



UNIVERSIDADE FEDERAL DE SANTA CATARINA
School of Physical and Mathematical Sciences
Graduate Program in Physics
Cx. Postal 476, 88040-900, Florianópolis (SC), Brazil
Phone: +55 48 3721-2308
E-mail: ppgfsc@contato.ufsc.br
<https://ppgfsc.posgrad.ufsc.br/>



Introduction to Nuclear and Hadron Physics

Course code: FSC410138

Credit hours: 4

Duration: 18 weeks

DESCRIPTION: Introduction to fundamentals properties and models of atomic nucleus. Introduction to the concepts of quantum field theories and elementary particles physics. Introduction to nucleon-nucleon interactions and hadronic models involving mesons and quarks. Development of recent topics of research.

COURSE CONTENT:

1. Atomic nucleus: basic properties and their constituents.
2. Nuclear phenomenology: size and shape of the nucleus. Radioactivity: alpha, beta, and gamma decays. Nuclear masses, semi-empirical mass formula, nuclear matter.
3. Phenomenology and properties of nuclear force.
4. Nuclear models: nuclear spectroscopy. Shell model, pairing and spin-orbit interaction. Fission and fusion.
5. Fundamental interactions: introduction to relativistic quantum mechanics and quantum field theory. Introduction to elementary particles, their symmetries and conservation laws. Introduction to quantum chromodynamics and standard model.
6. Mesonic theory of nuclear force.
7. Effective models: relativistic and non-relativistic mean-field hadronic models. Quarks models (Nambu-Jona-Lasinio, sigma model, etc).
8. Advanced topics: current developments in nuclear and hadron physics.

BIBLIOGRAPHY:

1. W.S.C. Williams, *Nuclear and Particle Physics*, Oxford University Press, 1991.
2. J. D. Walecka, *Theoretical Nuclear and Subnuclear Physics*, World Scientific, 2004.
3. M. E. Peskin and D. V. Schroeder, *An Introduction to Quantum Field Theory*, CRC Press, 2018.
4. D. Griffiths, *Introduction to Elementary Particle Physics*, Oxford University Press, 1991.
5. M. Thomsom, *Modern Particle Physics*, Oxford University Press, 2013.
6. U. Mosel, *Fields, Symmetries and Quarks*, Springer, 2nd Ed., 1999.
7. Related articles.