EVALUATION OF PHYSICS AT TEL AVIV 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
- Jerusalem College of Technology (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 of[1]:

• 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 School of Physics and Astronomy at **Tel Aviv University**. The Committee's visit to Tel Aviv University took place on June 3rd, 2019. The schedule of the visit is attached as **Appendix 2**.

1.7 The Committee would like to thank the management of Tel Aviv University and the Physics School for their self-evaluation report and for their hospitality towards the Committee during its visit to the institution.

Section 2: Executive Summary

Tel-Aviv University is one of Israel's premiere academic institutions with a distinguished Physics program and associated research portfolio. We found that Physics is doing quite well, and no essential changes are needed to maintain an excellent overall effort. We also applaud the department for taking meaningful steps to bring diversity to the Physics faculty.

Our major recommendations for TAU concern increasing flexibility and developing better monitoring of student progress and eventual outcome. The Physics School struck us as somewhat conservative in its approach to teaching innovation, departmental structure, and broad-based pro-active recruiting. We call for a consideration of more adaptability along each of these lines. Also, increased monitoring of graduate student thesis progress as well as tracking alumni to get a more quantitative sense of outcomes would be useful. These measures will enable the School to fully utilize the potential of the outstanding cadre of recently recruited young faculty and thereby become even more competitive on the worldwide Physics stage.

[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.

Section 3: Observations

3.1 Introduction

Tel-Aviv University (TAU) is one of the largest and most prominent universities in Israel, with a student population of 29,000, and over 1,000 faculty. The School of Physics and Astronomy, whose establishment dates back to 1963, has established a broad-based research program, including world-class theoretical and experimental efforts in astrophysics, particle physics, and condensed matter physics, including various aspects of biophysics and statistical physics. The faculty of the School is generally excellent, and is quite young, with a significant number of appointments having been made within the last ten years.

The School provided us with good visibility into its teaching and research programs through a well-organized series of meetings with administrators, faculty, and students during our one-day visit. The School is functioning quite well, and we found that both undergraduate and graduate students are very happy to be enrolled there.

Below, we detail our impressions on a series of specific topics appropriate to the CHE review.

3.2 Organizational Structure

The School of Physics and Astronomy at TAU is part of the Faculty of Exact Sciences along with the departments of Chemistry, Math, Computer Science and Geophysics. The School itself is broken up into three departments: Particle Physics, Astrophysics, and Condensed Matter physics, each with its own administrative head and with some degree of autonomy with respect to new faculty searches, space allocation etc. Our understanding is that faculty candidates within one of these areas are primarily discussed within the department before eventually being brought up to the entire School for consideration. Unfortunately, there was no explicit information regarding hiring practices presented in the self-study, making it hard to assess the detailed procedures.

Nonetheless we do have a specific concern that this structure could lead to unnecessary inertia in hiring; for example, it could make it more difficult to hire a particle astrophysicist (two departments) or someone in quantum computation (in some perspective, zero departments). We should note, however, that we saw no real evidence of this extra inertia, and in fact the young faculty hired over the last few years apparently do not really need to fit into the structure outlined above. But this leaves open the question of whether the whole partitioning needs to be revisited. In an era when many universities

(TAU included) are making good strides to lessen the walls between completely different disciplines (Physics and Life Sciences, Physics and Engineering) it seems reasonable to suggest that walls between different branches of Physics, however porous, might also be candidates for adiabatic elimination. Investigating issues like this could have been a more significant component of the self-evaluation process, but the School chose not to go that route.

We learned of the existence of a long-range planning committee although no further information about committee functioning was provided. We were made to understand that hiring in Israel is more complicated than in Europe or the US, given the much smaller candidate pool of native Israelis; often one just cannot find an excellent candidate in a desired field of expansion, quantum information science being one specific case. It does seem though that the School should devote more attention to strategic planning and might perhaps even consider delaying the use of available slots, until a desirable candidate in a strategically important field emerges.

In general, though, TAU has been very successful at replenishing its faculty ranks with excellent young faculty hires. Part of the success here relies on a very generous policy regarding start-up funding and some significant tech support (50% technician for each lab). This is discussed below.

3.3 Self-Evaluation and QA

The self-evaluation was written by the Head of the School, with minimal consultation with the faculty and students. Nevertheless, he stated that this was a useful exercise as it helped identify areas of growth and put the goals of the department into focus:

- Expansion of their dual degree programs, including programs in physics and humanities.
- Expansion into Experimental Quantum Information Sciences.
- Diversification and broadening of faculty searches.

