

DEPARTMENT OF PHYSICS

STRATEGIC PLAN 2018–19



Physics

UNIVERSITY OF COLORADO **BOULDER**

The Department of Physics asked its Strategic Planning Committee (SPC) to create a strategic plan to define and get broad agreement on the shared aspirations of the department and the initial actions needed to move in that direction.

This document represents the final work of the SPC. This plan is a “living” document to be implemented and revised as needed. To ensure progress on the actions identified, the SPC recommends the following implementation plan:

- Three faculty members from the Executive Committee become responsible for moving this work forward—the Strategy Implementation Group (SIG)
- Each of those three SIG members becomes responsible for one of the strategic imperatives
- SIG members enlist other department staff, students, faculty and/or external constituents to support actions where needed to make progress on their assigned imperatives
- SIG members engage with other department committees to ensure alignment of work
- The SIG maintains the attached traceability matrix to ensure progress and accountability
- The SIG members report progress on their imperative to the department once every semester
- The SIG is also responsible for developing amendments to the plan and bringing those amendments to the department for approval

DEPARTMENT OF PHYSICS STRATEGIC PLAN

VISION

The Department of Physics at the University of Colorado Boulder is an international leader in advancing the science of energy and matter at all scales. We are dedicated to teaching, learning and pivotal intellectual discovery. We are a welcoming, diverse and collaborative community devoted to positive societal impact and developing the future leaders in our field.

STRATEGIC IMPERATIVES

Strategic Imperative 1: Culture & Climate

Create a collegial, mutually supportive and inclusive culture—respecting differences—underlying the common goal of excellence of all the work we do across all members of the department.

Strategic Imperative 2: Research Excellence

Strive to become the top public university physics graduate program as defined by a broad range of metrics of scholarly excellence, national and international recognition, and research leadership in key areas of physics.

Strategic Imperative 3: Teaching Excellence

Support the development of future leaders in physics, or other chosen career paths of our students, through the continued development of excellence in undergraduate education.

STRATEGIC IMPERATIVE 1: CULTURE & CLIMATE

Metrics

- The physics department will strive to be a cohesive and inclusive scientific community. This is reflected in the mutual comprehension of work done across the department. Another reflection of the department as a scientific community is participation in departmental events designed to foster scientific interactions and the use of community space. The department will continue to engage across campus and beyond, as measured by interactions among departments, with national labs and with other relevant entities.
- All members of the department (students, staff and faculty) should feel that the department supports them in their work, should feel valued, should feel the department creates a collegial environment, and should feel the department fosters a sense of shared enterprise.
- A key goal of the department is to be a recognized leader in recruiting and retaining diverse faculty, students and staff that leads the AAU public physics departments in key measures of excellence. The department is committed to having a faculty, staff and student body that serves the state and supports its changing demographics. Relevant metrics include the percentage of faculty and students belonging to underrepresented groups, and new hires of faculty and staff belonging to underrepresented groups.

Key steps

- Build common language, inclusion and mutual understanding of what we do by fostering a sense of scientific community within the department. Take steps to increase engagement of department members with those working in other areas of physics, including developing and designating community space and events to encourage regular interactions.
- Support and recognize the diversity of the discipline of physics, continue to engage across campus with neighboring disciplines and support a positive societal impact.
- Follow established professional and ethical standards of the university and our professional societies, and seek external guidance to improve climate and culture.
- Take active, continuing and regularly assessed steps to refine goals and approaches for recruiting and retaining faculty and students from diverse backgrounds.
- Conduct a landscape analysis through survey or external climate visit to ascertain areas of strength and concern regarding climate and culture.

Resources needed

- The department's physical plant does not effectively support engagement among department members working in different areas of physics. Moreover, dedicated community and interactive space is largely lacking and will need to be identified and renovated. In the immediate future, existing space in Duane complex shall be systematically renovated and augmented by new space in the new Duane H-wing to support increased engagement across the department and enable the department to meet its core mission.
- A critical resource for increased engagement is faculty time. The department will identify common practices that result in inefficient or inequitable allocation of faculty time and take steps to remedy these problems, which will also benefit the core research, teaching and service missions of the department.

STRATEGIC IMPERATIVE 2: RESEARCH

Metrics

Graduate students

- Increase the acceptance rate of outstanding students to join our department.
- Simultaneously enhance excellence and diversity of our student body.
- Increase fraction of our graduate students and postdocs who take on careers as tenure-track faculty, national laboratory scientific staff or in leadership positions in industry.
- Broaden the participation of faculty in our department in mentoring/advising graduate students.

