

WORKSHOP SUMMARY AND CONCLUSIONS

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GANIL/FUSTIPEN Workshop

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GANIL/FUSTIPEN Workshop, March 14-18, 2016

Future Directions for Nuclear Structure and Reaction Theories

Major Topics and Themes

I. Experimental Nuclear Physics

Lambda hypernuclei: Large CSB confirmed. Can $4n$ form a cluster state? Most neutron-rich B & C isotopes. Need better understanding of 3NF and new reaction theories. Continuum proton and neutron rich on the way to FAIR.

II. NN + NNN (+NNNN) Interactions/Pionless EFT

New gen of NN & NNN interactions (precision); importance of 3N forces, evidence for 3NF effects, Chiral NN potential up to N4LO. Uncertainty quantification, regulators, cutoffs, power counting, RG invariance. Pionless EFT. N2LO_sat. LECs from pion-N scattering data.

III. Nuclear Many-body Techniques: Nuclear Structure

Beyond classical SR and MR EDF schemes: Ab initio many-body approaches for mid-mass nuclei, Symmetry breaking & restoration, predictive power, PoST, DFT in NCCI; NCSM/CC/IM-SRG-->SSM(A-dependence), calc of other physical operators. Large-scale SM calc with realistic effective Hamiltonians.

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IV. Many-body Nuclear Techniques: Nuclear Reactions

TD-DFT for reactions, Ab initio NCSM+C for fusion reactions, Microscopic Optical Potentials from CC calc. Single nucleon transfer reactions in NCSM/RGM. Nuclear contact and photoabsorption cross section.

V. The Continuum/Open Quantum Systems

Bound and unbound states of nuclei within the NCSM-C. NCGamowSM

VI. Other Topics

1. Nuclei, quantum entanglement and qubits.
2. Is there a crisis in nuclear-matter theory?

Our thanks to all participants for your contributions to this workshop and for making it so successful. Have a safe trip home.

Bruce and Marek

GANIL/FUSTIPEN Workshop, March 16-20, 2015

New Directions in Nuclear Structure and Reaction Theories

Major Topics and Themes

I. Experimental Nuclear Physics

GSI/FAIR: New data on the horizon, the continuum, proton & neutron rich
Bulk properties, F and Ni isotope chains, NUSTAR

II. NN + NNN (+NNNN) Interactions/Pionless EFT

Better NN & NNN interactions (precision); importance of 3N forces,
looking for 3NF effects, Chiral NN potential up to N4LO

Error quantification, regulators, cutoffs, power counting, RG invariance
Pionless EFT/EFT for Lattice Nuclei

III. Nuclear Many-body Techniques: Nuclear Structure

Beyond present state of the art: Convexity of energy surfaces, lambda hypernuc

Beyond the mean field: 2ndRPA, EFT techniques, 5 Dim-Coll Hamiltonian

Symmetry restored CC Theory, NCSM-->SSM, non-local EDF, NC-CI, Many-
body propagator theory, rotational bands from NC-CI, TDHF+BCS,

Resonances with EFT potentials (LIT)

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IV. Many-body Nuclear Techniques: Nuclear Reactions

TDDFT for reactions, *Ab initio* NCSM+C for fusion reactions

V. The Continuum/Open Quantum Systems

Gamow Shell Model, NCGamowSM, Complex energy formalism