In the future it would be more useful to have the self-evaluation process serve as a vehicle for intensive faculty discussions and self-reflection. Engagement of undergraduate and graduate students would further enhance the process.

3.4 Undergraduate Education

Overall, the School offers an impressive and high-quality study program, with 9 undergraduate tracks. This rich and diverse program is motivated by the vision of flexible learning, and roughly half the students are enrolled in dual programs. The number of programs does not over-burden the faculty, since the majority of Physics courses are the same in all programs. At the same time, there seems to

be relatively little involvement of the faculty in ensuring the cohesion of each joint track, or in monitoring the interface of the physics component with the "other" component on an on-going basis.

As expressed by the Rector, flexible, personalized learning is a central part of the University's vision and is deemed crucial for this generation of students, who are not as comfortable with traditional frontal classroom learning. However, it seems that virtually all teaching in the School of Physics is frontal classroom teaching, with little or no experimentation with non-traditional instruction such as flipped classrooms.

The department has only recently started to videotape lectures. Students are happy about the availability of online lectures but note that attendance in these lectures typically drops to around 50%. Some lecture and section materials are now available online, and the students seem to greatly benefit from them. It would be a good idea to expand this practice to other undergraduate courses.

Sections are still large, as noted in the past CHE Physics review (for example, for quantum mechanics there are only 2 Sections, with around 50 students in each).

The physics-math program has an uneven course load, with some semesters being extremely challenging and others being relatively light. It seems that few students manage to complete this program in the designated 3 years.

In general, it seems that the coordination between the different departments, and in particular with EE, which is in a different Faculty, could be improved, preferably by establishing a clear mechanism for resolving issues from subject matter to clashing class schedules.

One of the most impressive components of the program is the engagement of undergraduate students in research, through summer projects and/or the 3rd year Students Project course. A small research stipend provides extra incentive for long-term projects. This seems to be one of the highlights of the undergraduate experience for many students.

Many incoming students do not have labs in their high school physics programs, so the 1st year lab mainly introduces the concepts of measurements and data analysis. Experiments were redesigned so students have to construct the experimental setup themselves. A major challenge is the fact that this lab is taken by about 800 students from different faculties. There is no tailored lab for Physics majors, and they take exactly the same lab as Chemistry or Engineering students. A dozen physics students are selected to participate in an advanced program, with only 3 longer experiments, plus a research project which they propose.

Lab C aims to prepare the students for research, and emphasizes independent work, writing academic reports, advanced measuring instruments and statistical analysis of experimental data. Students perform 3 experiments each semester and can opt to replace one semester of the lab by a research project, or by outreach, for which they develop experiments for junior-high schools.

3.5 Graduate Education

The approach to graduate education at TAU closely parallels that taken at the other major Israeli research universities and is not dissimilar to that followed in the United States. The standard route is for students to first obtain an MSc degree. The requirements for that degree include roughly one year of coursework in a prescribed sequence (Advanced QM, Advanced E&M, and Advanced Stat Mech) and a small number of electives in the student's chosen field, plus a master's thesis. The program is expected to be completed within two years.

At that stage, a student with appropriate standing may continue on to a PhD degree, which involves a more extensive thesis project to be completed within four years. Students with a strong academic record can apply to be considered for a "Direct PhD" route, in which they complete the courses and move directly on to a PhD project, skipping the master's thesis. If they follow that route, they can still obtain an MSc degree in the unlikely event that they leave the program prematurely before submitting a PhD thesis, but after successfully passing the courses.

The School is enthusiastic about moving an increasing fraction of their graduate students to the Direct PhD path. This has the advantage of shortening the students' time in graduate school and allows them to get more focused on PhD research at an earlier stage. However, not all faculty and students are uniformly enthusiastic about this plan. Some faculty would prefer to see clearer evidence of the students' research capabilities before committing to sponsor them for a PhD. In addition, some students feel unsure of which research field to specialize in before first experimenting with a master's thesis project, and are happy with the standard system, which allows them some flexibility to make course corrections before they get too deeply engaged in research. The current situation, in which students have the flexibility to follow either course, seems to be optimal at present, until this settles down.

Our discussions with current graduate students in the program indicated that they are generally happy with the graduate program at TAU and feel that they are treated well by the School. The content of the required courses, however, is an item of concern, as it has only marginal relevance to the research work of many students. Students feel overly pressured to do well in these courses, and some find the courses difficult and time-consuming. The School should consider

providing more uniform advising to the incoming MSc students on what importance they should personally place on these courses, versus devoting themselves more fully to their early thesis work.

