



EVALUATION OF PHYSICS AT THE OPEN UNIVERSITY

COMMITTEE FOR THE EVALUATION OF PHYSICS DEPARTMENTS IN ISRAEL

AUGUST 2019

Section 1: Background and Procedures

1.1 In the academic year 2018-19 the Council for Higher Education [CHE] put in place arrangements for the evaluation of study programs in the field of Physics in Israel.

1.2 The Higher Education Institutions [HEIs] participating in the evaluation process were:

- Ariel University
- Bar-Ilan University
- Ben-Gurion University
- The Hebrew University
- Lev Academic Institute
- The Open University
- Technion – Israel Institute of Technology
- Tel Aviv University
- Weizmann Institute of Science

1.3 To undertake the evaluation, the Vice Chair of the CHE appointed a Committee consisting of¹:

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| • Prof. Steven Kahn: Committee Chair | Stanford University, USA |
| • Prof. Laura Greene | National MagLab and Florida State University, USA |
| • Prof. Herbert Levine | Northeastern University, USA |
| • Prof. Michal Lipson | Columbia University, USA |
| • Prof. Yael Shadmi | Technion, Israel |

Ms. Maria Levinson-Or served as the Coordinator of the Committee on behalf of the CHE.

1.4 The evaluation process was conducted in accordance with the CHE's Guidelines for Self-Evaluation (February 2018). Within this framework the evaluation committee was required to:

- examine the self-evaluation reports submitted by the institutions that provide study **programs in Physics**
- conduct on-site visits at those institutions participating in the evaluation process
- submit to the CHE an individual report on each of the academic units and study programs participating in the evaluation
- set out the committee's findings and recommendations for each study program
- submit to the CHE a general report regarding the evaluated field of study within the Israeli system of higher education

¹ The committee's letter of appointment is attached as **Appendix 1**.

- 1.5 The evaluation committee examined only the evidence provided by each participating institution — considering this alongside the distinctive mission set out by each institution in terms of its own aims and objectives. This material was further elaborated and explained in discussions with senior management, faculty members, students and alumni during the course of each one-day visit to each of the institutions.²
- 1.6 This report deals with the Physics Division at the **Open University**. The Committee's visit to Tel Aviv University took place on June 4th, 2019. The schedule of the visit is attached as **Appendix 2**.
- 1.7 The Committee would like to thank the management of the Open University and the Physics division for their self-evaluation report and for their hospitality towards the Committee during its visit to the institution.

Section 2: Executive Summary

The Open University of Israel (OUI) is successfully bringing the opportunity to learn Physics to a variety of population segments that might otherwise be excluded. It is therefore serving an important function for the overall Physics community. Much of the success can be traced to the Course Coordinators, who are the primary points of contact with the student body. This therefore presents a challenge, to make these positions sufficiently rewarding to guarantee recruitment and retention of outstanding individuals.

We were impressed by the overall rigor of the Physics courses, although some improvement is needed in the teaching labs. We expect that similar rigor could be accomplished in a Master's track. However, we do not see sufficient student demand for the type of program that could be fielded by OUI, and hence do not support a proposed MSc extension of the current degree options. Also, we encourage the faculty members to increase student contact as a way of broadening the student experience for those enrolled in the Physics program.

Section 3: Observations

3.1 Introduction

The Open University of Israel (OUI) is a unique institution that fulfills a very important role in the Israeli higher education system – providing access to high quality instruction and evaluation for non-traditional students that are not well-

² Prof. Yael Shadmi did not participate in the visits to the Technion and to Ariel University or in the panel's discussions concerning the evaluation of these institutions; Prof. Herbert Levine did not participate in the visit to Bar-Ilan or in the panel's discussions concerning the evaluation of this institution; Prof. Michal Lipson did not participate in the visits to Weizmann Institute of Science, Bar-Ilan University, Jerusalem College of Technology, Ariel University and Ben-Gurion University.

served by the conventional classroom teaching paradigms. For its physics programs, OUI has recruited outstanding faculty and staff, who have done an excellent job preparing and administering courses that form the basics of undergraduate degree program in physics. The current faculty are also engaged in research that is well-regarded by world standards.

