Study program	Level of studies		**Third cycle**	
	Title of the study program		**Doctoral studies in physics**	
Course title	**MOLECULES IN THE LASER FIELD**			
Course ID	Semester	Course status	ECTS credits	Teaching hours
PTH7061	**I /II**	**Elective**	**10**	**30**
Course aims and expected learning outcomes	**Introduction to important concepts in the interaction of molecular systems and a strong laser field. Familiarization with the quantum-mechanical models by which we describe the mentioned interactions. Mastering the concepts and mathematical apparatus of strong-field molecular approximation and molecular low-frequency approximation.**			

COURSE CONTENT

Quantum mechanical description of molecules. Electronic, vibrational and rotational energy states.
Symmetry. Basic molecular processes in a strong laser field and their geometry.
Above threshold (higher order) ionization. (Improved) strong-field molecular approximation.
Molecular low-frequency approximation.
Analysis of molecular spectra. Interference effects.
Effects of phase, laser pulse duration and ellipticity on molecular spectra.
Future research perspective.

LITERATURE

- S. H. Lin, A. A. Villaeys, and Y. Fujimura, *Advances in Multi-Photon Processes and Spectroscopy, Volume 19,* World Scientific, Singapore, 2010.

- P. W. Atkins and R. S. Friedman, *Molecular Quantum Mechanics*, Third Edition, Oxford University Press, Oxford, 1997.

- I. N. Levine, *Quantum Chemistry*, Fifth Edition, Prentice-Hall, Upper Saddle River, New Jersey, 2001.
- D. B. Milošević, *Strong-field approximation for ionization of a diatomic molecule by a strong laser field*, Phys. Rev. A **74**, 063404 (2006).

- A. Szabo and N. S. Ostlund, *Modern Quantum Chemsitry-Introdution to Advanced Electronic Structure Theory,* First Edition, Revised, Dover Publications, NewYork, 1996.

ASSESSMENT OF LEARNING

Assessment Method	Points
Homework	30
Seminar paper	30
Final exam	40
Total	100

Remarks