Action Plan for the Department of Physics, following the Undergraduate Program Review in March 2014.

We thank the review team very much for their work and we are delighted with such a very positive outcome. We agree completely with all recommendations, and will incorporate them all.

The faculty members of the Department of Physics have discussed the report by the committee. And our actions are listed below, together with the committee recommendations. Since the initial discussions, a new chair, Heidi Schellman, has joined the Department from Northwestern University, which has delayed a formal response, but not implementation of some of the recommendations.

1. The Department is commended for the able leadership it has enjoyed, both administrative and programmatic. In particular, the leading-from-the-middle collaborative outlook of the Department is worth emulating in all academic Departments.

We recommend that the choice of and charge to the new Department Head be done in a way that recognizes the significant intellectual capital that is resident in the Department. Special care needs to be taken to ensure that the Department ethos of collaboration is not compromised.

Our new Department Head, Prof. Heidi Schellman, started January 1, 2015. She is aware of the collaborative nature of the Department, but collaboration requires consultation and that means a longer process in implementing any changes that may need to be taken. The Department has weekly curriculum meetings, which rotate between lower division, upper division and graduate level teaching discussions. The Chair tries to attend all of these meetings and participate in the discussion.

Recommendation	Action	Outcome	Responsibility	Time scale	Resources
Don't screw up	Not screwing up	Dept. remains collaborative	Dept. Head	ongoing	Time

2. The Department is commended for its Paradigms in Physics national curricular effort. Faculty leaders have worked tirelessly over seventeen years to refine and disseminate this effort. Neither the University nor the Department should do harm to Paradigms. Any institutional or Departmental undergraduate initiative should build on Paradigms, not dilute it. In particular, any significant increase in the number of majors should be accompanied by a commensurate allocation of new human and facilities resources to the Department.

This recommendation is directly related to the OSU strategic plan, goal one. Our Paradigms program is a national example of high-impact learning. The highly interactive environment allows us to equalize retention and success of all learners.

The University has made a very positive step with the hire of Dr. Elizabeth Gire, an experienced PER researcher who did a postdoc at OSU researching the Paradigms. Prof. Gire is a Provost initiative hire and will be joining the Department in Fall 2015. She brings outstanding teaching skills as well as the ability to lead our younger faculty in further adoption of research based learning.

The number of majors we currently have in our junior year classes is at the point that quality starts to decrease when we add students. We generally have enrollments in the Paradigm's courses of 26-30 students. Adding additional seats in existing sections will have a significant negative effect on the highly interactive nature of Paradigms instruction. Currently, we are at the optimum balance between number of students and quality of education. It is clear that increasing the number of our majors in a significant manner while maintaining the high quality of our undergraduate program requires significant additional resources as we already are short on faculty to maintain our strong introductory course sequences, the rigorous major and an acceptable graduate program. The number of undergraduate majors at OSU is in fact quite high relative to other institutions and exceptionally high for institutions with fewer than 20 Physics faculty. Any increase in major numbers will either require more faculty members or be in direct conflict with the later recommendation to have tenure-line faculty teach in introductory courses.

Recommendation	Action	Outcome	Responsibility	Time scale	Resources
Keep Paradigms strong	Growth in major if resources available	Greater access to physics degrees	Physics, COS, OSU	1-5 years	Faculty lines if expansion is done

3. The Department is commended for being one of the few physics Departments in the nation that requires a significant undergraduate project for graduation. This requirement provides significant benefits to the students.

We recommend that the Department explore new ways to satisfy this requirement, including shifting the advising onus to REU programs elsewhere, and provide more opportunities for students to satisfy this requirement through internships with industry.

We have identified two ways in which we can diversify the research experience of our undergraduate students.

1) We are exploring adding a senior laboratory module which can be used for students to perform their research. Highly motivated students typically find a research group early on, but there are always some students who delay. By using a senior laboratory module we will be able to give these students the required research experience and also the material needed to write their thesis. This would be a 1-2 quarter course with a well-defined research project and dedicated equipment. To make this a reality, we will need to find space and an instructor able to commit significant time to supervising a group of 8-10 students in an exploratory research project. Our goal is to have this program defined in 2016 and operational in AY2017.

2) The Department will be working on sending more students to NSF sponsored summer REU programs. These are summer programs where students do research in national laboratories and/or other universities. Students are paid a stipend and travel costs so these are a wonderful opportunity. We are actively working to form partnerships with the remote REU advisors to ensure a smooth transition to

and from the REU program, with a local adviser capable of helping the student write up their research project as a thesis. Our goal is to have at least 50% of our students performing research over their 3rd summer, either on campus through programs like URISC and SURE or through these competitive national programs. The head Advisor and WIC instructor already work together to match students with research opportunities before the end of their Junior year to ensure that students do not fall through the cracks. The advent this year of a 199 course for majors as part of the First Year experience, where the requirements for the Major and these opportunities are discussed should reduce the need for late intervention.

