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## **21st International Conference on Few-body Problems in Physics**

May 18-22, 2015

Crowne Plaza Metro, Chicago, IL

### Sunday, May 17

4 pm-7 pm Registration open

### Monday, May 18

8-10 am Registration open

8:50 am

*Welcome*

C. Roberts (Argonne)

R. Janssens (Argonne)

9-10:30 am *Lasers for Few-body Physics*

Chair: D. Phillips (Ohio)

S. Jochim (Heidelberg) "Few-body physics with ultracold atoms"

J. Frenje (MIT) "High Energy Density Plasmas for studies of Basic Nuclear Science and Nuclear Astrophysics"

W. Noertershaeuser (TU, Darmstadt) "Laser Spectroscopy of Few-Electron Systems at the Extremes: Structure of Light Nuclei and QED in Strong Fields"

10:30-11 am Coffee break

11 am-12:30 *From Mesons to Hypernuclei*

Chair: C. Roberts (Argonne)

J. Dudek (Old Dominion/JLab) "Hadron resonances from QCD"

W. Detmold (MIT) "Properties of light nuclei from lattice QCD"

E. Hiyama (RIKEN) "Recent progress of hypernuclear physics"

12:30-2 pm Lunch break

2-3:50 pm Parallel sessions:

*Salon A: Continuum QCD* (Chair: Roberts)

L. Chang (Adelaide) "Pion electromagnetic properties in continuum QCD"

D. Binosi "From continuum QCD to hadron observables"

B. El-Bennich "Flavorful Hadron Physics"

E. Rojas "Insights into the quark-gluon vertex from lattice QCD and meson spectroscopy"

R. Williams "Confronting hadron phenomenology with the quark-gluon vertex"

*Salon B: Extracting three-nucleon forces* (Chair: Epelbaum)

K. Sekiguchi (RIKEN) "Recent results on deuteron-proton scattering"

R. Skibinski "Recent developments in the study of 3N systems within the new chiral forces."

I. Ciepal "Experimental Studies of Coulomb-Force Effects in dp breakup at Medium Energy"

B. Klos "Experimental study of Three-Nucleon Dynamics in the dp breakup reaction"

Y. Maeda "Study of 3NF effects at the intermediate energies by pd breakup measurements"

Salon C: Few-body universality from atoms to nuclei (Chair: Hammer)

- M. Ueda (Tokyo) "Relationship between the Onset of the Limit Cycle and the Universal Three-Body Parameter in Efimov Physics"
- L. Khaykovich "Universal Loss Dynamics in Unitary Bose Gas"
- P. Naidon "Scattering of universal fermionic clusters"
- A. Kievsky "Weakly bound state with spin-isospin symmetry"
- N. Barnea "The nuclear contact and the photoabsorption cross section"

Salon D: Light nuclei in astrophysics (Chair: Brune)

- B. Davids (TRIUMF), "Astrophysical reactions of light and intermediate mass nuclei"
- X. Zhang "How well do we understand  $7\text{Be} + p \rightarrow 8\text{B} + \gamma$ ? An EFT perspective"
- J. Dohet-Eraly "Towards an ab initio description of light-nuclei radiative captures"
- H. Masui "Deuteron-like correlation of valence nucleons for the  $T = 0$  channel in  $^{18}\text{F}$ "
- S. Ishikawa "Low-lying  $^{12}\text{C}$  continuum states in three- $\alpha$  model"

3:50-4:20 Coffee break

4:20-6:10 Parallel sessions:

Salon A: Pions and Resonances (Chair: Mokeev)

- M. Doering (George Washington) "Baryon spectroscopy: new results and perspectives"
- E. Biernat "Quark model with chiral-symmetry breaking and confinement in the CST"
- B. Liu "Few-body methods and results for hadrons in medium"
- W. Schweiger "The Pion-Cloud Contribution to the Electromagnetic Nucleon Form Factors"
- Y. Tian "Exclusive  $\pi$ -Electroproduction off the Neutron in Deuterium in the Resonance..."

