Topics of the Lectures

M. Aliotta

Introduction to experimental nuclear astrophysics;
Resonant and non-resonant cross sections, Gamow peak, S-factor, stellar reaction rates, rp-process, s- and r-process, X-ray bursts; stable and radioactive beam experiments, direct and indirect approaches, underground measurements

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T. Aumann

Experiments with high-energy radioactive beams;
Exotic nuclei and exotic structures, radioactive beam physics, reaction mechanisms

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P. Bortignon

Microscopic treatment with effective interactions; many-body methods: HF, RPA, Dynamical Shell Model, Second RPA; Elementary modes of excitations in exotic nuclei

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D. Baye

Microscopic cluster description of collisions;
R-matrix theory, clusters, antisymmetrization, forbidden states, resonating-group method

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H. Feldmeier

Introduction to quantum many-body theory, variational principle, second quantization, realistic and effective nucleon nucleon interactions, correlations

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R. Diehl

Observational High-Energy Astrophysics

P.v. Isacker

Collective nuclear structure models; nuclear rotations and vibrations, geometric and algebraic collective models, pairing and quadrupole collectivity in the shell model

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R. Johnson

Two-and three-body models of direct nuclear reactions,
scattering theory, P`s and Q´s, relation between few- and many-body theory, optical models, transfer reactions and nuclear structure, overlap functions, deuteron break-up.

G. Martinez Pinedo

Theoretical nuclear physics input for explosive nucleosynthesis; nucleosynthesis in neutrino heated matter: The vp-process and the r-process; sensitivity to the nuclear input and astrophysical conditions.

T. Neff

Ab initio nuclear structure models, effective low-k nucleon-nucleon potentials, UCOM, SRG, exotic structures in nuclei, Fermionic Molecular Dynamics.

B. Meyer

Nucleosynthesis, nuclear network calculations, static burning, statistical mechanics, detailed balance, entropy; explosive nucleo-synthesis, supernovae, equilibrium, reaction freezeout, r-process

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F. Nunes

Classification of reactions, motivation for the various types of reactions, examples with data, bound states versus scattering states; SF, ANC, delta, S-matrix, resonances, virtual states; scattering theory, optical potential, Lippmann Schwinger equation, PWBA, DWBA

T. Otsuka

E. Rehm

Experimental techniques in nuclear astrophysics;
direct and indirect techniques to measure reaction rates, masses and half-lives

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H. Schatz

Open questions and experimental approaches in nuclear astrophysics; Experimental techniques to study r-process nuclei, sensitivity of the r-process to nuclear physics with practical exercises, experimental approaches for X-ray bursts and neutron star crusts

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J. Tostevin

Coupled channels methods and breakup, higher energy approximation schemes, reaction and removal cross sections, reactions/structure interface, spectroscopic applications

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S. Typel

Nuclear matter equation of state, thermodynamics, relativistic mean-field model, nuclear matter parameters, astrophysical application

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A. Vitturi

Sub-barrier fusion reactions; ion-ion potentials, one-, multi-dimen-sional barrier penetration, coupled-channels approaches, fusion with

weakly-bound systems, S-factors, role of breakup: clustered and exotic nuclei, fusion hindrance at very-low bombarding energies

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R. Zegers

Charge-exchange reactions at intermediate energies, weak transitions, reaction theory, applications, supernovae

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