

JACK DINSMORE

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Education

Sept 2018–May 2022 Massachusetts Institute of Technology
GPA: 5.0/5.0
B.S. in Physics; Minors in Astronomy and Mathematics; Concentration in Music
Major advisor: Tracy Slatyer

Research Experience

5. **June 2021–present** Can asteroid density profiles be extracted from observed changes in their angular velocity, induced by tidal torques during flybys? This question is important because asteroid internal structures are rarely known, but they provide powerful insight into the evolution of the Solar System. I proposed it for a class project in the fall of 2020, and am currently following it up with more detailed research in which I derive the equations of motion for the system, build a simulation, and use it to fit density distributions to synthetic data. The class was taught by Prof. Julien de Wit (MIT), who is this project’s research supervisor. I consulted with Julien for high level advice. *20–30 hours per week.*
4. **Sept 2020–present** Could millisecond pulsars produce the Galactic Center Excess? This study is necessary because previous research on this Excess (which has been highlighted as a potential signal of dark matter annihilation) is sometimes contradictory. I analyze models for the Excess from the literature with my advisor Prof. Tracy Slatyer (MIT), helping to resolve conflicts and highlight common attributes between different models. I perform this investigation and discuss results on a weekly basis with my advisor, and am writing a paper which will soon be submitted for publication. *20–30 hours per week.*
3. **Summer 2020** Can the variability of unresolved stellar clusters be used to determine the clusters’ age? Such a tool is useful since age-dating stellar clusters is difficult without high spatial- or spectral-resolution, yet cluster ages are vital to many astrophysical studies. Under Prof. Joshua Pepper (Lehigh University), I extracted the variations of unresolved stellar clusters from TESS (Transiting Exoplanet Survey Satellite) data and compared them to data obtained from more sensitive telescopes in which the clusters are resolved. Publication is expected within a year. *40 hours per week.*
2. **Summer 2019** Can machine learning algorithms improve analysis speed of Large Hadron Collider data? The LHC processes data at record rates, and was slated for a hardware upgrade that would increase the rate beyond the capacity of its analysis algorithms. Under Prof. Phil Harris (MIT) and graduate student Jeffery Krupa, I timed standard machine learning algorithms on different hardware types, then built dozens of models to perform a specific regression required in the High Level Trigger and timed them. I also built a server to demonstrate the ability to regress on data sent from client machines [2]. *40 hours per week.*
1. **Summer 2018** What thermodynamic properties do black holes in an expanding spacetime and low temperature solids have in common? Working with Prof. Jennie Traschen (UMass Amherst), I found a peculiar

thermodynamic feature of Schwarzschild-de Sitter black holes embedded in her previous research into these black holes. She connected the feature to a quantum mechanical property of low temperature solids, which became the subject of Ref. [1]. *5 hours per week.*

Publications, Peer Reviewed

2. Jeffrey Krupa et al. GPU coprocessors as a service for deep learning inference in high energy physics. *Mach. Learn. Sci. Tech.*, 2(3):035005, 2021 (Further authors are not listed because there are 16; I am fourth.)
1. Jack Dinsmore, Patrick Draper, David Kastor, Yue Qiu, and Jennie Traschen. Schottky Anomaly of deSitter Black Holes. *Class. Quant. Grav.*, 37(5):054001, 2020

Presentations

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| Aug 2021 | • Concluding solo research presentation to PRISM, an MIT undergraduate research conference, for my research on the Galactic Center Excess. |
| Aug 2020 | • Final research presentation to conclude my REU at Lehigh University to REU faculty, students, and members of the public. |

Undergraduate Awards & Honors

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| May 2020 | • Accepted at competitive REU program at Lehigh University. See research with Prof. Pepper above. |
| March 2021 | • Best pendulum experiment in Experimental Physics (8.13) section as ranked by section leader Prof. Phil Harris (MIT). |
| Jan 2019 | • Fourth place in MIT Pokerbots competition (award shared among three other group members). For Pokerbots, competitors write a program that automatically places bets in a simulated game of Texas hold 'em. Programs written by different competitors play against each other and are ranked by amount of winnings at the end of the month. |

Teaching experience

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| Spring 2019 | • Problem set grader for Physics I (8.012) under Prof. Phil Harris. <i>4 hours per week.</i> |
| | • SAT Math section teacher for MIT ATI, a student organization that tutors local high school students on SAT prep. I designed and taught six one-hour lessons over the semester, each taught to three distinct classes of students. <i>7 hours per week.</i> |
| Fall 2018 | • SAT Math section teacher for MIT ATI. <i>7 hours per week.</i> |

Community Activities

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| Feb–Dec 2021 | • Chief copy editor for <i>The Tech</i> , MIT's student newspaper. <i>4 hours per week.</i> |
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- Jan–Mar 2020 • Build chief for Next Big Thing (Project canceled due to COVID-19). Next Big Thing was a medieval castle built temporarily in my dorm’s courtyard to attract first-years to the dorm. I advised in the design and orchestrated the construction budget. *3 hours per week.*
- Spring 2020 • Cellist for MIT Chamber Music Society (audition required). *6 hours per week.*
- Spring & Fall 2019 • Cellist for MIT Symphonic Orchestra (audition required). *6 hours per week.*
- Build assistant in Next Haunt, an escape room designed, built, and haunted by students for Halloween. *1 hour per week.*
- Fall 2018 • Cellist for MIT Symphonic Orchestra (audition required). *6 hours per week.*

Individual Projects

- 2021 • [Personal Website](https://jack-dinsmore.github.io) (HTML, Javascript). `jack-dinsmore.github.io`
- [Thorgan](#): A program to read notated music and compile it into an audio file. (Rust)
- *The Fifth Empire*: a sci-fi novel.
- 2020 • [Poetron](#): A Discord chat bot that reads users messages, finds text that conform to various poetic meters, and repeats them with line breaks to match the meter. (Python)
- [Vokdh](#): A word processor, dictionary, and translator for the spoken language *Fi Tobair* which I created. (C++)
- [My father’s professional website](https://people.umass.edu/dinsmore) (HTML). `people.umass.edu/dinsmore`
- 2019 • Astra: A space-themed, colony-building video game with a 3D engine I built. (C++)
- 2018 • Sidera: A maritime role playing video game with a 3D engine I built. (C++)
- 2017 • Azimuth: A space-themed, hyper-realistic fighter simulator with a 3D engine I built. (C++)

Programming languages known: Python, C/C++, Rust, Javascript, Java, R, Mathematica, and Bash.