There appear to be two "tracks" among the graduate students: (1) Those who were TAU undergraduates and involved themselves in research early, before obtaining the BSc; and (2) Those who did their undergrad work elsewhere, or were undergrads at TAU, but did not get involved with research at all before starting the master's program. Members of the former group are generally well-prepared to hit the ground running in grad school, and usually move easily into the Direct PhD path. However, members of the latter group can find it more difficult to choose a research field and get appreciably engaged with a faculty sponsor, especially during the first year, when they are consumed with coursework. The School might consider adopting a more organized and proactive system of advising for these students to help prevent them from getting "lost" at an early stage.

Even at the PhD level, the School could improve its approach to the monitoring of graduate student progress. It appears that the committee that evaluates a student's research proposal for the thesis meets only once, and it is not tasked with any follow-up. This is problematic as it eliminates a natural method of tracking thesis progress and monitoring the student-advisor relationship. We would like to suggest that the committee, or at least a subset of it, continue to meet with the student and adviser on a yearly basis to fill this void. We comment on this in the general section of our report, since the issue is common at a number of universities.

In general, the TAU graduate students appear happy with the financial support they receive through a variety of sources.

3.6 Faculty and Human Resources

New hiring and promotions seem to be handled well. We were happy to learn that newly hired junior faculty feel they have a significant voice in evaluating potential new faculty recruits, even though they do not have a formal vote. We heard no complaints regarding promotions, and information regarding procedures and expected accomplishment thresholds is adequately shared. Also, there seems to be in place a reasonable approach to junior faculty mentoring.

We heard statements to the effect of "we have a very thorough process", followed almost immediately by "everybody here gets tenure", which seem contradictory at first. It does make sense for most faculty members to be granted tenure, given a rigorous hiring process at the junior faculty level. However, the School does not have a perfect crystal ball, and it seems unlikely to

us that every junior faculty hire works out as desired 5 to 6 years later. Perhaps this issue should be reviewed more critically at the university level.

The School's usual process for hiring does not invoke advertising in the usual sense but is instead based on presumed knowledge of young up-and-coming Israeli scientists, as discerned through discussions among key faculty and administrators. In our view, broad-based advertising would help to identify a greater pool of more diverse candidates. The School did try advertising in their quantum information sciences search, and although that did not yield appropriate candidates in that particular field, they do intend to continue with that approach for future searches. We do want to congratulate the department on dramatically increasing the representation of women on the Physics faculty.

Startup packages for experimentalist hires have been quite generous, typically ~ $2M. This puts significant financial demands on the School, which means that cost is an important factor in the evaluation of potential new hires. That is not an uncommon situation at most universities, but it does imply that the School must pay extra attention to ensure that cost considerations do not get in the way of hiring the best people.

Each lab is supported from University funds for 50% of a technician. Some researchers have chosen to hire a more advanced "lab manager" person, with more specific expertise and often with a PhD, and the funding covers a smaller percentage of the salary for this type of person. One ongoing challenge is competing with industry for such people, but it seems to us that TAU labs were in general successfully meeting this challenge at present. We also comment on this topic in the general section of our report.

3.7 Research

Optics

In quantum optics, the development of innovative avenues combining femtosecond optics, nanoscience, and mid-infrared techniques by TAU faculty has been enormously successful in mapping out new areas of discovery. There is good cohesiveness within the School in this field, and they have created alliances with other departments within TAU (such as EE), with other schools in Israel, and through particularly diverse and strong international collaborations. Their faculty have also generated a number of patents, which has led to the formation of several startups. They are winning major awards, such as the Alon fellowship, and they are frequently invited to present their work at important international conferences.

Astrophysics

The School of Physics and Astronomy at TAU has a distinguished history in the fields of both theoretical and observational astrophysics, and it has played a major role in advancing astrophysics generally in Israel. The present faculty includes 10 active members working in astrophysics (Arcavi, Barkana, S. Beck, Bromberg, Levinson, Maoz, Nakar, Poznanski, Sternberg, Trakhtenbrot) and 4 emeriti, who remain active. Key areas of research include extrasolar planets, binary systems, interstellar medium, star formation, supermassive black holes, galaxy evolution, transient astrophysics, astro-particle physics, and cosmology. Over the years, TAU faculty have achieved particular distinction in observational and theoretical research on active galactic nuclei, transient phenomena such as supernovae, and some aspects of cosmology, and they have produced many of the leading Israeli PhD researchers in this field.

