Professional Evaluation and Growth Plan

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August 9, 2022

Contents

Chapter 1

Introduction

Dear Friends,

I have compiled a report on my progress as an instructor, scholar, steward, and advisor for Whittier College during the period of 2021-2022. The following is a reflection on the development of my educational and scholarly practices, and the service I have performed for the College as a mentor, advisor, and committee member. I strive to perfect my teaching abilities, and I am pleased to report that my students are learning and growing at Whittier, and achieving success in the professional world. In our last communication, after my second major PEGP report (delayed to the fifth year due to the pandemic), you asked me to reflect on my pedagogical practices. In particular, you suggested four concrete topics on which I could reflect. First, you asked me to describe my interpretation of the learning process. Second, you asked me to describe how I incorporate tools and practices in my courses. Third, you asked me to describe how the tenets of my teaching philosophy help us to achieve the learning objectives that we set for our courses. Finally, you asked me to focus on the *why* behind specific teaching decisions as opposed to the *how*. You also posed similar questions about the *learning focuses* that I have provided in the past.

With these four simple questions in mind, I have taken what I think is the most straightforward and concise approach to the structure of my teaching philosophy in Sec. xxx. I reflected on what practices I actually use most often in my teaching, and answered each of the four questions for all practices. This exercise has been useful and enlightening, as it has encouraged me to think carefully about how the central principles of *order* and *shared meaning* are reflected in the subject of physics, and the instruction of physics. It is my hope that this exercise provides you with useful insight into modern physics instruction. I have also reflected on the *learning focuses* I have provided in the past. These ideas were derived originally from my colleagues in my department, but I have since modified them and made them my own. In reflecting on how I conduct my courses, I have come to the conclusion that the learning focuses simply guide my course creation and course content selection. How I conduct my courses, and the *why* behind specific teaching decisions I make are driven primarily by the tenets of my teaching philosophy.

Turning to my scholarship, I have many new and exciting accomplishments to share with you in Sec. xxx. Three recent experiences come to mind as examples. First, I have finally published in *Physical Review D,* the flagship peer-reviewed journal in my field by the American Physical Society (APS)[1]. As far as I can tell, I am the first professor at Whittier College to achieve this. This publication was the culmination of two years of work with an undergraduate student who has become a dear friend. This result marks the first time a professor from my department has published in one of the *Physical Review* journals in the last 16 years[2]. The piece provides the first fully analytic model of Askaryan radiation. I hope to make clear why the results represent a significant contribution to my field, and how my undergraduate researcher helped me to improve and finish this work (see Sec. xxx, and also Sec. 3.3.2 of my previous PEGP).

The second experience pertains to my radio-frequency (RF) engineering and radar research with the Office of Naval Research (ONR). In 2021, I published a paper involving the computational electromagnetism (CEM) of radar design[3]. This work was ranked Top 10 Most Notable Articles in Electronics Journal for six months. The work caught the attention of CEM experts from four different countries who each contacted me for advice and collaboration. This Summer, I was invited to speak at a CEM conference held at MIT. I gave a 45 minute lecture on open-source RF CEM design alongside colleagues from MIT, Google, Georgia Tech, Stanford, and BYU. It was an incredibly meaningful moment in my career. I took the opportunity to promote the mission and values of Whittier College to our peers at

[1] J.C. Hanson and R. Hartig. "Complex analysis of Askaryan radiation: a fully analytic model in the time domain." Phys. Rev. D **105**, 123019 (2022).

[2] See, for example, S. Zorba *et al.* "Fractal-mound growth of pentacene thin films." Phys. Rev. B **74**, 245410 (2006).

[3] J. C. Hanson. "Broadband RF Phased Array Design with MEEP: Comparisons to Array Theory in Two and Three Dimensions." Electronics Journal **10**, 415 (2021).

this institutions. Having received an ONR Summer Faculty Research Program (SFRP) grant for the third year in a row, I am eligible for ONR Senior Fellowship in Summer 2024 after a mandatory one-year break. For the past two years, our ONR partners at NSWC Corona Division have granted us money and precision RF equipment to boost the engineering research experiences of our students. Based on this fruitful collaboration, I'm happy to share that they would like to form an Educational Partnership Agreement (EPA) with Whittier College. NSWC Corona forms EPAs with colleges througout Southern California in order to strengthen undergraduate engineering research, and to recruit engineering talent. Including Whittier College students in this endeavor will be wonderfully beneficial for our students' career development.