Below, we comment on the OUI programs in several key areas.

3.2 Organizational Structure

The OUI was founded in 1974, and was patterned after the British Open University (est. 1959). It has completely open admissions. However, the courses and study program are rigorous and challenging, including the very first course in physics, with well-defined prerequisites. If the student is not prepared to begin the program in physics, she or he can take a preparatory course, which OUI offers for zero credit.

Almost every student that does her or his first year at OUI can go on to another institution for the second year, based on agreements that the OUI courses count for credit at the other institutions. We note that OUI presently does not have a general way to track the success of students after they leave, but they are working on that and recognize it as a desirable goal.

Approximately 3,000 students are currently enrolled in the Natural Sciences Department, yielding about 6,000 course enrollments per year. In the Physics courses, there are over 1,000 students in total, which includes introductory physics that every student in Natural Sciences and Management and Industrial Engineering must take. There are currently just over 40 students taking advanced physics courses; possibly headed to a degree. Last semester, 4 students received a BSc degree with a Physics major from OUI.

3.3 Mission and Goals

The mission of the OUI is quite different from that of Israel's other universities. Specifically, the OUI aims to provide access to high-level university courses to those who, for various reasons, cannot access these courses in a more traditional setting. In some cases, the issue is physical access to university campuses, for example by active duty military, by high school students, and by individuals who feel tied to life in highly insular sub-communities. In other cases, there are mental barriers preventing individuals from succeeding in the traditional lecture-based approach taken at the universities. From every indication, OUI is succeeding in general at this mission.

From the specific point of view of the physics program, it is important to distinguish subpopulations of OUI students. There are those interested in life-long learning, who take physics courses (usually but not always the introductory ones) as an adjunct to their overall interests. A good example of this is a new course in chemistry for Intel factory workers. For these, the overall structure of the degree program is mostly irrelevant. There are others who are using OUI courses as a way to get started on the physics degree while they are as yet unable to attend full-time university studies. Many of these individuals transfer to standard universities after completing the initial OUI courses. In some of these cases OUI provides a more manageable path between the differing expectations between high schools and universities. For these students, it is critical that the courses meet the same rigorous requirements as the corresponding courses at leading standard universities. OUI seems to be very successfully meeting this challenge. Finally, there are those relatively few physics students who are pursuing a full OUI degree in pure physics, or in some combination major involving physics.

The OUI is also contributing to increasing diversity in higher education in Israel. There are more ultra-orthodox students there than in any other Israeli university, as well as about 7,000 Arab students. It seems that gender representation is also quite balanced. Although it is difficult to track these demographics, our experiences during the on-site visit supported those claims.

A reason that OUI has a large ultra-orthodox student population is the distance learning aspect and open admission policy. OUI has a policy that they do not practice gender separation, which can limit ultra-orthodox participation, but they do seem to have found acceptable ways to mitigate this problem.

We had some difficulty in evaluating the OUI physics degree programs in the context of diversity, due to the lack of data on the breakdown of specific course enrollments by demographic categories. OUI prides itself on taking in all comers, but it is unclear how successful they actually are in meeting the real needs. From our discussions with current students, and with recent alumni of the degree programs, we did become convinced that the program can be successful for particular types of students. However, the numbers are small. They have typically only produced a handful of BSc graduates in physics in any given year. That could be due to a relatively small demand, or it could be due to a lack of awareness of OUI offerings in the overall Israeli populace. If the latter is the source of the small enrollments, then a more targeted advertising campaign to specific communities might be warranted.

3.4 Infrastructure

The campus laboratories are modern and in generally good condition. They are well supported. The team that runs the labs is composed of four full time staff. The labs have an allocated budget for purchasing and renewing equipment. In addition, the university is currently in the process of building more laboratories for physics experiments.

The university has made a substantial investment in providing High Performance Computing capability to its faculty and researchers. They have procured a cluster which is partly funded by the university and partly by research groups. The system is comparable to other clusters in the country, such as the one in the Hebrew University, Tel Aviv University, and in Technion. There is no general access to centralized HPC facilities, if the on-campus cluster proves insufficient.