Summary: Students should be able to satisfy the research requirement in 3 ways:

1) Ideally, through a continuing relationship with an OSU professor, preferably starting in the sophomore or early junior year. This is the current default. Additional funds for SURE/URISC will help more students use their summer time to work on their projects.
2) Through an external research experience, with local support from the advisor, WIC instructor and a faculty mentor in collaboration with the external researcher. The head advisor and WIC instructor need to encourage students to apply for these programs in time to be accepted.
3) Through a dedicated research course to be developed. This should be limited to 6-8 students to ensure that they receive proper attention. Implementation of option 3 depends on finding sufficient teaching resources.

Recommendation	Actions	Outcome	Responsibility	Time scale	Resources
Increase research opportunities for majors	Earlier direction of students towards internal and external research opportunities.	More effective research projects.	Advisor, Junior year course instructors, students	ongoing	
	Dedicated class	Backup plan for students who fall through the cracks.	Dept./COS need to find resources	1-3 years.	Instructor for course, space for projects

4. We recommend that tenured and tenure-line faculty teach more lower division and service courses and appropriately mentored instructors teach in the upper division curriculum. We think this could cross fertilize the lower division instruction with lessons learned from the Paradigm approach. This improved instruction would potentially attract more majors, especially among women and underrepresented minority students.

In the last few years several of our tenure-line faculty members have been involved in lower division instruction. Prof. Dedra Demaree initiated all recent reform in our lower division courses. Prof. Henri Jansen has played an active role in teaching these courses. Prof. Davide Lazzati is teaching introductory astronomy. Prof. Emily van Zee has developed our teacher preparation course. Prof. Henri Jansen is now teaching almost exclusively in the new studio based calculus based sequence offered for engineers. In earlier years several other tenure-line faculty members have also been instructors in these courses.

It is important to realize that being instructor of record for the large introductory physics courses involves a significant administrative commitment. As a department we need to balance the efforts spent on all aspects of the work of all faculty members. Assigning research active faculty members large administrative tasks is not the best use of resources from a departmental point of view. Instructors who have no research programs are much better suited for these tasks. This is, of course, exactly why nation-wide all departments moved into the direction of appointing more instructors and in treating them well as invaluable colleagues.

This recommendation, however, is asking for more than being the instructor of record. The purpose is to make sure that instructional ideas are shared between lower and upper division courses. The same theme is expressed in recommendations two and five. Therefore, we consider alternative means to improve sharing of ideas.

We have started lower division reform introducing a studio model based on the SCALE-UP ideas. Our studio sections have important aspects in common with our instruction in the Paradigm program. Both rely on small group activities. We have been running the studio format – which to some extent reproduces what we do in Paradigms, for a year now. It appears to be quite successful. Withdrawal and failure rates have dropped and students rate the courses higher in the SET's. There is a significant time commitment involved, though. Any new instructor doing this for the first time will need significant release time while preparing and offering their first course. As such release time is limited, we can only proceed with, perhaps, one instructor/year making the full transition. We are exploring the possibility of having a much broader group of faculty guide the studio sections, which incorporate the new learning methods, without the huge administrative burden of being the lead instructor.

A second benefit from having all faculty members actively participating in some aspects of the lower division is that the tenure-line faculty members become more familiar with the study habits of current students. This will be of great help to retain upper division students in our major and our graduate students who might be thinking of leaving, because they do not encounter an atmosphere that they expected. This is particularly true for minority students.

In response to this review we have already begun a move of instructors into the upper division courses. One of our lecturers, KC Walsh, just began teaching the upper division Modern Physics course using group participation techniques used in Paradigms and the studio courses.

We also already have strong communication between the different levels. In our department we have adapted the use of teaching trios. In Winter term we organize ourselves in groups of three, typically involving lower division, upper division, and graduate instructors. We visit each other's class room as a team and discuss our observations afterwards. This exposes everyone to instruction at all levels.

Summary – We have already started a movement of lecturers into some upper division courses. We meet both weekly and through teaching trios to share experiences. Going forward, the only real possibility of integrating tenure-line faculty further into introductory courses without severely reducing the teaching resources available at the upper division is through the studio sections.

Recommendation	Actions	Outcome	Responsibility	Time scale	Resources
Increase cross-fertilization between lower	Have tenure-line faculty teach lower	Tenure line faculty more aware of intro	Faculty, head, COS	1-5 years	Backfill for paradigms, course relief

and upper division courses	division	courses.			for development
	Have instructors teach some upper division courses.	Instructors more aware of goals for major.	Faculty, head, COS	Ongoing.	Course relief for development. Professional development conferences.
	Teaching trios and weekly meetings	Feedback between different courses	Faculty	Ongoing	Already in place

5. We commend the Department for its current support of teacher education. We recommend that the Department and the College of Education develop stronger collaboration in the area of teacher preparation and professional development.