The third and final experience is related to both my scholarship and teaching. In Fall 2019, I taught INTD255, entitled "Safe Return Doubtful: History and Current Status of Modern Science in Antarctica" (CON2). In Spring 2021, I taught INTD290, entitled "A History of Science in Latin America" (CON2,CUL3). I concluded these courses with material related to the connection between modern scientific endeavors by peoples of diverse cultures and exploration literature. I showed the students how it is possible to travel to Antarctica through the United States Antarctic Program (USAP). As part of my research with the IceCube Gen2 collaboration[4], I have conducted research expeditions to Antarctica through USAP. Thus, there is a deep connection between my teaching and research through the concept of exploring the unknown. A long-time goal of mine has been to inspire my students to begin their own careers in science and in life with the same organization, mental discipline, curiosity, and confidence required of any explorer. I am thrilled to report that we are finally sending our first Poet undergraduate to Antarctica. Scout Mucher, who was my student in INTD290, was inspired to go, and we met to go over the application process in detail. Scout was hired as a contractor to help run USAP operations in McMurdo station, our flagship base on Ross Island. Scout has now PQ'd (physically qualified), and is slated to begin work there when the sun rises this Fall! I am so proud of Scout, who will become the first Whittier Poet to set foot on Antarctic shores.

For my service to Whittier College for the 2021-2022 academic year, I joined the Educational Policy Committee (EPC). I had been in discussions with Prof. Rehn about joining the Whittier Scholars Program (WSP) advisory board. Near the end of Spring 2021, I was called to first serve for a year on EPC, and I answered the call. The major task for EPC was to generate consensus around a revised course sytem proposal to be brought before the full faculty by the end of the year, in light of proposed changes to faculty load. While discussions of the course system and faculty load proposals continued, we also completed a long list of other tasks. These included studying and approving changes to ten major programs and changes to programming within the Center for Engagement with Communities (CEC), raising student per-semester credit limits, revising the definition of a credit hour, revising the new course proposal form, revising handbook language pertaining to syllabi, and to study the use of "tracks" or "emphases" within major programs at Whittier College. I led a sub-committee dedicated to the study of tracks and emphases, and our goal was to develop a common language for tracks within major programs across campus. I framed the task by comparing tracks, emphases, and options within major programs to *partitions*, as a hard drive is partitioned in a computer system. We examined data from Whittier College websites and DegreeWorks to determine the number of partitions across all major programs. We found a diverse data set that helped us formulate a survey which we sent to department chairs. As the data comes in, the plan is to use the data set and chair responses to formulate common policy surrounding how our major programs are partitioned. One example of how I helped to advance the discussion of the course system proposal was to offer a compromise between two positions regarding the maximum number of courses a new student could take. We ultimately adopted this compromise into the final proposal.

[4]See, for example, `https://icecube.wisc.edu/`.

Chapter 2

Teaching

I have reflected on my teaching
In my report submitted

2.1 Teaching Philosophy: Growth, Order, and Shared Meaning

The pandemic has tested
FPC always

2.2 Addressing Diversity, Equity, and Inclusion

Whittier College

Open Educational Resources (OER)

give three OER

2.3 Introductory Course Descriptions

The introductory
Algebra-based physics (135A/B). Algebra

2.4 Analysis of Course Evaluations: Introductory Courses

17-25 pertain to the professor.

Algebra-Based Physics

2.5 Advanced Course Descriptions

My advanced

2.6 Analysis of Course Evaluations: Advanced Courses

The course evaluations

Computer Logic

things

2.7 Liberal Arts Course Descriptions

My liberal arts

Safe Return

In 1913,

2.8 Analysis of Course Evaluations: Liberal Arts Courses

The course evaluations

2.9 College Writing Seminar Course Descriptions

In Fall 2021,

2.10 Analysis of Course Evaluations: College Writing Seminar

things

Chapter 3

Scholarship

Whittier College faculty classify scholarship using the *Boyer* model... My scholarship primarily falls within two categories: the scholarship of discovery, and the scholarship of application.

