

Experimental search for dark matter
- COURSE SYLLABUS

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| 1. | Course title: <i>Experimental search for dark matter</i> |
| 2. | Lecturer: <i>Marcin Kuźniak and Masayuki Wada</i> |
| 3. | Field, type and level of studies, year of study: <i>astroparticle physics, experimental physics, all years of study</i> |
| 4. | Course character: <i>monographic lecture</i> |
| 5. | Teaching method: <i>hybrid (traditional and on-line)</i> |
| 6. | Language: <i>English</i> |
| 7. | Course type and number of hours: <i>lecture, 24h</i> |
| 8. | Estimated load of student's independent work: <i>10h</i> |
| 9. | Total workload and number of ECTS points: <i>34 h, 3 ECTS</i> |
| 10. | Short description and main focus of the course: <i>This lecture provides an overview of dark matter, including the evidence from cosmological observations, possible candidates (axions, WIMPs, primordial black holes, heavy sterile neutrinos, modified gravity), and the motivations behind its study in physics. The landscape of current experimental results will be discussed, including direct, indirect and collider searches. We will delve in more detail into the methods of detection: expected signatures of dark matter events, detector technology, challenges of direct detection including background mitigation, and basics of analyzing data in direct dark matter detection experiments.</i> |
| 11. | References: <i>TASI Lectures on dark matter http://www-hep.colorado.edu/~degrand/Tasi/dark.html</i> |
| 12. | Prerequisites: <i>Basic level of particle physics, quantum field theory, and physics in general</i> |

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| 13. | Educational outcomes: | <u>PQF level 8 codes:</u> |
| | <i>Knowledge: Basic knowledge about dark matter, dark matter candidates and experimental side of dark matter searches.</i> | <i>P8S_WG</i> |
| | <i>Practical Skills: Students are able to understand the most important challenges and limitations of dark matter searches. They are able to derive the basic formula for predicting the rate of dark matter interactions in the detector, and understand the statistical data analysis process leading to the extraction of results.</i> | <i>P8S_U, P8S_UK</i> |
| | <i>Social Skills: Students are ready to discuss this topic with experts in the field. They have basic knowledge to present the importance and motivation for this type of research.</i> | <i>P8S_K</i> |
| 14. | Evaluation of the educational outcomes: | |
| | <i>a final written exam</i> | |
| 15. | Criteria to complete the course: | |
| | <i>at least 80% attendance, final grade depends on the evaluation of the final exam</i> | |
| 16. | Contact with the lecturer: | |
| | <i>Masayuki Wada at masayuki@camk.edu.pl, Marcin Kuźniak at mkuzniak@camk.edu.pl, office: ul. Rektorska 4, room 5.38, consultation hours: Tue. 3-6 pm</i> | |