Student teams modeling COVID-19: An example of experiential learning in research methods

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*Undergrad
*Graduate

Outline

- Who we are
- Educational goals of the project
- Building a team and an agent-based model
- Preliminary results from the model

How we started:

- Hired in 2020 as particle astrophysics researchers
- COVID-19 hit
- Started modeling COVID-19
- Undergraduate led group

Who we are

Goal Develop COVID-19 model using physics "skills" to inform Public Health

Goal Provide mentoring opportunities for students

Goal Undergraduate led research project to inspire others

Student learning outcomes

SLO 1   Conducting a literature review
SLO 2   Programming in Python
SLO 3   Working as a group
SLO 4   Mentoring/ teaching others
SLO 5   Creating production level software
SLO 6   Disseminating findings
SLO 7   Applying for grants
SLO 8   Inspiring undergraduate research

Literature review

- Modelling methods
- What has been published
- Not many agent-based models (experience from physics)
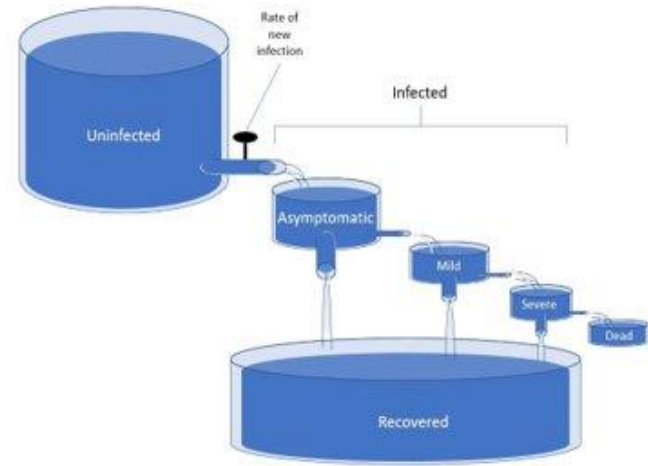- We focused on understanding (less on prediction)
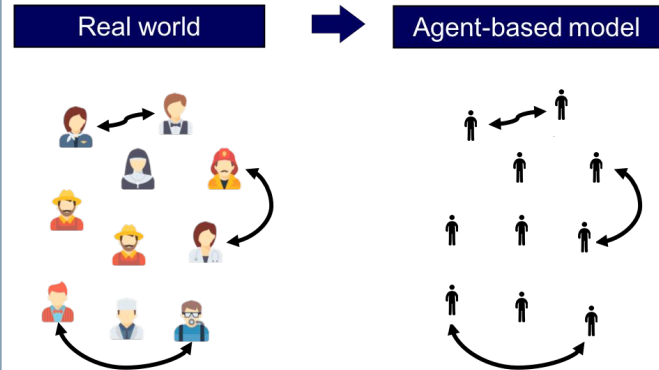

Fig 1. Differential Equation Modelling

Fig 2. Agent-Based Modelling

Developing software for the model

Learning to model (SLO 1)	Learning Python (SLO 2)	Creating the model (SLO 1-3)	Production level code (SLO 2-5)
• Learning typical SIR modeling methods • Monte Carlo simulation tools	• Learning to write and read Python code • Create pull requests on Github • Use linux	• Putting together how to build a model and how to code in Python • Creating an agent-based Monte Carlo simulation	• Created production level code • Grad students review code • Docstrings • Reviewing and checking errors in code

SLO 1 Conducting a literature review
SLO 2 Programming in Python
SLO 3 Working as a group
SLO 4 Mentoring/ teaching others
SLO 5 Creating production level software

End of summer 2020, developed working code

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Applying for Grants

SLO 3 Working as a group
SLO 6 Disseminating findings
SLO 7 Applying for grants

Steps to applying
1. Learning to write and develop a proposal with a budget
2. Managing research funds

As a group we have received over **$10,000** from The Arts & Science Undergraduate Research Fund

- Fall 2020
- Winter/ Spring 2021
- Fall 2021

To cover:
- Conferences
- Publication costs
- Stipends (5 hours a week per undergraduate)!

Individual side projects

Projects included:
- Contact tracing
- Masking and lockdown mandates
- COVID-19 testing based on symptoms then quarantined
- Visitors and student population
- Different variants

HIGHLIGHT

One student with no coding experience from Health Science learned how the model worked, learned how to read and code in Python, created and implemented code to include vaccinations in the code.