3.1 IceCube, Cosmic Rays, and Neutrinos from Deep Space

Cosmic rays are

3.2 Invitation to Become a Member Institution of IceCube

Recently,

3.3 Ultra-High Energy Neutrino Research with IceCube Gen2

In the following five

3.3.1 Computational Electromagnetism

Askaryan signals

Beyond Ray-Tracing: Open-Source Parallel FDTD Methods

I have received three *Summer Faculty Research Internship grants* from the Office of Naval Research (ONR).

Connection to Teaching and Academic Mentorship

We always attempt

3.3.2 Mathematical Physics

In 2015

Frequency-Domain Model

Missing

Time-Domain Model

There are four main advantages of analytic time-domain models

The

Connection to Teaching and Academic Mentorship

Researching mathematical physics

3.3.3 Firmware, Software, and Hardware Development

Askaryan-

The Multi-Mode Frequency Counter (MMFC) and ARIANNA

My student, John Paul Gómez-Reed and

Future Plans and Applications

To continue this

Connection to Teaching and Academic Mentorship

There are important connections

3.3.4 Open-source Antenna Design

The MEEP-based phased array design technique has generated enthusiastic feedback

Connection to Teaching and Academic Mentorship

Creating RF antennas requires

3.3.5 Drone Development and The Whittier Scholars Program

A gap exists in Askaryan-based UHE-ν science.

The Open Polar Server Data Gaps, and Drones

The Open Polar Server (OPS)

Connection to Academic Mentorship and the Whittier Scholars Program

While guiding Nicolas through the WSP program, I had a great experience working with Dr. Andrea Rehn and the WSP team. I have offered to serve on the Whittier Scholars Advisory Board, and my offer has been accepted.

3.4 Collaborations with the Office of Naval Research

During 2019-2020, it became clear that not only were missions to Antarctica postponed, but that progress in my field will only resume once the IceCube Gen2 design is finalized.

I have been awarded this ONR Summer Faculty grant

3.4.1 Computational Electromagnetism and Open-Source Radar Design

In Sec. 3.3, I described how *phased arrays* will be useful for UHE-ν physics.

First, I believe my work represents the first time it has been shown MEEP can produce RF phased array designs.

3.4.2 3D Printing of RF Antennas

This summer, my ONR colleagues and my student, Adam Wildanger, and I have begun fabricating

3.4.3 Applications to Mobile Broadband

There are a variety of applications for this research. Progress in high-gain ultra-wideband radar development is hindered because desireable parameters compete with each other. The authors

According to an economic analysis by the Los Angeles County Economic Development Corporation in 2016

3.5 Building Student Success after Whittier College

When I began to interact with the Office of Naval Research, my contacts raised the possibility of a more formal partnership with Whittier College.

To date, I have advised five physics and engineering students toward graduation (not counting my WSP student)[1] Three of them are attempting

3.6 Equipping Whittier College Laboratories

My colleagues at NSWC have already provided our laboratory in SLC with equipment

3.7 Financial Support

From Tab. ... I can receive $16.5k per summer as a Summer Faculty Research Fellow through ONR. At the next level, Senior Fellows receive $19.0k per summer. To qualify for Senior Fellow, one must have been awarded tenure as an Associate Professor at an institution accredited by the U.S. Department of Education. One also must have published one paper per year since receiving a doctoral degree. If awarded tenure in academic year 2022-23, I would meet both requirements for the 2024 application round. Regarding sabbatical, the ONR does have another program designed for professors to complete research projects while on sabbatical for 1 or 2 semesters. This funding is important for my family, and we are proud to work hard for Whittier College and our students as they help serve ONR. Regarding student financial support, I am hoping to coordinate that this year as a team effort between Whittier administrators and ONR personnel.

3.8 Conclusion

Since my last supplemental PEGP in 2019, my students and I have made wonderful progress, and I am proud of them.

1. J.C Hanson *et al.* "Observation of Classically Forbidden Electromagnetic Wave Propagation and Implications for Neutrino Detection." Journal of Cosmology and Astroparticle Physics, n. 7 p. 55 (2018). doi:10.1088/1475-7516/2018/07/055 *and* C. Glaser *et al.* "NuRadioMC: simulating the radio emission of neutrinos from interaction to detector." The European Physical Journal C, vol. 80 n. 2 p. 77 (2020). doi:10.1140/epjc/s10052-020-7612-8

2. J.C. Hanson. "Broadband RF Phased Array Design with MEEP: Comparisons to Array Theory in Two and Three Dimensions." Electronics Journal, vol. 10 n. 4 p. 415 (2021). doi:10.3390/electronics10040415

3. J.C. Hanson and R. Hartig. "Complex Analysis of Askaryan Radiation: A Fully Analytic Model in the Time-Domain." *Accepted to Physical Review D.* arXiv:2106.00804 (2021).

