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Proseminar on Theoretical Physics for students of the physics Bachelor programme Summer Term 2021

The seminar will require students to read an academic paper selected from the list below and to present a 30 minutes seminar on the subject. The aim of the seminar will be to familiarize students with scientific research literature, and to develop their comprehension and communication skills. All articles are taken from the American Journal of Physics, and are available on-line through the subscription of the SLUB.

The following talks are from the field of classical mechanics:

- M1. "Probability, geometry, and dynamics in the toss of a thick coin", E. H. Yong and L. Mahadevan, Am. J. Phys. 79, 1195 (2011).
- M2.** "The domino effect", J. M. J. van Leeuwen, Am. J. Phys. 78, 721 (2010).
- M3. "Oscillations of a candle burning at both ends", S. Theodorakis and K. Paridi, Am. J. Phys. 77, 1049 (2009).
- M4. "Mechanics of two pendulums coupled by a stressed spring", M. Maianti, S. Pagliara, G. Galimberti, and F. Parmigiani, Am. J. Phys. 77, 834 (2009).
- M5. "Motion of a hexagonal pencil on an inclined plane", A. Rezaeezadeh, Am. J. Phys. 77, 401 (2009).
- M6. "A block slipping on a sphere with friction: Exact and perturbative solutions", T. Prior and E. J. Mele, Am. J. Phys. 75, 423 (2007).
- M7.** "Fun with stacking blocks", J. F. Hall, Am. J. Phys. 73, 1107 (2005).
- M8. "Impact of a ball on a surface with tangential compliance", R. Cross, Am. J. Phys. 78, 716 (2010).
- M9.** "Anti-Newtonian dynamics", J. C. Sprott, Am. J. Phys. 77, 783 (2009).
- M10. "Spinning eggs - which end will rise?", K. Sasaki, Am. J. Phys. 72, 775 (2004).
- M11. "Reinventing the wheel: Hodographic solutions to the Kepler problems", D. Derbes, Am. J. Phys. 69, 481 (2001).
- M12. "Constants of the motion for nonslipping tippe tops and other tops with round pegs", C. G. Gray and B. G. Nickel, Am. J. Phys. 68, 821 (2000).
- M13. "The libration limits of the elastic pendulum", D. M. Davidović, B. A. Aničin, and V. M. Babović, Am. J. Phys. 64, 338 (1996).
- M14.** "Remarkable shapes of a catenary under the effect of gravity and surface tension", F. Behroozi, P. Mohazzabi, and J. P. McCrickard, Am. J. Phys. 62, 1121 (1994).
- M15. "Thomas precession: Where is the torque?", R. A. Muller, Am. J. Phys. 60, 313 (1992).
- M16. "Ball moving on a stationary or rotating horizontal surface", J. Gersten, H. Soodak, and M. S. Tiersten, Am. J. Phys. 60, 43 (1992).

- M17.** “Isynchronous motion in classical mechanics”, E. T. Osypowski and M. G. Olsson, Am. J. Phys. 55, 720 (1986).
- M18.** “Nonrelativistic contribution to Mercury's perihelion precession”, M. P. Price and W. F. Rush, Am. J. Phys. 47, 531 (1979).

The following talks are from the field of electrodynamics, they are suitable starting from the 5th (4th) semester:

- E1. “Is the electrostatic force between a point charge and a neutral metallic object always attractive?”, M. Levin and S. G. Johnson, Am. J. Phys. 79, 843 (2011).
- E2. “Point charge dynamics near a grounded conducting plane”, K. L. Haglin, Am. J. Phys. 78, 1190 (2010).
- E3. “On the stability of electrostatic orbits”, S. Banerjee, B. Taylor, and A. Banerjee, Am. J. Phys. 77, 396 (2009).
- E4. “The charge distribution on a conductor for non-Coulombic potentials”, D. J. Griffiths and D. Z. Uvanović, Am. J. Phys. 69, 435 (2001).
- E5. “Infinite resistive lattices”, D. Atkinson and F. J. van Steenwijk, Am. J. Phys. 67, 486 (1999).
- E6. “The flow of electromagnetic energy in the decay of an electric dipole”, H. G. Schantz, Am. J. Phys. 63, 513 (1995).

Topics with a **bold** label have already been assigned to participants.

Course Structure and Aims

The course will start on **April 16th** and will run the whole semester with a break on May 26th. It will run in the 6th teaching period (**4:40 pm**) on Wednesdays. The assigned room is **BZW A120**, most probably it will run on-line via **Jitsi.tu-dresden.de**.

In the first week I will give a discussion on how to present a scientific talk, and how to read a scientific paper. I will also give a demonstration seminar on the paper “The inertia tensor of a magic cube” by A. Rogers and P. Loly, Am. J. Phys. 72, 786 (2004).

In the following weeks each student will give a seminar. One student will give a seminar each week. I will meet privately with the students on the Wednesday one week before their talk after the seminar, or other time/date on mutual agreement. The aim of this meeting is to discuss remaining questions on the paper, and also to listen to a first draft of the talk so that feedback can be given to the student to improve their presentation. The first student presentation will be on **April 28th**, the first consultation on April 21st.

The students should not simply recite the paper in their talks. Rather, comprehension of the work must be shown by discussion of the aims, methods, and results of the paper, and critically evaluating the appropriateness of the author's treatment of the problem. The students may also need to consult further literature to understand the context and significance of the work. Students must be prepared to answer questions from the audience on the paper.

The seminar is not to be a passive experience for the audience. I expect that **all students will read the paper for each talk**, so that they can ask questions to the speaker at the end for a period of no more than 20 minutes. If outstanding questions remain, I will lead a discussion of the paper in the remaining time.

Please contact me preferably by email. Please send your (ranked) preference for up to **3 topics** until **April 12rd**. Registration will be done **first-come-first-serve**

I thank Mr. Philip M.R. Brydon, Ph.D. for valuable help in preparing this course.