



# UC Davis Progress and Plans

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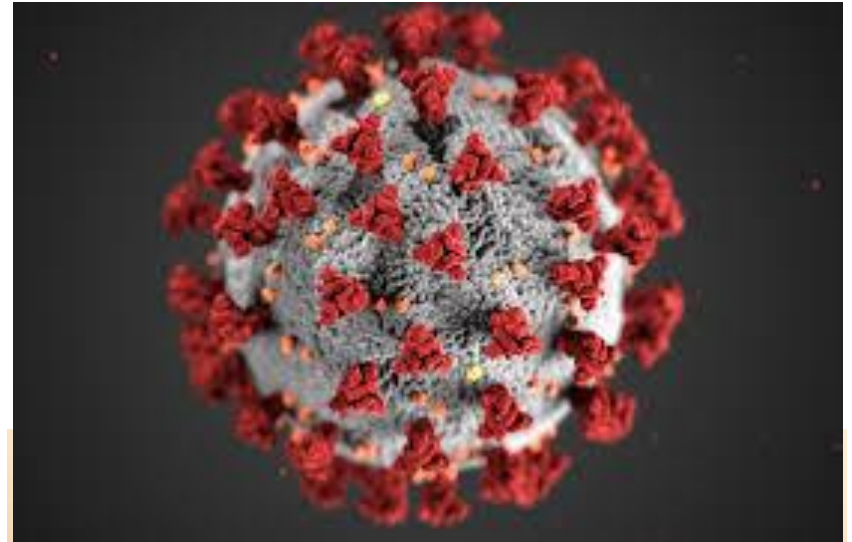




# Corona Virus

## Why I am mentioning Corona Virus?

- This has had a major impact and is an existential threat to higher education
- The UCD Nuclear Group:
  - Entirely virtual
  - Cebra sheltering at my farm in Oregon
- UC Davis:
  - Campus is almost closed – Phase II
  - Physics Dept – Classes all virtual Fall, Winter
  - Financially still somewhat OK – still hiring
  - Just notified of 2.6% Faculty/Staff pay cut





# Progress

The UC Davis team for EIC:

- Daniel Cebra
- Manuel Calderon
- Sam Heppelmann
- (Ramona Vogt)



The Davis effort has focused on Heavy Quarkonia.

Our main progress has been the work that will be reported on by our senior graduate student – Sam Heppelmann. He has been using STARlight as an event generator for heavy flavor quarkonia and testing the efficiency of reconstruction using detector models.



# Progress

From the MRI Budget justification:

*The graduate student at UC Davis will collaborate with personnel from UC Berkeley, LBNL and LANL to perform EIC experiment integrated tracker simulations and collaborate with personnel from LBNL. S/he will also work with laboratory personnel to develop an EIC software package to run on high performance computing platforms.*

Sam is a senior graduate student (starting his sixth year). As an undergraduate, he worked with Elke Aschenauer on the STAR forward upgrade. At Davis, he had done service work developing a GEANT model of the Event Plane Detector (EPD) and for the target and target frame added into STAR for the fixed target program. He has relocated to Berkeley and has been applying this previous expertise to the challenge of reconstructing heavy Quarkonia in proposed EIC detector models. At LBNL, he has been sharing his time between analysis of the STAR data and on EIC software development.



# Progress

Short time-line goal from previous Consortium Meeting:

Identify the correct contacts for Sam at LBNL and LLNL

→ completed



# Plans

## Integrated Tracker Simulations

Calderon and Cebra's primary expertise focuses on the software and data analysis of the Time Projection Chamber. Calderon was part of the team that developed the original tracking packages for STAR. Cebra authored early versions of the vertexing code. Therefore EIC tracking code and simulations seemed to be the area where we could best contribute.

Heppelmann has experience running heavy-ion event simulators through the STAR GEANT model which is essential for studying the tracking performance.





# Plans

## 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 ( $\rho$ ,  $\omega$ ,  $\Phi$ ) and of heavy quarkonia ( $J/\psi$  and  $Y$  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.



# Longer Term Plans

## **One goal of the Consortium is to stimulate faculty hiring:**

A EIC-focused hire in Nuclear Physics was voted as the third priority in the current department hiring plan. The dean, who has been hostile to Physics, approved only one hire (Condensed Matter Theory). This search is going forward despite the financial stress of the Corona virus.

This Dean has announced that she is leaving, which always allows for a reset in administration priorities (i.e. hopefully no longer hostile to physics). The department will push for a High Energy Experimental position next year. Hopefully the EIC-focused Nuclear Physics position would be requested for the 2023 (Still in time to make an impact on an EIC experiment construction effort).

## **The UC Davis group is positioned to assist in a construction effort:**

Cebra served at interim director of the Cyclotron Lab on campus, and during that period he re-organized and consolidated the machine shop facilities of the Cyclotron Lab, and the Departments of Physics, Chemistry, and Earth and Physical Sciences.

The UC Davis HEP group built the CMS inner silicon vertex detector → there is expertise.





# Draft EOI Table

| Institution Name | Professor | Research Professor | Staff Scientist | Postdoc | Graduate Student | Undergrad. student | Engineer | Designer | Technician | Total Sum |
|------------------|-----------|--------------------|-----------------|---------|------------------|--------------------|----------|----------|------------|-----------|
| UC Davis         | 0.1       |                    |                 | 0.5     | 0.2              | 0.2                |          |          |            |           |
|                  | 0.1       |                    |                 |         | 0.2              | 0.2                |          |          |            |           |
|                  | 0.2       |                    |                 |         | 0.5              | 0.2                |          |          |            |           |
|                  |           |                    |                 |         |                  |                    |          |          |            | 2.4       |

It is anticipated that the collaborative effort of UC Davis to cooperate on the EIC Project is to include (at an annual basis) 0.4 full-time equivalent FTEs of three professors, 0.5 FTE of a postdoctoral researcher, and 0.9 FTEs of three Ph.D. students. The technical collaborative effort contributed to be determined. We anticipate the duration of this collaborative effort to cooperate on the EIC Project to start at the DESIGN phase and to continue through the commissioning phase of the project.



**Please indicate any other information you feel will be helpful:**

(e.g., this could be things like assembly and storage space at your institute, clean rooms and class, special skills or machine shops, or perhaps some pointers to past accomplishments – you can expand on those in an appendix. If you could make existing engineering, design or technician labor available to the EIC experimental equipment but would rely on funds coming from the EIC Project you can also list those here).

575 Sq. ft. Lab space, could be upgraded to clean room

Large Divisional machine shop facility

Past UC Davis accomplishment – construction of CMS inner silicon vertex detector

Electrical Engineers and technicians available but recharged to faculty