The papers in item (1) deal with the

Thankfully, my field has recovered from the turmoi

[1] Students: Cassady Smith, John Paul Gómez-Reed, Nicolas Clarizio, Nicolas Bakken-French (WSP), Raymond Hartig, and Adam Wildanger.

Chapter 4

Service

A key part of our

4.1 Committee Service

In 2017, my department had arranged my schedule such that I did not serve on a committee for the first year. By Fall 2018, I had developed the idea that I could serve Whittier College through data analysis. I was interested in the connection between the high school preparation of our students and their ability to pass introductory courses required for their major. On the Enrollment and Student Affairs Committee (ESAC), in Fall 2018, I learned that this is a topic with which many administrators and intructors had been struggling. I spent two years working on ESAC, and I watched as our committee carefully approached consensus while remaining respectful of the diverse perpectives that included athletics, student life, and instructors. In the second year, we began discussions with Falone Serna, Vice President of Enrollment Management, to implement the policy result of the prior year. On ESAC, I also learned about first year orientation, for which I volunteered in 2019 and 2020.

In 2020-21, having served two years on ESAC, we decided it would be good for me to experience service with other types of committees.

4.1.1 Educational Policy Committee

My sub-project, the survey. Framing the issue of the course system, understanding it. Mathematical analyses of the proposals: (a) financial implications (b) pedagogical implications (c) curricular implications (d) the compromise i offered that was accepted regarding maximum course loads

4.1.2 The Whittier Scholars Program

Another year, another advisee, acceptance to join the WSP board

4.1.3 Future Proposals for Institutional Research

Full utilization of the Tableau dashboards left by Gary Wisenand, growth of the ICS/Math major etc.

4.2 First Year Orientation

In the Fall of 2018, I was invited by Prof. Seamus Lagan to help with the first-year orientation.

The second mentoring experience in 2020 occurred during the height

4.3 Open Educational Resources (OER) Workshops

I was invited to give two lectures at OER workshops

The OpenStax Tutor system

In my OER lectures, I also gave examples of OER usage in advanced courses.

4.4 Center for Engagement with Communities: The Artemis Program

In Sec. ..., I wrote about my experiences serving the Artemis program. To avoid covering the same ground twice, I give just a simple summary of the facts here.

Chapter 5

Advising and Mentoring

I reflect on my role as an advisor and mentor at Whittier College below.

5.1 Connections to Teaching, Advising First-Year Students

Advising and mentoring students resembles our teaching practice, because we must create a sense of *order and shared meaning* in the mind of the student surrounding the curriculum.

Physics professors often classifiy students into two broad categories: *non-majors* and *majors* (see Sec. 2.1). Most of our advisees as teachers fall into the first category.

Advising non-majors follows a basic progression: introducing them to the curriculum and campus (*order*), beginning a conversation surrounding major selection (*shared meaning*), and future course selection.

5.2 Advising and Mentoring First Year Students

A

5.2.1 First Year Advising, by the Numbers

B

5.2.2 Navigating the First Year

C

5.2.3 Discernment of Major

D

5.2.4 Equity of Access

E

5.2.5 Inclusion and Belonging: Activities with First Year Advisees

5.3 Advising and Mentoring Majors in Physics, ICS, and 3-2 Engineering

After reflecting on my advising practices with my STEM students, I realized that there is an implicit decision-tree that lives in my mind (see Fig. 5.1).

Semester	**Number of First Year Advisees**
Fall 2019	15
Fall 2020	14
All semesters	**Physics, ICS, and 3-2 Majors**
	Cassady Smith (Physics '20)
	John Paul Gómez-Reed (Math/ICS '21)
	Nicolas Clarizio (Physics, Business Admin. '19)
	Alex Ortiz-Valenzuela (3-2 Engineering/Physics '22)
	Raymond Hartig (Physics and Math '23)
	Adam Wildanger (3-2 Engineering/Physics '21)
	Matthew Buchanan Garza (ICS/Physics '23)
	Natasha Waldorf (ICS/Physics '24)
All semesters	**Whittier Scholars Program Majors**
	Nicolas Bakken-French (WSP '21)

Table 5.1: A summary of my advisees, broken into three categories: first-year advisees, STEM majors, and WSP majors. There are some first year advisees who have chosen ICS/Math for their major, for whom I remain a mentor. One example is Emily List (ICS/Math '23).