3.5 Human Resources

The academic faculty is small and it is their primary responsibility to design the study program and courses. This involves writing, translating or commissioning textbooks, and writing study guides containing supplementary material. Naturally, the former only happens rarely. Thus, most of the ongoing teaching work is performed by the course coordinators, who oversee several courses each.

The coordinators prepare the tutorials and exams (exams are prepared well in advance with the faculty involved); hire and supervise tutors; answer students' questions about the material; and manage all administrative aspects of the courses. In some advanced classes, they also teach. Despite their central role in instruction and close interaction with students, course coordinators have little control of the syllabus, and changes they want to make require a lengthy and cumbersome approval process. As a result, improvements deemed necessary often don't happen, or happen very slowly. There are also no options for promotion as a course coordinator, and no path to becoming regular faculty. This structure naturally leads to some level of frustration among course coordinators. The course coordinators we met are highly qualified and impressive individuals, and their commitment and enthusiasm are remarkable, especially given these circumstances.

The Open University would do well to address these issues, bearing in mind that in practice, from the student's point of view, the course coordinators are the "face" of the university. Virtually all physics-related interaction, and most other interactions the student have, are with the course coordinators, and their role from this point of view is comparable to the role of faculty at standard universities.

3.6 Curriculum

Judging from the material submitted to our committee, we believe that the course content of the standard series of physics courses offered by OUI is of generally high quality, and is comparable to that of similar courses offered by more conventional universities. Since the instruction is self-paced, it is essential for the courses to be well-organized, so that students can assess what material they are going to have to master, and what exercises they need to complete to receive credit. This appears to be a strength of the OUI program: the courses are well-documented and well-prepared, which is a credit to the faculty and staff they have engaged in the program.

The lab courses provide the primary vehicle for direct interaction with the students. In the lower level courses, physics labs experiments are focused on mechanics and electromagnetism. In the more advanced lab course, the experiments are focused more on modern physics. The advanced physics lab has a typical enrollment of ~ 10 students. It includes a selection of appropriate topics such as NMR, laser experiments, FTIR, etc. However, most of the experiments require the students to follow cookbook level instructions. At the end of the experiments, there are more open-ended opportunities, which allow students to pursue their own proposed mini- projects, while still under the guidance of the instructor. However, the opportunities for student-initiated experiments are not as extensive as at other, more conventional universities.

3.7 Students and Alumni

Our committee had the opportunity to interview both currently enrolled students, and alumni of the OUI physics programs. To some degree, these were self-selected groups, so it is difficult to assess whether they are representative of the general OUI physics student population. But it was clear from the testimonials offered by the students and alumni that we spoke to, that OUI has served them well. We heard from a number of individuals who became engaged in physics through OUI, but who would have certainly been lost to physics if they were forced to enroll in other components of the Israeli higher education system. Some students cannot function well in traditional lecture-based courses, and others are hampered from attending classes at traditional colleges and universities by their personal circumstances. We came away convinced that OUI is serving an important service for Israeli higher education in physics, and must be maintained.

Since this is primarily a distance-learning environment, the university does not place a huge emphasis on the on-campus environment. Nevertheless, we found it curious that the student population we met were primarily concentrated in the center of Israel, and it is unclear to us whether the program is drawing effectively from the periphery. We recommend that the institution investigate if

they can do more to attract students who are located far from the Ra'anana facility.

3.8 Research

There are only three faculty members in the Physics group within the Department of Natural Sciences. All pursue research in the general area of astrophysics and gravitation, so the program has some coherence, approaching critical mass. Professor Jonathan Granot is a theoretical high energy astrophysicist, who has worked on a range of topics involving the physics of compact objects like black holes and neutron stars. Professor Saleem Zaroubi is a radio astronomer and cosmologist, who studies the epoch of reionization when the first stars in the universe were born. He retains a position in the Netherlands, where he is playing a significant role on the LOFAR project, one of the primary facilities in the world for epoch of reionization research. Professor Yosef Verbin is a theoretical relativist, who has studied alternatives to general relativity and their implications for particular astronomical systems. Given its small size, this group has maintained a respectable level of research productivity, as appropriate for a university-based physics faculty.

