List of final projects/problems (1-3 students)

The projects must have a clearly written introduction (up to 5 pages) on the topic or topics and the solution of the corresponding problems, when applicable. All sections and problem numbers refer to the textbook.

The written projects should be handed in at least one week before the end of the term.

1. Primordial element formation (exercise BT 4.10) one student (Lucas Silva)
2. Bose-Einstein condensation (sec 4.9 and exercise BT 4.12) up to two students who did not take a SM course previously (Pedro Melo e Tomás Pinto)
3. Thermodynamics & SP of Black Holes (sec 4.10.2 and exercise BT 4.16) up to three students (Catarina Ferreira e Henrique Eira)
4. Structure formation in the expanding Universe (sec 4.10.3 and 4.10.4) up to two students (Maria Lourenço e José Carmelo)
5. Derivation of Landauer’s theorem (exercise BT 4.21) one student (Sara Durão)
6. Grand canonical ensemble for a classical relativistic perfect gas (exercise BT 5. 3) one student (Loumi Gatouillat)
7. Electron-positron equilibrium at low temperatures (exercise BT 5.9) one student (Daniel Cruz)
8. Out-of-Equilibrium Gibbs Potential for Water: Surface Tension and Nucleation (exercise BT 5.14 – adapted from Sethna ex. 11.13) up to two students (Helder Esteves e Carolina Ribeiro)
9. Diffusion (exercises BT 3.17 and 6.3) up to two students (Eduardo Caetano)
10. Random walk and central limit theorem (exercise BT 6.4) one student (Débora Mendes)
11. Discussion and proof Doob’s theorem (exercise BT 6.5) up to two students (Mafalda Nunes e Margarida Ferreira)
12. The Wiener-Khintchine theorem (Proof and exercises BT 6.6. and 6.7) up to three students (Timothee Belime, Pedro Batista e Santiago Costa)
13. Types of filters (exercise BT 6.9) one student (Tiago Barreiro)
14. Brownian motion sec 6.7.2 (exercise BT 6.10) one student (Matilde Dorelli)
15. Filters sec 6.7.3 (exercises BT 6.11 and 6.12) up to two students
16. Shot noise sec 6.7.4 (exercises BT 6.14 and 6.15) up to two students (Madalena Gamboa e Luis Barroso)
17. FD theorem (exercise BT 6.8.2) one student (Matteo Falcionni)
18. FP equation (exercises BT 6.21 and 6.22) up to two students
19. FP equation (exercise BT 6.23) one student (Tomás Henriques)
20. Smoluchowski equation for active Brownian particles (Guilherme Amaral e João Silva)
21. You can suggest a topic of your own choice, from chapters 3-6 of BT, not dealt with in detail during the classes. You have to submit an outline of your chosen topic (title and a 5 line index, with references) for approval. One student per topic.