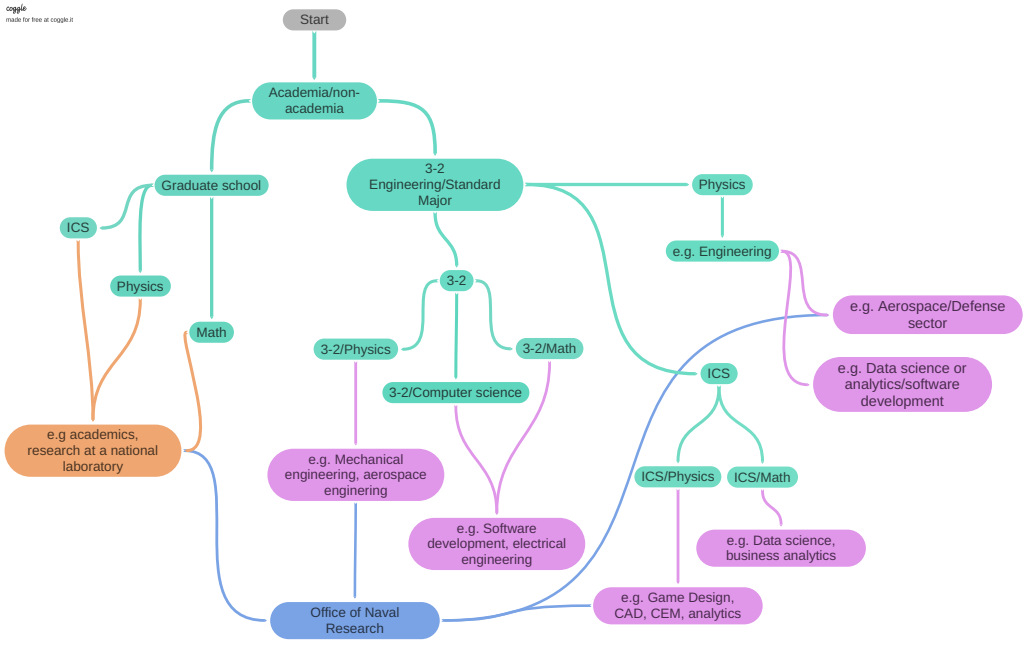

Figure 5.1: A decision-tree that orders my thinking around the advising of my STEM students.

5.3.1 Discernment within STEM: Major Selection, and Diverse Pathways to Graduation

Discernment means the ability

5.4 Advising and Mentoring Whittier Scholars Program Majors

I have had a wonderful time recruiting students for the Whittier Scholars Program. There are two moments that stand out for me. The first happened when I accompanied Nicolas Bakken-French to his final meeting with Profs. Rehn and Kjellberg,

Now mention Jackson Diamond, and the connection between WSP and computer science

Chapter 6

Conclusion

This semester marks the beginning of my sixth year with Whittier College. These years have been filled with both wonderfully uplifting experiences, but also sacrifice. I hope that my writing

Respectfully submitted, Jordan C. Hanson

Chapter 7

Appendix: Supporting Materials

A simple listing of supporting materials referenced throughout the report is given below.