Currently our involvement in teacher preparation is direct because we offer PH111 (Prof. Emily van Zee) as part of the coursework for K-8 teachers. Prof. Emily van Zee is a member of the College of Education, and has coordinated our teacher preparation efforts. In the past Prof. Emily van Zee and Prof. Henri Jansen delivered the physics part of a middle school science teacher preparation program in Redmond Oregon.

Teacher preparation as a program clearly belongs in the College of Education. We have looked at the effectiveness of PH111 as a course, but there is also a need for studying the program as a whole. This is a topic of interest for Prof. Henri Jansen, after he steps down as chair. The driver for this research will have to come out of the College of Education, though. Prof. Henri Jansen will be at the right place to strengthen the interactions with the College of Education.

Another indirect way for the department to increase collaborations in teacher education is via the STEM center at OSU. The new STEM center director is working on several initiatives that include K-12 components, and our department has possible roles in these. These efforts go beyond teacher preparation, though, and connect directly to our reforms in the lower division courses. In order to improve the lower division courses we need to understand connections with both the upper division programs and with high school programs. The lower division experience is not an isolated event! The WIDER initiative on campus, of which we are a part, will be extremely helpful in addressing such issues.

Recommendation	Actions	Outcome	Responsibility	Time scale	Resources
Collaborate with College of Education on teacher training	Work with STEM center and School of Education.	Continued support for teacher education in Physics	Emily van Zee, Henri Jansen, School of Education	ongoing	---

6. We recommend that the Department develop stronger connections to its alumni by tracking them better.

This is very important, and needs a two part approach. Tracking is the first task in creating relationships, but, more importantly, there is also the nature of these relationships and how to use the information obtained by the tracking.

Tracking at the department level is very inefficient, and should be done at the college level. It is the same amount of work to keep an alumni data base up-to-date for one department as for seven. We have a list of all our alumni, but currently we must ask the alumni association for current addresses. The use of the lists we received is very constrained, however. We need to be able to control the use of such lists so we can decide what to send, not the alumni association. The College of Engineering is a good model, they keep track of students for ABET. Discussions on this topic have now started in the College of Science.

Summary: We would greatly appreciate a concerted College of Science effort to help all COS departments track and contact our alumni.

If we had easy access to alumni data, It would be a great follow-up on our exit interviews if we can survey alumni ten years later and ask what contributed to their success.

At the departmental level we use informal tracking through Facebook and LinkedIn. We send out a yearly newsletter in which we ask former students to sign up for these on-line platforms. The new Chair has appointed a faculty member to be the outreach coordinator for the department and to improve our external communications including alumni.

Recommendation	Actions	Outcome	Responsibility	Time scale	Resources
Maintain better contact with Alumni	Get better access to Alumni database	Improved communication with Alumni	Department, COS, Foundation	ongoing	COS coordinator to avoid duplication of effort.
	Improve Department communications	Better web presence, more participation by alumni in dept. activities	New outreach coordinator in the department	2016	Help with drupal upgrade.

7. We recommend that the Department strengthen the preparation for Teaching Assistants by making it ongoing and instituting Departmental guidelines and expectations that will make it less instructor dependent. We applaud the Department for considering implementing the Colorado Learning Assistant model.

Our Teaching Assistant preparation for graduate students is already ongoing. We offer a TA training seminar every fall term for incoming graduate students, in which we discuss many details related to the work that needs to be done. We have a teaching seminar in winter and spring for students with more interest in education research topics. As part of that process, and in response to that recommendation, we have discussed with the TA's themselves what preparation they feel they needed to start. We are now working with the TA's on a preparation module for Fall 2015 that incorporates their experience.

We plan to deliver that module in the 2-3 days available between the 5 days of graduate school orientation and the start of classes.

The preparation of undergraduate TAs and LAs is not done centrally in the department, though, but is handled by the instructors. Fortunately, we are part of the WIDER collaboration on campus. As part of this collaboration we will be able to use a common preparation for all undergraduates involved in the educational mission. On campus, in the biology arm of WIDER, undergraduate training is in place every term, because the number of students involved is so large. We will participate, and add on a small amount of work which is specific to physics.

Recommendation	Actions	Outcome	Responsibility	Time scale	Resources
Improved and consistent TA training.	Have TA's help design the new TA orientation for all new TA's	Consistent training program, older mentors for TA's	Department, instructors, experiences TAs	Fall 2015	Some additional stipend for senior TA's
	Ongoing TA seminars	Continued followup	TA seminar instructors	Ongoing	
	Participate in LA training through WIDER	More consistent LA training	Department, WIDER collaboration	AY2016	Increased wages for LA, TA's

8. We recommend that the Department engage in a strategic planning process that will allow it to proactively map out the next five to seven years, i.e., develop a prioritization of efforts and hiring that goes beyond reacting to annual budgetary exigencies.

The schedule for a strategic planning retreat has slipped to Fall 2015. Integrating a new chair has taken longer than expected.

Recommendation	Actions	Outcome	Responsibility	Time scale	Resources
Strategic plan	Departmental retreat	Strategic plan	Head, faculty	Fall 2015	Costs for retreat, time for writing