3.9 Graduate Degree

The Physics Faculty have proposed the establishment of an MSc Program at the Open University, with the usual complement of coursework plus a master's thesis. Given the expertise of the current faculty members, the research component would be concentrated in the areas of Astrophysics, Cosmology, and Gravitational Physics. To achieve critical mass, they suggest that \sim two additional faculty members might be hired, which would support the development of the requisite course materials, and the supervision of the graduate students that they expect to enroll in such a program.

The motivation for the establishment of the master's degree is primarily stated in terms of the benefits to the University and the Faculty, as opposed to the current OUI student population. They argue that to be a "real University", OUI must have a vibrant Physics Department, and for that they need an active research program, supported by graduate student researchers. We have no major disagreement with these arguments per se. The current Faculty are excellent and have significant and impactful individual research efforts. There is no question they would be even more impactful if they have graduate students working with them, and if the department size were expanded to include additional Faculty.

However, we have a harder time understanding the necessity of this initiative from the standpoint of the student body that OUI currently serves. At present,

only a handful of students per year complete the BSc degree in Physics, or in Natural Science with a Physics specialization. It is hard to imagine that the masters' program would attract more than a student or two per year, especially in its early stages. In addition, judging from the anecdotal experience conveyed to us by the existing students and alumni we met with, few if any have or had become strongly engaged with the current faculty members themselves, in terms of discussions of physics or research opportunities. Several had indeed become engaged in some form of research activity, but they had sought out and arranged those opportunities themselves at other universities. So we do not see that the Bachelors program would naturally feed a graduate extension, as it does at other, more conventional universities in Israel. Further, such a graduate program would necessarily be narrow in terms of the diversity of physics research topics, and there is no shortage of graduate degree opportunities in currently existing programs.

We have become strongly convinced that the unusual character of the OUI educational experience is crucial for certain kinds of students, to introduce them to physics and to enable the successful completion of an undergraduate degree in the field. When a student moves on to graduate work, on the other hand, the nature of their engagement changes, and most of his or her effort, even at conventional universities, is not devoted to enrollment in lecture courses, but rather to less formal interactions with faculty in a research setting. Therefore, the uniqueness of OUI is much less apparent in this context. Indeed, some of the students we talked to had already successfully made the transition to another university for graduate studies in Physics.

Section 4: Recommendations

Essential:

- **Reevaluation of the career path for course coordinators:** The course coordinators provide the primary points of interaction for students enrolled in the current degree programs at OUI. At present, they feel over-burdened, and under-appreciated, with minimal authority to shape the structure of the courses they are teaching. We recommend that the OUI rethink their role generally, potentially providing them with more autonomy, and greater opportunities for advancement.

Important:

- **Abandon plan for MSc in physics:** While the establishment of an MSc program in physics at OUI could have significant benefits for the OUI faculty and for the university, we remain unconvinced that the demand is sufficient to justify the establishment of new degree program at this time. There is no evidence that the enrollment in such a program would comprise more than a small number of

students, and opportunities for such students already exist in the graduate programs at other universities.

- **Increase interaction between faculty and students:** While the faculty in physics clearly play crucial roles in constructing and implementing the physics courses, their contact with students appears to be minimal. We believe that this separation is unhealthy. Faculty must interact more frequently and more directly with the student population.

Advisable:

- **More open-ended components of student labs:** The student lab exercises are overly cookbook, and don't appear to offer enough opportunities for students to engage with the equipment and figure out for themselves how to construct an experiment. We believe that more attention to opportunities for student creativity could be incorporated into the lab courses.
- **Outreach to the periphery:** The student populations appears to be overly concentrated in the center of Israel, where other universities provide ample opportunities for higher education in physics. Given its unique approach, OUI is in an ideal position to attract students from the periphery of the country. However, we did not see much evidence that they are fulfilling this role, especially for physics.

