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|  **UNIVERSITY OF NIŠ** |
| **Course Unit Descriptor** | **Faculty**  | **Faculty of Sciences and Mathematics** |
| **GENERAL INFORMATION** |
| Study program  | **Mathematics** |
| Study Module (if applicable) |  |
| Course title | **Atomic and Molecular Physics** |
| Level of study | [ ] Bachelor [x]  Master’s [ ]  Doctoral |
| Type of course | [x]  Obligatory [ ]  Elective |
| Semester  |  [ ]  Autumn [x] Spring |
| Year of study  | First |
| Number of ECTS allocated | 6 |
| Name of lecturer/lecturers | Ivan Mančev |
| Teaching mode |  [x] Lectures [ ] Group tutorials [ ]  Individual tutorials [ ] Laboratory work [ ]  Project work [ ]  Seminar [ ] Distance learning [ ]  Blended learning [ ]  Other |
| **PURPOSE AND OVERVIEW (max. 5 sentences)** |
| Atomic and molecular physics is of fundamental importance in an education in physics. To start with, it is the most direct, concrete application of quantum mechanics. Thus, it promotes the understanding of, and concretizes the importance of quantum mechanics. Moreover, fundamental atomic and molecular structure is the basics for all that we know about matter. In order to understand e.g. condensed matter, nuclear physics and particle physics, one must first learn the basics in atomic and molecular physics. Included in the course will be fundamental atomic and molecular structure. Systems will be treated with an increasing level of complexity.  |
| **SYLLABUS (brief outline and summary of topics, max. 10 sentences)** |
| **1. One-electron atoms:** fine structure, hyperfine structure and interactions with external electric and magnetic field. **2. Two-electron atoms:** Para and orthohelium. Ground and excited states. Double excited states. Auger effect Resonance**. 3.** **Multi-electron atoms:** Spectra of the alkali metals**.** The Hartree-Fock SCF method. Thomas-Fermi models of atoms. Periodic table Hund’s rules. **4. Interactions of the multi-electron atoms with electromagnetic. 5. Atomic collisions:** Basic concepts. Electron-electron and atom-atom collisions. **6. Some applications of atomic physics.** **7. Physics of molecules:** General nature of molecular structures. Adiabatic approximation.  . The theory of chemical bonds. Classifications of the electronic terms. Symmetry of the molecules. The spectra of the molecule. [Franck](https://en.wikipedia.org/wiki/James_Franck)–[Condon](https://en.wikipedia.org/wiki/Edward_Condon) principle. |
| **LANGUAGE OF INSTRUCTION** |
| [x] Serbian (complete course) [ ]  English (complete course) [ ]  Other \_\_\_\_\_\_\_\_\_\_\_\_\_ (complete course)[ ] Serbian with English mentoring [ ] Serbian with other mentoring \_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **ASSESSMENT METHODS AND CRITERIA** |
| **Pre exam duties** | **Points** | **Final exam** | **points** |
| **Activity during lectures** | **10** | **Written examination** | **30** |
| **Practical teaching** |  | **Oral examination** | **40** |
| **Teaching colloquia** | **20** | **OVERALL SUM** | **100** |
| **\*Final examination mark is formed in accordance with the Institutional documents** |