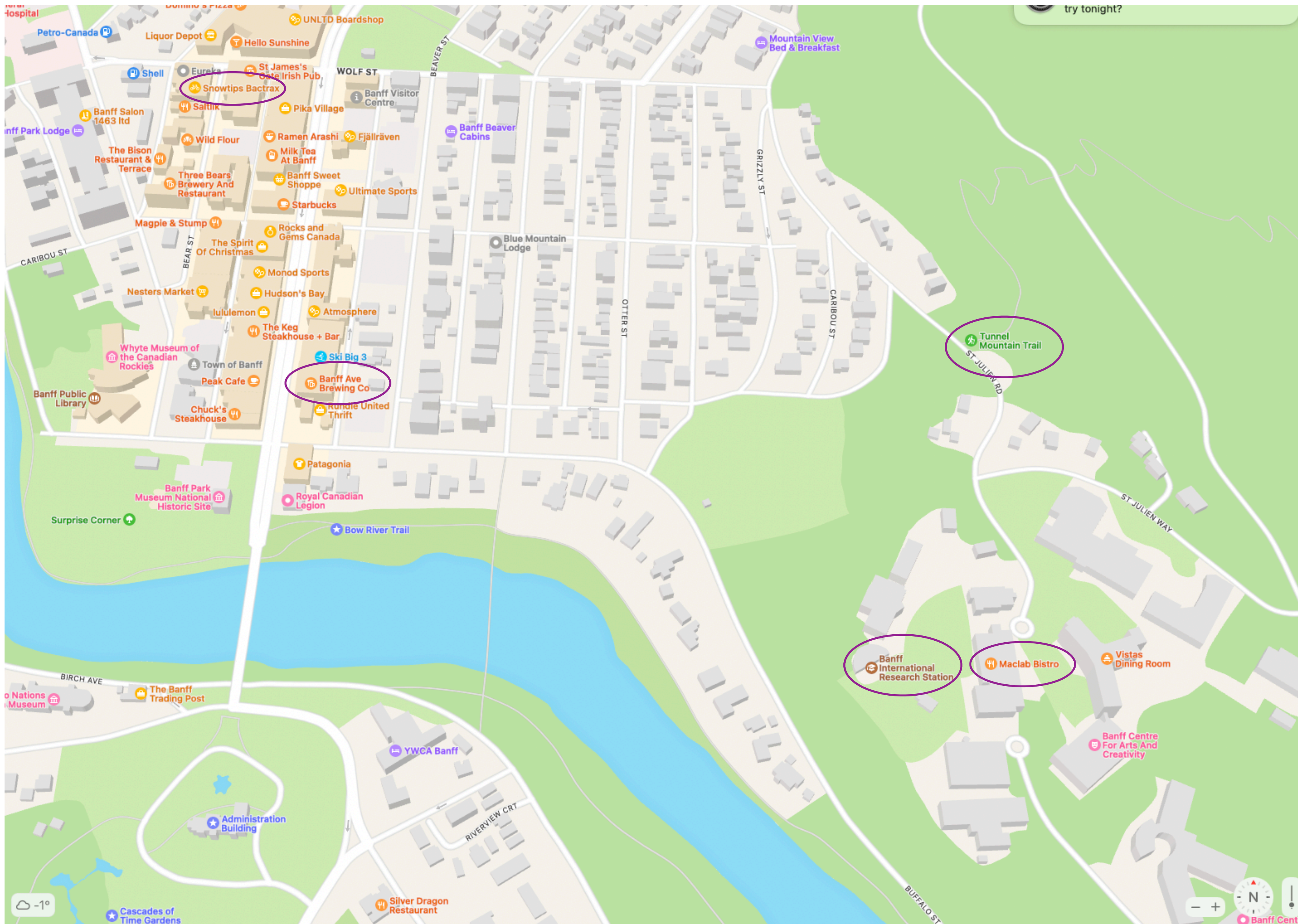
Locations of some nearby trails, Gondola and hot springs:

An overview of the winter walking trails possibilities in the vicinity is here:
https://parks.canada.ca/pn-np/ab/banff/activ/marchehiver-winterwalking/banff

Current trail conditions are here:
https://parks.canada.ca/pn-np/ab/banff/activ/randonnee-hiking/etat-sentiers-trail-conditions

Trail with larger elevation gain

https://www.alltrails.com/trail/canada/alberta/tunnel-mountain-summit

Trails with smaller elevation gain:

https://www.alltrails.com/en-gb/trail/canada/alberta/fenland-trail--3

https://www.alltrails.com/de/route/canada/alberta/marsh-loop--2

Today's program

Monday, April 24	
07:00 - 08:45	Breakfast ↓ (Vistas Dining Room)
08:45 - 09:00	Introduction and Welcome by BIRS Staff ↓ (TCPL 201)
09:00 - 09:10	Olaf Behnke: Introduction to Meeting (TCPL 201)
09:10 - 09:35	NICHOLAS WARDLE: PHYSTAT-Systematics 2021 review - Physicist's view (chair: O. Behnke) ↓ (TCPL 201)
09:35 - 10:00	Sara Algeri: PHYSTAT-Systematics 2021 review - Statistician's view (chair: O. Behnke) (TCPL 201)
10:00 - 10:15	Olaf Behnke: PHYSTAT-Systematics 2021 - Discussion Session (TCPL 201)
10:15 - 10:45	Coffee Break (TCPL Foyer)
10:45 - 11:05	Robert Cousins: Marginalise v Profile - Physicist's view (chair: G. Cowan) ↓ (TCPL 201)
11:05 - 11:25	Anthony Davison: Marginalise v Profile - Statistician's view (chair: G. Cowan) (TCPL 201)
11:25 - 12:00	Glen Cowan: Marginalise vs Profile - Discussion Session (TCPL 201)
12:00 - 13:00	Lunch ↓ (TCPL 201)
13:00 - 13:30	Guided Tour of The Banff Centre ↓ (TCPL 201)
13:30 - 13:40	Group Photo ↓ (TCPL Foyer)

13:45 - 14:10	Francesca Capel: Bayesian approaches in Astro/Cosmo (chair: Wolfgang Rolke) (TCPL 201)
14:10 - 14:45	Wolfgang Rolke: Bayesian approaches in Astro/Cosmo - Discussion Session (TCPL 201)
14:45 - 15:15	Coffee Break (TCPL Foyer)
15:15 - 15:40	David van Dyk: Pragmatic v Full Likelihood approaches (chair: A. Brazzale) (TCPL 201)
15:40 - 16:15	Alessandra Brazzale: Pragmatic v Full Likelihood approaches - Discussion Session (TCPL 201)
16:15 - 16:40	Ann Lee: Likelihood-free frequentist Inference (chair L. Heinrich) (TCPL 201)
16:40 - 16:55	Alex Shen: Simulation-based inference of atmospheric cosmic-ray showers (chair: L. Heinrich) (TCPL 201)
16:55 - 17:30	Lukas Heinrich: Likelihood-free frequentist Inference - Discussion Session (TCPL 201)
17:30 - 19:30	Dinner ↓ (Vistas Dining Room)

Enjoy!

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Location Map