The School maintains the Wise Observatory as a research and teaching tool. However, this, in and of itself, is inadequate for the observers at TAU, and in Israel, generally, to play an important and commensurate role in world astronomy. For a number of years, TAU faculty members have argued vigorously for Israeli membership in the European Southern Observatory (ESO). We strongly endorse that proposal, and comment on it specifically in the general report.

Bio-Physics and Soft Matter Physics

TAU has been strong for many years in the area of soft condensed matter physics (especially theory), and its extension to cover immediately neighboring parts of biological physics. Individuals such as Andelman, Kantor and Lifshitz have contributed major ideas to the field of the phase diagrams of physio-chemical systems, such as membranes and biopolymers. There is a good balance of theory and experiment (such as in the R. Beck lab), and there are useful interactions with related scientists in other fields such as chemistry.

It should be noted, however, that the TAU approach to biophysics is rather conservative. With the exception of one faculty member (Eisenberg) who works on RNA editing, and occasional forays into neural physics by researchers in other sub-disciplines, biophysics at TAU is really being pursued as merely an extension of condensed matter physics. The structure of the School, with its segmentation into three Departments, undoubtedly exacerbates this issue. In fact, in the physics community world-wide, individuals trained in physics have wandered into much more general areas of living systems research, conducting investigations further afield from traditional condensed matter topics. At TAU, physicists working on those more general topics are not in the School of Physics and Astronomy. That may be a reasonable choice for the School to make, as not everything can be covered in a single academic unit. The potentially adverse

effects can be mitigated through serious efforts at maintaining contact with physicists working in other units of the university, but we heard little bit about such efforts, if they exist. In any case, we believe that the School should make active decisions about what topics to include in its biophysics research program, not simply opt for those closest to condensed matter physics by default.

High Energy

The TAU HEP program is strong and diverse, spanning a broad range of topics including experiment, particle theory, QFT and string theory, with significant cross-talk and collaboration between some of these. Barak (experiment) and Geller (particle theory) were hired in the past couple of years.

The main effort of the experimental group (Abramowicz, Barak, Etzion, and Soffer) is ATLAS, with individual PIs conducting different analyses targeting new particles, particularly low- and high-mass new resonances, and long-lived particles. Hardware and trigger development are performed in collaboration with the Technion and WIS groups. Soffer was a major contributor (and Physics Coordinator 2011-12) at BABAR. The group has had a leading role and high visibility in analysis, with a somewhat lesser role in hardware development.

This trend seems to continue with the hiring of Barak, who comes with a strong track record in Higgs analyses. Some of the PIs have joined SENSEI (Sub Electron Noise Skipper-CCD Experimental Instrument), a DM detector developed by Volansky and collaborators and currently operating at Fermilab, and are also involved in R&D for MATHUSLA, a proposed large-scale detector forlong-lived particles near the LHC ring.

Theoretical particle physics, which saw many retirements, had a significant boost with the hiring of Volansky, with key contributions in light dark matter, including novel approaches for direct detection of sub-GeV dark matter, as well as LHC physics, model building and cosmology. The latter two will be strengthened by the addition of Geller.

Other areas of research include lattice gauge theory (Svetitsky), and the study of exotic hadrons (Karliner) - pentaquarks, doubly heavy-tetraquarks, and hadronic ``molecules". This area is generating a lot of interest, with LHCb probing many of these exotic states.

The formal group (Itzhaki, Oz, Sever, Sonnenschein), has a strong record of activity in String theory and QFT, and was further strengthened in 2014 with the hiring of Sever, who is currently also a staff member at CERN. AdS/CFT is a major focus of the group, with applications to a broad set of fields, from QCD (Sonnenschein), strongly-interacting supersymmetric QFT (Sever, Itzhaki), to hydrodynamics and turbulence (Oz). Other areas of activity include cosmology

and its interface with string theory (Itzhaki), and amplitudes and integrable models (Sever).

The HEP group has several active emeriti working on topics mentioned above as well as on low-X QCD.

Nuclear physics and Light Matter Interactions

The nuclear physics group has two faculty (Piasetzky and Pomerantz) and benefits from additional visiting faculty. Piasetzky studies nuclear and nucleon structure (at facilities such as Jefferson Lab, Dubna), the proton radius puzzle (PSI), and neutrino scattering (MicroBoone).

Although trained in nuclear physics, Pomerantz has expanded into research the interaction of matter with extremely short-pulse and intense laser light. An important application of this niche technology is high-resolution time-of-flight laser-based neutron spectroscopy. The appointment of Pomerantz is a good demonstration of the School's willingness to make appointments at the interface of traditional fields.