Research productivity and mutual support

- Increase research products and enhance impact measured by a combination of conventional scholarly metrics (impact factors, publication activity overall and per graduate student, citations, awards) and newer nontraditional metrics (e.g., Altmetrics).
- Increase extramural research funding per faculty and per student.
- Lead scientific programs and engage strategically in national initiatives with impact.
- Strive to mutually support all research participants through understanding of each other's scholarly work, nominate outstanding colleagues for awards, and engage in science advocacy to the state, the nation and the general public.

Set overarching physics themes and goals

- Develop and invest in overarching physics themes that may bridge traditional boundaries.
- Catalyze new areas with impact and vision to balance our research portfolio.

Key steps

Attract and recruit the best graduate students in the U.S. and internationally

- Provide broad scientific education to a diverse student body focused on research excellence and career development.
- Explore expansion of our Applied Physics Certificate into its own PhD degree option.

Leverage the large size of the department

- Build strength in a few key areas with scholarly impact that are representative of the breadth of physics.
- Grow organically into new frontier areas with impact, leveraging our current strengths.
- Cultivate relationships with major private foundations (Kavli, Moore, Simons, Gates, etc.) to provide support for new research directions, innovations and institutes.
- Support high-impact research leadership (e.g., research centers, institutes, industry partnerships).
- Further leverage and interconnect with campus institutes and national laboratories (e.g., NIST, NOAA, NCAR, NREL, LASP), to support the broad goals of the department and the success of the faculty as a whole.
- Explore possible institute/research unit structure within the department, potentially with an associate chair for research, to improve infrastructure to enhance research support.

Improve faculty hiring process

- Advocate for autonomy and flexibility in hiring.
- Balance institute and initiative hires for program building against broad searches for exceptional talent with leadership potential in their field.
- Develop a search committee culture with impartial chairs and scientific leaders.

STRATEGIC IMPERATIVE 2: RESEARCH *continued*

Resources needed

- Provide competitive graduate student fellowships to attract the best talent.
- Explore a re-envisioned TA program that enables teaching experience while enabling significant research immersion.
- Improve teaching, communication and research space based on a comprehensive new H-wing expansion and existing Gamow/Duane complex renovation plan.
- Engage, improve and develop competitive shared research and support facilities in the department and across campus (machine shop, clean room, analytics, nano-fabrication, etc.).
- Seek a new college structure with the Natural Sciences Division and more departmental representation at the graduate school level.
- Increase staff support from the college for department fundraising with donors, private foundations and from industry.
- Explore avenues to improve our infrastructure for research support, and to support award nominations and other externally focused activities to raise the profile of our faculty.

STRATEGIC IMPERATIVE 3: TEACHING

Metrics

- CU graduates are admitted to top U.S. research and graduate programs of their choice.
- CU graduates secure faculty positions in top research universities or staff positions at national labs.
- CU physics students with undergraduate degrees compete successfully in the job market with their up-to-date technical/computational skills. Develop new courses to meet the needs of our students' diverse career pathways.
- CU physics programs provide excellence in training of the diverse population of Colorado.

Key steps

- Establish/improve long-term tracking of our graduates (grads/undergrads).
- Introduce studio-style classes
 - Establish space for a transformed PHYS 1115 in which lecture/tutorial is replaced with a flipped studio-style class for our majors. Transform PHYS 1125 in a similar manner.
 - Capture additional studio classes in the renovated Carlson building or other available spaces and expand the studio to sections of PHYS 1110.
 - Offer a transformed PHYS 2010 as studio-style alternative to traditional lecture. Design and pursue the establishment of a state-of-the-art studio class infrastructure in the H-wing.
 - Choose an existing assessment, or develop our own, to measure the effectiveness of studio physics on problem-solving ability.
- Increase the number of students in thesis-writing degree programs. The number of physics undergrads (PHYS & EPHYS) ~ 65/y. The number of honors students is ~16 (average of past five years), ~ 25%, or 50% of the 32 eligible students with GPA > 3.3). The goal is to increase this number to ~ 24, or 75% of eligible students. We have about 56 faculty + NIST PREP, but only a small number are interested/available to support undergrad research projects. The department should establish scholarships for the students/professors to engage in honors projects.

