

## Course analysis for "Basic Statistical Physics and Quantum Statistics, FYSB12" HT 2020

**Course responsible:** Claudio Verdozzi (L)

**Other teachers:** Ross Church (L), Anders Irback (CL), Felipe Zapata (EL), Daniel Nilsson (CL), Drilon Zenelaj (E), Nicholas Borsato (E), Dejan Stancevic (SI), Fredrik Granström (SI)

L=lectures, CL=computer lab, EL=experimental lab, E=exercises sessions, SI=supplemental instruction

**Number of students registered:** 76

**Course representatives:** Joseph Binns, Felipe Abedrapo

**Grades:** U (3), G (31), VG (22).

### Analysis

#### I. Summary of the course evaluations

Total number of responses: 28

General: Overall the students were satisfied (grade 3.7) with the course, and they felt that they learnt at a good degree the material and that they had the prerequisite knowledge to be proficient in the course. Some student expressed the wish to go back to the lecture hall, not being able to separate between home and studies. Also, long hours in front of the computer and staying focused during long lectures is hard for both for tiredness and concentration. The student's advice is that all lectures should be recorded. The students had no or little use of the course textbook. However, there were large spreads in many answer distributions, and the answer frequency was about 36% of the registered students. As a consequence, it not easy to tell whether the answers are fully representative for the course.

Lectures: Ross' lectures were considered by all students highly positively: clear structure, coherent lectures, nice flow, good pace, easy to follow and easy to take notes. In particular, the recording of Ross' lectures was highly appreciated, something that was missing in Claudio's lectures. Claudio's lectures reported an only-slightly positively average score, and the lack of recorded lectures was overall considered negatively. However individual student's scores and comments widely ranged from highly negative to highly positive. On the negative side, the lectures were found by some not to be very organised, with a not easily discernible learning goal, with too much mathematics, and difficult handwriting on tablet and lecture notes (some students suggested that the lectures should be typeset in Latex). On the positive side, the lectures were judged good or very good with good explanations, Claudio's style was found highly engaged, his clickers session were a good summary of the topic, and the use of a tablet rather than a lecture based on slides was found useful to take notes and follow the content.

Labs: Students found the labs successful and enjoyed them, also in this case they provided a spectrum of opinions. The computer lab was felt by some to be not fully connected to the course, but many others found it highly useful, in perfect

sync with the course, and very enjoyable. Similarly, for the experimental lab some students found the reports difficult to realise, but many others thought this lab was very clear and very well executed.

Hand-ins, exercises, SI: Hand-ins (they bring 10% bonus score to the final grade) and exercises (and the relative sessions) were found hard, but overall useful for a better understand of the content of the course. The hand-ins were found by some to match better than the exercises the content of the course. It was suggested that the latter should be closer to the course topics. Many students would have liked to have a detailed correction of hand-ins and exercises. The SI sessions were found enjoyable and useful by those (not many) who attended.

Exam: The structure of the exam was highly appreciated, and considered appropriate for the pandemic. Some students suggested the exam should be longer and monitored in the written part. The oral part was appreciated, where one could discuss more. Some students found the exam very hard, but many found it of the right level of difficulty, and that it reflected the content of the course. Finally, it was suggested that the outcome of a short exam could be somehow accidental, depending if you know the answer or not of the selected topic.

Online study environment: Some students liked the present course setup, since an online study environment gives a more flexible way to study, as long as the course material (lectures, exercises, important information) is available through Canvas. Other expressed dissatisfaction, hoping to get back soon to a lecture hall. In particular, for some it was harder to be focused at home (for example, in front of a video) than in the lecture hall. But it was also pointed out that with good enthusiasm from the lecturer, pre-recorded lectures, and also sharp 3\*45 min lectures with 15-minute breaks this can become easier to accomplish. Also, remote online labs were considered not a completely satisfactory replacement of the real on-campus labs, because the hands-on experience with manipulating machines is lacking.