Condensed Matter

The experimental condensed matter quantum materials group (Barad, Shalom, Dagan, Gerber, Plaevski, Suchowski) covers a broad range of experimental techniques and materials. They are internationally recognized for their successes in novel methods of electronic transport in a wide range of strongly correlated quantum materials, particularly unconventional superconductors, magnetism, and emergent phenomena at interfaces. Their work on topological materials and spin systems is also outstanding. Students trained in these areas have found positions at first-rate universities, internationally.

The theoretical condensed matter quantum materials group (Goldstein, Ilan, Sela) focus on low-dimensional quantum systems, topological materials, novel superconductors, mesoscopic systems, and quantum transport. Much of their work is in collaboration with the experimentalists, and some of these strong ties, such as with those studying emergent phenomena at insulator interfaces that yield metallic and superconducting behavior, have been particularly successful and are highly recognized internationally. Newer areas of research, such as applying high-energy theoretical methods to topological systems, and investigating how Dirac materials can play a role in the detection of dark matter, are intriguing and are quickly gaining international recognition.

There have been five recent and significant hires in traditional experimental CMP areas, each with about a $2M startup, but the School is still looking to broaden and expand in this field. An area in which they are trying to move into is

experimental quantum information sciences. Some offers have been made, but they were not accepted. The latest candidate was lost to Weizmann, not due to the size of the start-up package, which was significant ($4M), but due to the lighter teaching and committee work compared to TAU.

3.8 Students and Alumni

Students

It is the sense of the committee that both undergraduates and graduate students feel supported and generally have good relationships with the physics faculty. The efforts of the faculty to expose undergraduate students to their respective research activities are well-appreciated. However, we believe that improvements can be made in ensuring that all students are aware of vehicles in place to communicate any concerns they may have to the management. We recommend, in particular, that an unbiased and rigorous process be established to evaluate the climate for graduate students within the School.

Alumni

Our committee has the impression that most alumni are satisfied with their studies as TAU, have enjoyed their experience there, and were able to secure excellent positions after graduation, either in industry or in academia. We commend the efforts of the School in connecting with alumni a few years ago (when organizing the 50-year anniversary of the School). We suggest that the School maintain an even stronger relationship with its alumni, since there seems to be an interest among them to create better connections with one another. A strong interaction with the School could also help to ensure that the students are aware of various opportunities in industry that differ from the traditional academic path.

3.9 Infrastructure

The School has been proactive at renovating laboratory space for new experimental appointments. The startup packages provided for new faculty hires are about $2M, comparable to the startups in top universities elsewhere. However, due the age of the building, the core infrastructure has caused serious problems. For example, old water pipes have burst, and the electricity has been unreliable.

There is a need for centralized computing cluster facilities that could provide support across all areas of physics (and beyond). Faculty currently engaged in numerical work, use a variety of facilities, both within and outside the School. This is a general problem in Israel.

The teaching labs are in good shape, Equipment is being purchased every 6-10 years and is being adequately maintained. The advanced teaching lab includes cutting edge experiments such as quantum optics and superconductivity.

3.10 Diversity

The School is aware that the fraction of women and minorities in physics is too low. This is generally true in Israel, and we comment on it in the general section of this report. At TAU, they will continue to try to address raising the number of women with initiatives already in place, and also look for new and effective methods. However, in terms of minorities, the School did not express a coherent plan to address the issue.

The number of female faculty members is increasing. Two years ago, there were only two women faculty members, and now, including a new hire arriving next year, there will be 6 women out of the 43 faculty members (14%). This is a major accomplishment and is ahead of other Institutions in this regard.

Studies have shown that more proactive hiring techniques, such as those which are now routinely adopted in the US, will increase the number of female hires. These include broadly advertising the position, and egalitarian interview methods. Hiring at TAU is basically done by word of mouth, and there are traditionally no calls or advertising. This year, they did broadly advertise in quantum information sciences, although that did not yield any new appropriate candidates. The School plans on more broadly advertising in other areas, and it would be interesting to see if that is effective.

The graduate students have formed the She-Physics group that meets once a week. This group includes women and men at all levels. They discuss mostly science, but other issues are also addressed. The students very much appreciated the She-Physics group for its positive impact on the climate of the department.

