UC Davis Overview

Daniel Cebra
UC Davis

People

The UC Davis team for EIC:

- Daniel Cebra
- Manuel Calderon
- Ramona Vogt (also LLNL)
- Zach Sweger (GS 6th)
- Saeahram Yoo (GS 6th)
- Mathias Labonte (GS 3rd)
- Andrew Liggett (GS 3rd)
- Ziyuan Zeng (GS 2nd)

Soon to be joining:

- Kate Matsubayashi (GS 1st)

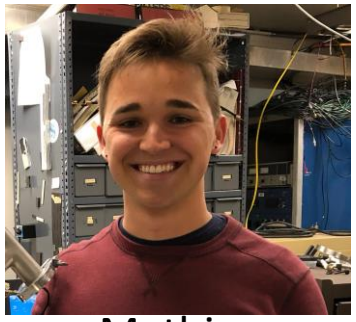
Daniel

Manuel

Other Senior Students
Matt Harasty (STAR)
Frank Gonzalez (CMS)

Group Policy is that all new people joining the group will share time between EIC and other UCD efforts.

Zach



Saeahram

Mathias

Ziyuan

Andrew

Prospects for more People (Faculty)

Prospects for a new faculty member:

- UCD Physics is ***still*** in the process of writing a new five-year hiring plan.
- Nine months ago, the thinking was that maybe the Dean would allow us two hires per year.
  ➔ Nuclear was ranked sixth in priority, which would have suggested a new hire in 2026.

- Painful reality confronted us in the summer of 2023, and got worse on the fall and winter.
  ➔ The Governor is further cutting the State's contribution, this hurts L&S.
  ➔ UCD has a structural deficit, with the deficit being worst in L&S.
  ➔ The University has dictated a annual budget cuts for the next six years.
  ➔ The Dean's office pushes back on Physics department's plan, especially startup costs.

- The department planning committee got more conservative
  ➔ Dropped a generic "new initiative from the priority list ➔ Nuclear move up to 4th.
  ➔ The dean pushed back further on our 1st priority CME ($ 1.5M startup)
  ➔ Nuclear moves up to 3rd.

  ➔ The Ask that that includes a joint UCD/LNBL hire in 2026. Approved by Department.
  ➔ The Dean has not yet responded to our Hiring request.

Prospects for more People (PD or Grads)

Prospects for a Postdoctoral Scholar:

- **No more PD opportunites at UCD using MRPI funds.**
- Decided to convert the PD funding into more partial funding for GS, now funding two students who are resident at LBNL (Zach Sweger and Mathias Labonte).
- Will submit our NSF renewal this December and we will likely request at 50/50 PD.

New graduate students:

- Kate Matsubayashi will be joining the group at a new GS in the Fall.
- All new students joining the group will split time between EIC and another UCD effort.

Undergraduates:

- Now our most experienced EIC students are at LBNL.
- Saeahram has returned from CERN and Ziyuan has restarted research activities in the Spring quarter. We are now ready to bring undergrads onto EIC efforts.

Physics Interests

How do our current interests mesh will the EIC?

Daniel

Manuel

- Phase Diagram on QCD Matter
- ➔ Working with Spencer Klein on Backward Vector Meson Production, DVCS, Nuclear excitations.
  (Zach Sweger, Mathias Labonte, Ziyuan Zeng)
- Nuclear Data for Space Radiation Protection
- Astatine-211 production and applications

- Heavy Flavor (Upsilon) Production
- ➔ Saeahram Yoo has made progress. Working with LBNL group (Minjung, Yuanjing, Xin, and Spencer)
- Outreach (IMAX Movie)

- Detector development

➔ Efforts to assist Nikki Apadula's work
(Mathias Labonte, Saeahram Yoo, Andrew Liggett, and Ziyuan Zeng)

Past Progress

MRPI Goals:

Encourage collaboration between personnel from campuses and labs to develop EIC detector proposals.

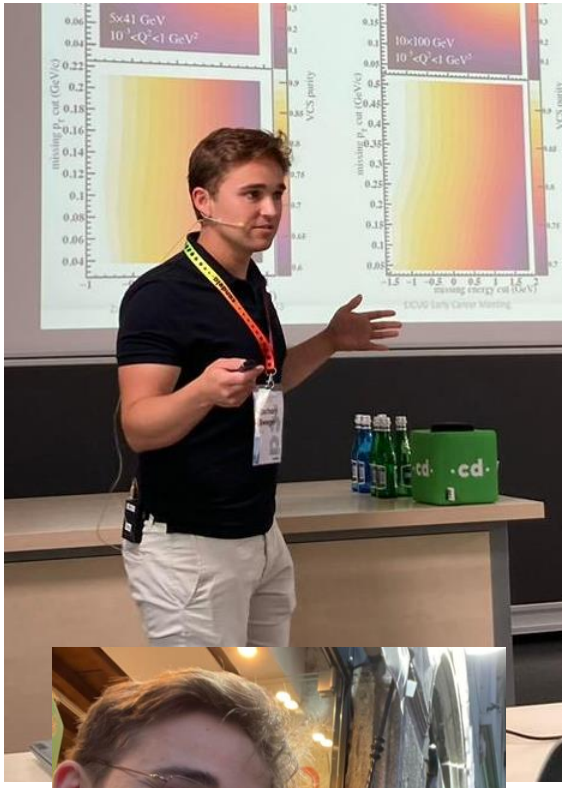
Historical Timeline:

- Sam Heppelmann (UCD GS) moved to LBNL to work with Spencer on Vector Meson Production (2019-2021) (Now a staff scientist at LLNL)
- Zach Sweger (UCD GS) completed the Backward Vector Meson Production paper https://journals.aps.org/prc/pdf/10.1103/PhysRevC.106.015204. (**LDRD 2021**)
- Zach moved to LBNL in summer 2022.
- Zach starts DVCS project with Spencer in summer 2022. Paper now ready to submit.
- UCD hosts EIC Consortium meeting July 2022.
- Mathias Labonte, Saeahram Yoo, and Ziyuan Zeng commit to going to LBNL to work with Nikki on thermal measurements of carbon fiber structures in Fall 2022.
- Mathias moved to Berkeley in summer of 2023.
- Zach completed the Deeply virtual Compton Scattering Paper https://twitter.com/PhysRevC/status/1727100097605910638

One of our goals has been to have a UCD grad student resident at LBNL (now two):
➔ *Sam Heppelmann (2020-2021), Zach Sweger (2022-2025), Mathias Labonte (2023-6)*

Recent Progress - Zach

- Zach's paper was published (editor's suggestion) by PRC: Z. Sweger, S.R. Klein, Y. Ji, M. Kim, S. Yoo, Z. Zeng, D. Cebra, X. Dong, Modeling Backward-Angle (u-channel) Virtual Compton Scattering at an Electron-Ion Collider, (https://journals.aps.org/prc/abstract/10.1103/PhysRevC.108.055205 2023).
- Zach attended the EPIC Collaboration meeting at Argonne in January to participate in workfests.
- Zach was invited to speak at the CFNS First Workshop on Baryon Dynamics at Stony Brook in January, on interpretations of u-channel physics at the EIC. His talk is can be found here: https://indico.cfnssbu.physics.sunysb.edu/event/113/contributions/763/attachments/154/224/uChannelInterpretations-2.pdf
- Zach has worked on studies on ZDC requirements for backward physics channels to inform the ZDC design.
- Zach completed work with the Exclusive/Diffractive/Tagging group on far-forward benchmarks for B0 and ZDC development.

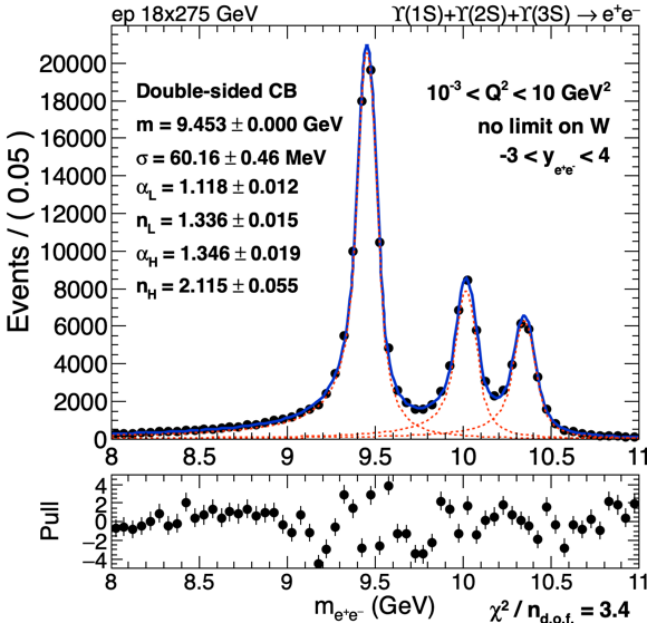


Recent Progress - Saeahram

- Saeahram is back from CERN!

- She is now working on studying the tracker resolution of the EPIC detector using three Upsilon states in the electron decay channel. The goal was to prepare a plot for the TDR.

- The main result is shown here.
- She we now be focusing on upsilon polarization.



Recent Progress - Mathias

Mathias had been working the ongoing cooling studies with Nikki, where we are trying to identify an ideal stave material and configuration to supply air cooling to the silicon tracker. Mathias is our most experienced student with this group. He has helped bring Saeahram, Ziyuan, and Andrew up speed.

Mathias is now working on a simulation project with Spencer. Using BeAGLE (an eA event generator) to look at how well we can parse coherent vs. Incoherent events. Starting this by looking at events of the variety eA → Gamma (The nucleus excites, then de-excites, and shoots a gamma into the ZDC). How well will the ZDC be able to measure these gammas?

Plans - Overview

Physics Goals: Heavy quarkonia production in DIS and in photon-nucleus collisions

Building on the expertise of Calderon, who has studied upsilon production at RHIC and at the LHC in p+p, p+A, and A+A collisions, and the theoretical work of our colleague, Ramona Vogt, we would like to continue this research into the EIC era.

Photonuclear collisions involving the exclusive production of light vector mesons (ρ, ω, Φ) and of heavy quarkonia (J/ψ and Υ particles) provide an excellent tool to probe gluon distributions at low *x*. Tagging the outgoing electron and is necessary to fully constrain the kinematics. Tracking is essential for the measurement of the leptons from the decays of the vector mesons and heavy quarkonia – this stimulates our interest in tracking simulations and performance.

Summary and Outlook

Summary:

- **UCD has had a GS resident at LBNL (SH ➔ ZS ➔ ML ➔ …). Now two students.**
- **Zach completed and published work started by SH and supervised by SK.**
- **Zach has completed the DVCS project, paper published (supervised by SK).**
- **Saeahram has assisted in producing TDR plots. Will now focus on polarization.**
- **Mathias has started a study of the nuclear excitations.**
- **Mathias, Saeahram, Andrew, and Ziyuan have assisted the hardware effort at LBNL (led by NA).**

Outlook:

- **Faculty hire likely in the 2026 timeframe.**
- **Converted Postdoctoral scholar position to more GSR funding.**
- **Started UCD efforts in heavy flavor production and polarization.**