STRATEGIC IMPERATIVE 3: TEACHING *continued*

- Increase the number of physics majors who are planning careers in pre-college teaching (Plan 3).
Recruiting, preparing and supporting physics majors in careers in pre-college teaching is a leading educational priority for the American Physical Society through its Physics Teacher Education Coalition (PhysTEC). Last year we were part of the APS / PhysTEC 5+ club (preparing five or more physics majors to be teachers). The department will strive to always be in the APS 5+ club. We will reinstate the Teachers of Physics in Training (TOPIT) club, reinstate the PhysTEC teacher advisory group and increase recruitment efforts into Plan 3.
- Broaden our support for the departmental LA program and include LAs in all of the 2000 sequence with appropriately increased funds to support this effort.
- Establish a 1-credit seminar about career paths in physics, engaging at least local industry and government labs to discuss their immediate workforce needs as a nonacademic or research option.
- Actively engage in the recruitment of students in Colorado from underrepresented populations to the undergraduate physics program such that both the enrollment and graduation rates of these students are significantly increased in the next five years. This will require an increased involvement monitoring the progress of all our students through our program, and an active, timely engagement in identifying academic/social challenges and offering solutions. This support must include significant student financial aid from the university in return for strong departmental efforts to ensure high graduation rates. The studio-style physics courses will be designed to create a supportive cultural environment. The creation of a welcoming and safe environment for ALL of our students will be a top priority of the physics department.

Resources needed

- Large classrooms (100 students) fitted with circular tables (6–9 people), with computers, projectors and audio technology for studio physics as well as a support staff person.
- Physics professor/department officer to oversee expansion of honors program (not necessarily the honors instructor), which may include the securing of funds.
- Physics professor/department officer to oversee recruitment and retention programs.
- Inviting and congenial study and meeting spaces for students, designed with input from R3 and students, presumably in a new physics building.
- Provide department support for faculty to develop new curricula and teaching techniques.
- Provide support to expand the Learning Assistant program to all our large introductory classes, where it is deemed helpful.

STRATEGIC PLAN ACTION TRACKING

When	Key Actions to Support Imperatives	Strategic Imperative			Owner	Resources Needed	Obstacles to Success	Metric	Progress
		1	2	3					
Imperative One: Culture & Climate									
Now	Establish recurring events/social interactions to foster sense of our scientific community within and outside of the department	X	X	X	M1	Update 11th FI commons and reading room	Funds	Y/N	Yellow
Soon	Create community space to foster interaction	X	X	X	M1	Update 11th FI commons and reading room. Increase administrative support to free up more faculty time.	Funds and lack of support staff positions	Y/N	Yellow
Now	Survey the faculty to identify common practices resulting in inefficient or inequitable allocation of faculty time	X	X	X	M1				Yellow
Soon	Enlist expert to conduct a comprehensive survey of our climate and culture	X	X	X	M1	Identify options	Funds	Y/N	Yellow
Soon	Recruit and retain a diverse faculty and student population	X	X	X	M1				Yellow
Now	Socialize professional rights and duties of faculty members	X			M1	Engage the Academic Affairs Office	None		Yellow
Imperative Two: Research Excellence									
Now	Attract and recruit the best graduate students		X		M2	Scholarship funds	Funds / Recognition	#	Yellow
Now	Provide broad scientific education focused on research excellence and career development		X	X	M2				Yellow
Soon	Provide an applied physics degree option		X	X	M2				Yellow
Now	Enhance collaboration with campus institutes and national laboratories	X	X	X	M2	Leadership			Yellow
Soon	Improve infrastructure to enhance research support		X	X	M2		Funds		Yellow
Soon	Advocate for autonomy and flexibility in hiring		X	X	M2	Available faculty lines	Dean & provost agreement	#	Yellow
Now	Balance institute and initiative hires with department hires		X	X	M2				Yellow
Now	Develop a search committee culture where members represent a perspective broader than their own		X		M2				Yellow
Now	Allow searches to fail and restart until best talent is found		X		M2				Yellow
Imperative Three: Teaching Excellence									
Now	Incrementally introduce undergraduate studio style classes			X	M3	Classrooms	Space and development funds		Yellow
Now	Increase the number of students participating in the thesis writing degree programs		X	X	M3	Faculty engagement	Scholarship funds	#	Yellow
Soon	Increase the number of students planning careers in pre-college teaching	X		X	M3	Faculty engagement	Scholarship funds	#	Yellow
Now	Broaden support for the department's learning assistance program			X	M3	Securing funds and leadership	Funds		Yellow
Soon	Establish a career path seminar for all undergraduates			X	M3			Y/N	Yellow
Soon	Enhance recruitment and graduation rates for underrepresented populations in Colorado	X		X	M3	Faculty engagement		#	Yellow