Section 4: Recommendations

Important:

- **Interactions with alumni**: The School should endeavor to maintain a more frequent and more organized interaction with its alumni. At the very least, they should utilize social media to enable alumni to stay in contact with one another, as well as with the School.
- **Attention to diversity**: The School should examine its processes for recruiting and attracting new faculty, and potentially consider adopting “best practices” for improving diversity that have proven successful in the US. The School should

also develop a plan to improve the representation of ethnic minorities (Arabs, ultra-orthodox) at all levels.

- Investigation of alternative teaching methods: The School should undertake a more serious investigation of alternative teaching methods, especially for large lecture classes. There is a wide range of literature available on this subject that can be reviewed and assessed.
- Reevaluation of the structure of the School: We found some evidence that the organization of the School into three Departments may create obstacles to full consideration of candidates in new emerging areas. We suggest that the School undertake a self-evaluation of that structure to see if it is still optimal.
- Monitoring of graduate student performance: We suggest that a more formal process be invoked for the monitoring of graduate student progress, after the approval of the research proposal and before the submission of a thesis. We see advantages to instituting monitoring committees with multiple faculty members, beyond just the immediate advisor. This should prove helpful in avoiding problems that sometimes develop between a student and his or her advisor, and students will also benefit career-wise by having more than one faculty member at the institution who is intimately familiar with their work.

Advisable:

- Taking a more broad-based view of biophysics: Biophysics has expanded into many other fields of research on living systems, beyond those typically encountered as extensions of condensed matter physics. We recommend that the School reevaluate its strategic plan in biophysics to ensure that it is addressing the most pressing and interesting problems in the field.
- Hiring in quantum information science: We strongly endorse the stated desire of the School to make new experimental hires in quantum information science. We understand the difficulties in making appointments in this new field, given competition both within and outside Israel. We suggest that this may be a case where a concerted effort to examine non-Israeli candidates may be advisable.
- More proactive efforts at hiring international candidates: Given the limited number of appropriate native Israeli candidates, a more proactive consideration of how to hire international faculty should be initiated. TAU is in a strategically good position on this front, due to its location in Tel Aviv, which is the most cosmopolitan city in Israel, a factor that will be important for many applicants.

Signed by:

Prof. Steven Kahn

Committee Chair

Prof. Laura Greene

Prof. Herbert Levine

Prof. Michal Lipson

Prof. Yael Shadmi

Appendix 1: Letter of Appointment

مجلس التعليم العالي
המועצה להשכלה גבוהה
COUNCIL FOR HIGHER EDUCATION

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

Physics - Schedule of site visit Tel Aviv University Monday, June 3 ,2019		
09:00-09:30	Opening session with the head of the institution	Prof. Yaron Oz, Rector Prof. Eyal Zisser, Vice-Rector Prof. David Horn
09:30-10:00	Meeting with the Dean of the Faculty of Exact Sciences	Prof. Michael Krivelevich
10:00-11:00	Meeting with the Head of the School of Physics & Astronomy, two department heads and the undergraduate studies committee chair	Prof. Dan Maoz Prof. Rennan Barkana Prof. Erez Etzion Prof. Yoram Dagan
11:00-11:15	Break	Closed-door meeting of the committee
11:15-13:00	Presentations – research groups (including research lab visits)	Research labs visits: Dr. Ishay Pomerantz – NePTUN Nuclear Photonics research group Dr. Haim Suchowski – Femto - Nano Laboratory
13:00-13:45	Lunch (in the same room)	Closed-door meeting of the committee
13:45-15:00	Presentations – research groups (including research lab visits)	High Energy Astrophysics Prof. Ehud Nakar, Prof. Amir Levinson Dr. Omer Bromberg , Dr. Benny Trakhtenbrot High Energy Physics Dr. Liron Barak , Prof. Erez Etzion Prof. Halina Abramowicz , Prof. Eli Piasetzky Prof. Marek Karliner Bio-Soft/complex-systems Prof. David Andelman, Prof. Roy Beck-Barkai Dr. Yoav Lahini Quantum theory Prof. Moshe Goldstein, Prof. Lev Vaidman Dr. Roni Ilan
15:00-15:30	Tour of teaching labs	Prof. Halina Abramowicz - Lab A + Lab C
15:30-16:15	Meeting with BSc student	
16:15-17:00	Meeting with research students - MSc and PhD	
17:00-17:45	Meeting with Alumni	
17:45-18:00	Break	Closed-door meeting of the committee
18:00-18:30	Closing meeting with heads of institution, Dean of the Faculty and the Head of the Physics Department	Prof. Eyal Zisser, Prof. Michael Krivelevich Prof. Dan Maoz, Prof. David Horn