1. **Previous Letter from Faculty Personnel Committee**
2. **Letter from Department of Physics and Astronomy**
3. **Curriculum Vitae**
4. **Course syllabi**
   (a) PHYS135A: Algebra-based physics 1
   (b) PHYS135B: Algebra-based physics 2
   (c) PHYS150: Calculus-based physics 1
   (d) PHYS180: Calculus-based physics 2
   (e) PHYS306/COSC330: Computer Logic and Digital Circuit Design
   (f) PHYS330: Electromagnetic Theory
   (g) COSC360: Digital Signal Processing (DSP)
   (h) INTD100: College Writing Seminar
   (i) INTD255: Safe Return Doubtful: History and Current Status of Modern Science in Antarctica
   (j) INTD290: A History of Science in Latin America
   (k) MATH080: Elementary Statistics
5. **Course Evaluations** (each corresponds to courses listed above)
6. **Published Papers**, lead author
   (a) "Observation of classically 'forbidden' electromagnetic wave propagation and implications for neutrino detection." JCAP (2018).
   (b) "Broadband RF Phased Array Design with MEEP: Comparisons to Array Theory in Two and Three Dimensions" Electronics Journal (2021). Results from this paper also published in the Proceedings of the International Cosmic Ray Conference (ICRC) 2021.
   (c) Two notices from Electronics Journal indicating the above paper was in the Top 10 Most Notable articles in the journal in 2020-21.
   (d) "Complex Analysis of Askaryan Radiation: A Fully Analytic Model in the Time-Domain" (Phys. Rev. D) 2021.
7. **Other Papers**, contributed but not the lead
   (a) "A search for cosmogenic neutrinos with the ARIANNA test bed using 4.5 years of data." JCAP (2020).
   (b) "NuRadioMC: simulating the radio emission of neutrinos from interaction to detector." European Physical Journal C (2020)
   (c) "Probing the angular and polarization reconstruction of the ARIANNA detector at the South Pole." JINST (2020).

8. **Letters of Recommendation** (Advising and Mentoring)
   (a) Cassady Smith (2017)
   (b) Nicolas Haarlammert (2017)
   (c) John Paul Gómez-Reed (2018)
   (d) Nicolas Clarizio (2020)
   (e) Eliott Bergerson (2020)
   (f) Razmig Bartassian (2020) (2 letters)
   (g) Raymond Hartig (2020)
   (h) Taylor Watanabe (2020)
   (i) Raymond Hartig (2021)
   (j) Danny Diaz (2021)
   (k) Adam Wildanger (2021)
9. **Examples of Student-designed Final Projects**
   (a) Taylor Watanabe (MATH080), presentation
   (b) Teani White (PHYS135B), presentation
   (c) Emmie Fernandez (MATH080), presentation
   (d) Natasha Waldorf (INTD100), writing project
   (e) Scout Mucher (INTD290), infographic
   (f) Elmer van Butselaar (PHYS135A), paper
   (g) Andrew Householder, digital storytelling project
10. **Letters from Students and Colleagues**
   (a) Chistopher Clark, PhD (Office of Naval Research)
   (b) Taylor Watanabe, student from PHYS135A/B and MATH080
   (c) Raymond Hartig, student from PHYS150/PHYS180, PHYS306, INTD290, physics advisee
   (d) Nicolas Bakken-French, Whittier Scholars Program advisee
   (e) Email correspondence from Profs. Gragnani and Fedeli of Universtà de Genova regarding potential radar design collaboration
11. **ESAC Admissions Data Presentations**
   (a) Results presented November 15th, 2018
   (b) Results presented December 6th, 2018
12. **Grant Proposals and Evidence of ONR SFRP Grants**
   (a) Cottrell Scholars Grant Proposal
   (b) SFRP, Summer 2020
   (c) SFRP, Summer 2021
13. **Open Educational Resources (OER) Workshop Lectures**
   (a) Workshop January 28th, 2020
   (b) Workshop July 28th, 2020
   (c) Workshop March 2nd, 2021
14. **Course Materials Referenced in Teaching Section**
   (a) Error analysis in PHYS180, group lab activity
   (b) Paper about the contributions of Mexican astronomers in the late 18th Century, reading assignment for INTD290 (A History of Science in Latin America)

(c) Unit on nerve function, PHYS135B, lecture notes and activities

(d) Number systems of the Maya and Inca, asynchronous activities for INTD290 (A History of Science in Latin America)

(e) Spring Force Lab, lab activity for PHYS135A and PHYS150

(f) Example of an article bonus (see Teaching Section)

(g) Information on Artemis Program (see Service Section)

15. **Research Related Materials**

(a) ***Whittier Scholars Program Thesis, Nicolas Bakken-French***

(b) LA County Aerospace Cluster information sheet (See Research Section)

(c) "The Changing Face of Aerospace in Southern California," report referenced in Research Section

(d) Study regarding physics students by the American Institute of Physics (AIP) (see Equity and Inclusion Section)

(e) IceCube Collaboration List of Institutions (See Research Section)