SLO 2 Programming in Python
SLO 5 Creating production level software
SLO 6 Disseminating findings
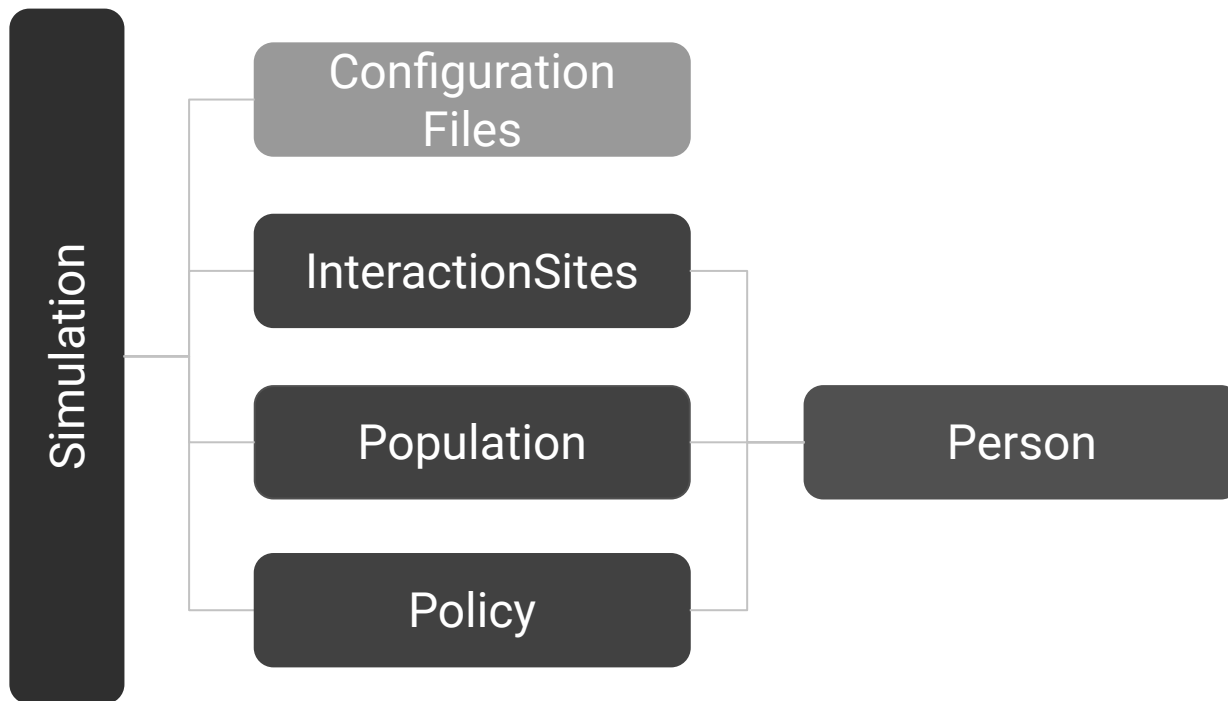
What the model looks like now

Fig 3. Software framework used for mathematically modelling COVID-19
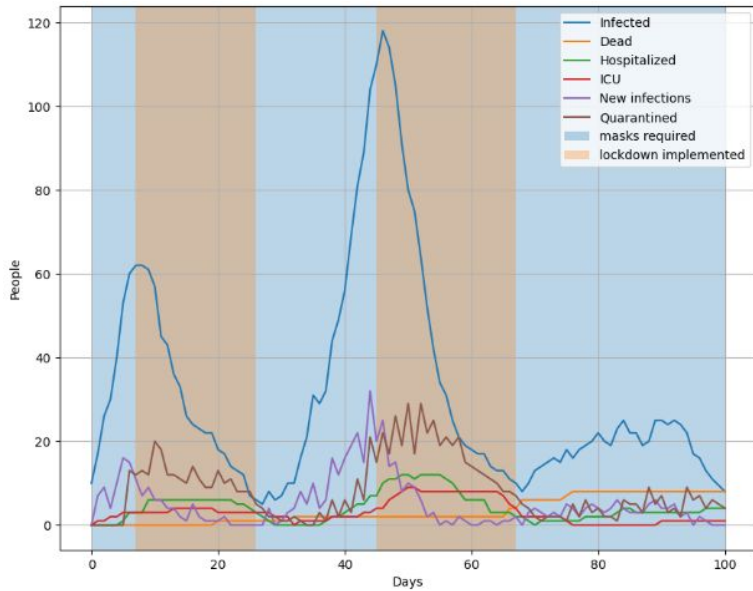
Example results from the code

