

# Physics 140x – a Foundational Course Initiative Studio Teaching Experiment

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## Background & Motivations

Physics 140 is the introductory mechanics course taken by almost all UM engineering and physical science students. As such, the course is large, enrolling nearly 700 students per term. It is also important, gating entry to a wide range of STEM majors, and hence careers.

Large Foundational Courses like Physics 140 should be designed, developed, and delivered by sustainable, multi-generational teams. They should focus on widespread student success in an exciting, supportive, learning environment. To demonstrate success, they should provide evidence that they are both equitable and inclusive.

## What is Physics 140 Today



### Physics 140 today:

- Meets four hours a week as a flipped, active-learning, large lecture hall environment, with evaluation done in three mid-terms and a final which are high-stakes, timed MC exams
- Exhibits substantial gendered performance differences: as do all other STEM courses taught and evaluated in similar ways at Michigan
- Cannot effectively respond to individual differences among students, struggles to develop significant community among students, and provides few opportunities for individual students to interact in a sustained way with members of the instructional team
- Physics 140: a **good version of a course of this kind**. But its outcomes regularly disappoint both students and faculty

## The FCI and Physics 140x

In May of 2018, the Physics 140 instructional team officially entered the Foundational Course Initiative or FCI. Our FCI team includes physics faculty, postdocs, undergraduates and staff, along with four instructional consultants from CRLT. We have been studying Physics 140 and using the results to develop a new model for instruction.

Motivations for this redesign include:

- Increasing equity and inclusion
- Increasing student learning of physics
- Making participation in the instructional team a practical and attractive option for physics faculty and students

**Physics 140x – learning physics in a neighborhood.** In fall 2019, we will transform one of the three sections of Physics 140 into a new 'studio model.' This new version will teach the same material, meeting the same requirement for all students.



The student experience in 140x will be radically different. Students will meet in two hour sessions in the new BSB 1060 active learning space. Each section of 120 students will experience the class in 5 'neighborhoods' of 24 students who will spend the whole term together, creating a small course environment within the larger class. Students will spend most of their time working in groups of three. Group membership will be cycled through each neighborhood of 24, so that by the middle of the term, every student in a neighborhood will have worked with every other.

Each neighborhood will be directly overseen by one undergraduate learning assistant, who will provide a continuous point of contact for both technical questions in the course and social support. Each 140x section will employ five learning assistants, a GSI, and a faculty member. In fall 2019 the two sections will be led by Professor Tim McKay and Associate Professor Dragan Huterer.

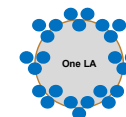
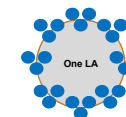
## Plans for the Future

Space constraints have long prevented the use of studio instruction in our large, introductory STEM courses. Even now, 140x is possible for only 1/3 of all Physics 140 students. In 2023 the new Central Campus Classroom Building will open, providing substantially more active learning space. We consider the current 140x offerings part of a development cycle which we hope will allow us to offer studio style instruction to the majority of all introductory physics students.

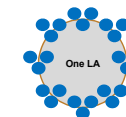


## 140x Course Structure

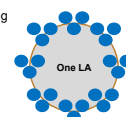
Five 'neighborhoods' of 24 students, working in groups of 3 throughout the term. Each is overseen by one learning assistant.



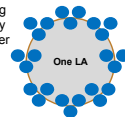
Groups cycle through the neighborhood, so that every student works with every neighbor, creating a learning community within the large course.



Roving GSI



Roving Faculty Member



Two hour periods spent in group work, reporting out, and individual work

## Who should sign up for 140x sections?

These new 140x sections would be a great way for any student to take 140. They are especially appropriate for students who want a supportive, collaborative environment, and are ready to pitch in and work hard to make it effective. Students who prefer regular, low stakes evaluation to a few high stakes exams will likely enjoy it too.

## Collaborators

<sup>†</sup>Heather Rypkema, Kairos Marquardt, Karishma Collette, Meg Bakewell, Yuri Popov, Nita Kedharnath, Thomas Finzell, Juniar Lucien, Rob Dalka, and the Physics 140 learning assistants, MWrite fellows, and students.