## **II. Comments and reflections from the teachers**

The teachers felt that the course went rather well, but of course there are aspects that need further consideration. The students have raised a number of important points, and these will be considered more in detail in section IV below. However, in considering possible modifications to the course, one should take into account that i) significant changes have already been introduced in the new version (with a new-code FYSB23) of the course, that will start in the Fall semester of 2021 ii) some of the suggestions provided by the students refer to aspects in the course that are specific to the remote-learning instalment, and so hopefully destined to be not so relevant when the pandemic emergency is over. In a more general perspective, it is also interesting to consider the actual structure of the course and the specific time at which it comes in the students' education. Concerning this point, Statistical Mechanics is a challenging subject, and both its formal aspects and some applications are discussed in the course. The course is traditionally considered to be hard by the students and naturally a more surface/descriptive learning approach could be adopted, where basic principles/equations are simply reported (instead to be at some extent derived within a conceptual framework) and extensively applied to different concrete examples. The key point is that the course is not only providing tools to the students, but al-

so the "reference frame" of a new ("statistical") way of thinking of physics. The same issue in principle presents itself in quantum mechanics FYSB11, but the students are already accustomed, at least qualitatively, to the conceptual difference between quantum and classical mechanics. It is also true that the course presents at this time three basic structural hurdles to the students: 1) it comes too early for the student's level of education. 2) It has a significant dichotomy between the abstract concepts given in the lectures on the basic statistical mechanics part, and those in the astronomy part which are far richer in applications. In addition, and specifically for the remote-teaching part of the course version: 3) only one part of the lectures is currently recorded, and this unavoidably induces a contrast between the two subsets of lectures.

### **III. Evaluation of changes since last time the course was given**

Since last time the course was given the major change has been the arrival of a new teacher for the astronomy part, namely Ross Church. Students were highly appreciative of Ross Church's lectures. The other notable change has been the use of a tablet writing device in Claudio Verdozzi's lectures; this was seen by many as a good novelty (but not by those who had problems with due Claudio's handwriting). Replacement of teachers occurred also for exercises sessions, the experimental lab and the SI; these changes had positive feedback.

### **IV. Suggestions for modifications and measures until the next time the course is given**

Many of the students' observations, criticisms and suggestions refer to elements of the course that are specific of online study environment. We will address these in case the online teaching continues. If the comments apply also outside online teaching, this will be specified.

For online study, one of the most important aspect considered by the students was the recording of all the lectures. Recording all lectures, and at the same time to comply with the accessibility directive requirements (specifically, by introducing subtitles for all the mathematical terms, expressions, etc.) would require a truly very great deal of time. This point is currently being under consideration, but no concrete course of action has been concretely considered yet.

For the labs, we plan to take no action if the online study continues.

It has been suggested that the online exam should be made longer, and less challenging: Just before the pandemic period, the exam was only written and 4 hours long. The present written exam is 90 minutes long, and contains about one-third of the original "amount" of questions, and is of a level consistent with the longer exam. So, if the pandemic emergency continues, no changes will be introduced. Even from the short, written exam, it is always possible for the examiners to ascertain the level of knowledge of the students. For on-campus teaching, we will go back to the normal written exam.

The students asked to have the exercises solutions posted after the sessions, but so far only the answers (i.e. not the full solutions) have been made available to

them during the course. Nevertheless, the teachers, based on their own experience, do not plan to offer the solutions, since not all students go the exercise sessions; thus, trying one's own solution to the problems becomes less motivating when solutions are available beforehand. The teacher will however recommend the students to attend the exercise sessions, where the solutions will be presented.

*Remarks for both online and on-campus teaching*

Concerning the book, we are actually currently examining a new book. At the same time, students suggested to typeset the lecture notes. We are currently doing this.

For Claudio's lectures, the course material is spread over four sources. However, at the beginning of the course it is always clearly stated that the lecture notes represent the primary source of reference, and they reflect very closely the material presented in the lectures, and the other three sources provide support information. On the other hand, such complementary material provides a valuable resource for deepening the subject, and a complementary perspective. This point does not seem to be entirely grasped by a number of students; thus, we will stress even further and repeatedly that the lecture notes are the baseline material for the course (in principle enough to read the course) and that, already at the start of the course, there is a "roadmap" document which establishes in detail connections between the material in the lecture notes and the additional reference sources.

The possibility of having "clicker" checkpoints and class feedback during the lectures themselves, aiming to assess "in real time" the status of learning, will be considered. Better handwriting, either on a tablet or at the blackboard, will be attempted in Claudio's lectures.

Finally, the two lecturers are currently exploring ways to try to tie the astronomy material back more to the first part of the course.

2021-03-11, this course analysis has been put together by Claudio Verdozzi and Ross Church and shared with the course representatives.

*The course analysis is sent by e-mail to the assistant director of studies at the latest on March 15: [jan.knudsen@maxiv.lu.se](mailto:jan.knudsen@maxiv.lu.se)*