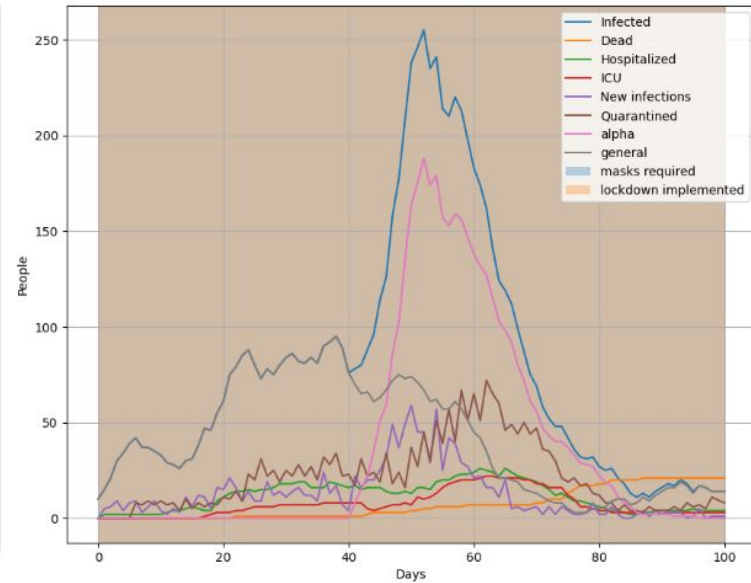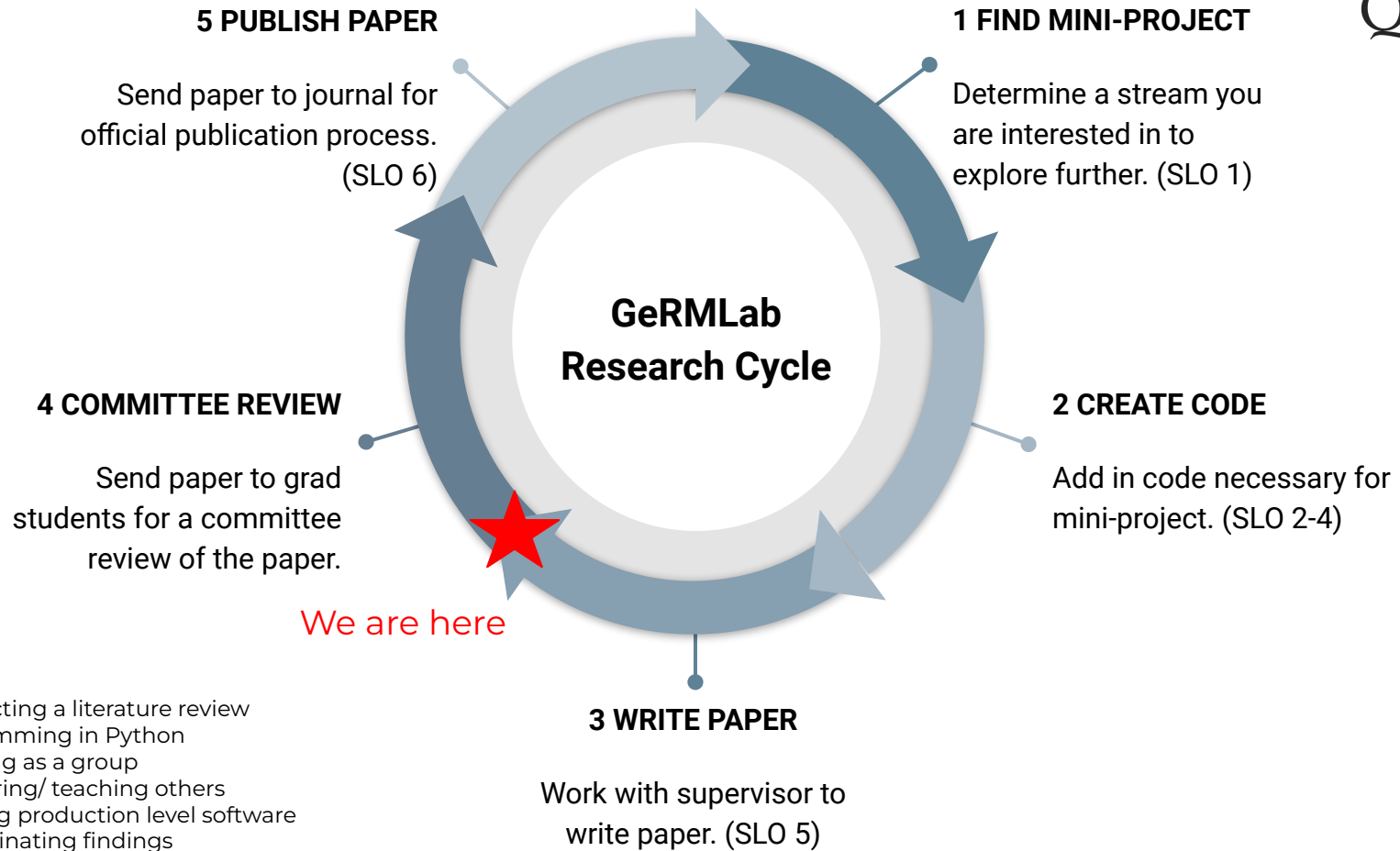*Fig 4. Sample of a simulation where the lockdown is triggered on and off.*

Fig 5. Sample of a simulation where a second variant is introduced on day 40.

Undergrad Research Cycle

5 PUBLISH PAPER

Send paper to journal for official publication process. (SLO 6)

1 FIND MINI-PROJECT

Determine a stream you are interested in to explore further. (SLO 1)

GeRMLab Research Cycle

4 COMMITTEE REVIEW

Send paper to grad students for a committee review of the paper.

We are here

2 CREATE CODE

Add in code necessary for mini-project. (SLO 2-4)

3 WRITE PAPER

Work with supervisor to write paper. (SLO 5)

SLO 1   Conducting a literature review
SLO 2   Programming in Python
SLO 3   Working as a group
SLO 4   Mentoring/ teaching others
SLO 5   Creating production level software
SLO 6   Disseminating findings

In summary

- Undergrad led project
- Allowed us to develop a lot of new skills
- Upcoming scientific papers

Thanks!

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