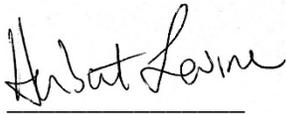
Signed by:



Prof. Steven Kahn
Committee Chair



Prof. Laura Greene



Prof. Herbert Levine



Prof. Michal Lipson



Prof. Yael Shadmi

Appendix 1: Letter of Appointment



December 2018

Prof. Steven Kahn
Department of Physics
Stanford University
USA

Dear Professor,

The Israeli Council for Higher Education (CHE) strives to ensure the continuing excellence and quality of Israeli higher education through a systematic evaluation process. By engaging upon this mission, the CHE seeks: to enhance and ensure the quality of academic studies, to provide the public with information regarding the quality of study programs in institutions of higher education throughout Israel, and to ensure the continued integration of the Israeli system of higher education in the international academic arena.

As part of this important endeavor we reach out to world renowned academicians to help us meet the challenges that confront the Israeli higher education by accepting our invitation to participate in our international evaluation committees. This process establishes a structure for an ongoing consultative process around the globe on common academic dilemmas and prospects.

I therefore deeply appreciate your willingness to join us in this crucial enterprise.

It is with great pleasure that I hereby appoint you to serve as chair of the Council for Higher Education's Committee for the Evaluation of **Physics** departments. In addition to yourself, the composition of the Committee will be as follows: Prof. Laura Greene, prof. Herbert Levine, prof. Michal Lipson and prof. Yael Shadmi.

Ms. Maria Levinson-Or will be the coordinator of the Committee.

Details regarding the operation of the committee and its mandate are provided in the enclosed appendix.

I wish you much success in your role as a member of this most important committee.

Sincerely,


Prof. Ido Perlman
Vice Chair,
The Council for Higher Education (CHE)

Enclosures: Appendix to the Appointment Letter of Evaluation Committees

cc: Dr. Varda Ben-Shaul, Deputy Director-General for QA, CHE
Ms. Maria Levinson-Or, Committee Coordinator

Appendix 2: Visit Schedule

<u>Physics - Schedule of site visit</u> <u>Open University</u> Tuesday, June 4, 2019		
09:00-09:30	Opening session with the head of the institution	<ul style="list-style-type: none"> ●Prof. Sarah Guri-Rosenblit, Vice-President for Academic Affairs ●Prof. Tzahi (Yitzhak) Weiss, Dean of Research ●Dr. Gadi Sagiv, Quality Assessment Coordinator ●Ms. Einat Hacoheh, Academic Secretariat
09:30-10:00	Meeting with the Head of the department of Natural Sciences	Dr. Inbal Tuvi-Arad
10:00-10:30	Meeting with the Head of the Physics group	Prof. Jonathan Granot
10:30-10:45	Break	Closed-door meeting of the committee
10:45-11:30	Meeting with senior academic faculty*	<ul style="list-style-type: none"> ●Prof. Jonathan Granot ●Prof. Yosef Verbin ●Prof. Saleem Zaroubi
11:30-12:15	Meeting with course coordinators	<ul style="list-style-type: none"> ●Dr. Merav Hadad ●Mr. Guy Hetzroni ●Dr. Alon Marcus ●Dr. Rinat Ofer
12:15-13:00	Lunch (in the same room)	Closed-door meeting of the committee
13:00-14:00	Tour of facilities	HPC presentation – Mr. Benny Friedman Labs – Ms. Ruty Tal Stein, Dr. Rinat Ofer Multimedia studios – Mr. Amir Winer
14:00-14:45	Meeting with BSc students	
14:45-15:30	Meeting with Alumni	
15:30-15:45	Break	Closed-door meeting of the committee
15:45-16:15	Closing meeting with heads of institution, head of the department and the Head of the Physics group	<ul style="list-style-type: none"> ●Prof. Sarah Guri-Rosenblit, Vice-President for Academic Affairs ●Dr. Inbal Tuvi-Arad, Head of Department ●Prof. Jonathan Granot, Head of Physics Group ●Ms. Einat Hacoheh, Academic Secretariat