Salon B: Two-photon physics (Chair: McGovern)

- M. Ahmed (North Carolina Central) "Photon-Induced Reaction Studies at the High Intensity Gamma Ray Source (HIGS) for  $A = 3$  to  $16$ "
- L. Myers "Recent Deuteron Compton Scattering Results and ... Neutron Polarizabilities"
- H. Griesshammer "News on Deuteron and  $^3\text{He}$  Compton Scattering in Chiral EFT..."
- M. Distler "Inclusive electron scattering on light nuclei: constraining the two-photon..."
- M. Miorelli "Electric dipole polarizability: from few- to many-body systems"

Salon C: Unequal masses and the Super-Efimov effect (Chair: Ueda)

- E. Kuhnle (Heidelberg) "Efimov physics in an ultracold Bose-Fermi mixture of  $^{133}\text{Cs}$  and  $^6\text{Li}$ "
- J. Johansen "Efimov Physics in a  $^6\text{Li}$ - $^{133}\text{Cs}$  Atomic Mixture"
- S. Endo "Third virial coefficient of a two-component unitary Fermi gas across..."
- S. Moroz "Super Efimov effect and its extension to mass imbalanced systems"
- Z. Yu "Revealing the origin of super-Efimov states in the hyper-spherical formalism"

Salon D: Fusion reactions and Inertial Confinement Fusion plasmas (Chair: Frenje)

- D. Sayre (Livermore) "Measurement and Analysis of the T+T Neutron Spectrum from ICF"
- G. Hale "Spectra for the  $A=6$  reactions calculated from a three-body resonance model"
- A. Bacher " $T(t,2n)^4\text{He}$  Reaction: energy dependence of its mechanism"
- C. Romero-Redondo "Advances in the ab initio description of nuclear three-cluster systems"
- C. Parker "The  $3\text{H}(d, \gamma)$  Reaction at  $E_{c.m.} \leq 300$  keV"

Tuesday, May 19

9-10:30 am *Recent progress in Efimov physics*

Chair: D. Blume (Washington State)

S.-K. Tung (Chicago) "Geometric scaling of Efimov states in ultracold  $^6\text{Li}$ - $^{133}\text{Cs}$  mixtures"

D. Kang (Los Alamos) "How to extract two- and three-body contacts"

N. Zinner (Aarhus) "Exploring the few- to many-body crossover using cold atoms in 1D"

10:30-11 am Coffee break

11 am-12:30 *Nuclei as few-body systems*

Chair: E. Garrido (Madrid)

M. Freer (Birmingham) "Clustering in light nuclei"

H.-W. Hammer (TU, Darmstadt) "Few-body universality in halo nuclei"

S. Quaglioni (Livermore), "Ab initio calculations of reactions with light nuclei"

12:30-2 pm Lunch break

2-3:50 pm Parallel sessions:

Salon A: Distribution functions (Chair: Arrington)

J. Roche (Ohio) "Precision studies of the DVCS process at JLab"

H. Moutarde "Overlap Representation of GPDs in the Dyson-Schwinger Formalism"

J. Rodriguez "A DSE-inspired approach for the computation of the pion's ..."

H.-M. Choi "Light-Front Quark Model Phenomenology Consistent with Chiral..."

E. Pace "The  $^3\text{He}$  spectral function in light-front dynamics"

Salon B: Three-nucleon systems at low energy (Chair: Sekiguchi)

C. Howell (Duke), "Few-nucleon research at TUNL: probing 2N and 3N forces with neutrons"

L. Girlanda "Tuning the 3N force from 3N scattering data"

R. Malone "Neutron-neutron quasifree scattering in nd breakup at 10 MeV"

K. Sagara "Systematic study on Space-Star Anomaly in pd breakup"

S. Koenig "The proton-deuteron scattering length in pionless effective field theory"

Salon C: Electronic dynamics in few-body systems (Chair: Greene)

A. Orel (UC-Davis) "Studies of HeH: Dissociative Excitation and Mutual Neutralization"

M. Schulz "Experimental Test of Theoretical Analysis of Coherence Effects in Atomic..."

T. Kirchner "A theoretical analysis of recent ion-lithium collision experiments..."

R. Sultanov "Low temperature HD + H<sub>2</sub> inelastic scattering of astrophysical interest"

D. Fischer "Collision dynamics studied with a polarized MOT target"

Salon D: Clusters and halos (Chair: Platter)

E. Garrido (Madrid) "Rotational character of the  $^{12}\text{C}$  spectrum investigated through inelastic cross sections via photon emission"

Y. Funaki "Hoyle band and  $\alpha$  condensation in  $^{12}\text{C}$ "

J. Walshe "Exotic cluster structures: the search for nuclear water"

M.D. Jones "Further insights into the reaction  $^{14}\text{Be}(\text{CH}_2, \text{X})^{10}\text{He}$ "

S. Watanabe "4B and 3B channel-coupling effects on  $^6\text{Li}$  elastic scattering in CDCC"

3:50 pm POSTER SESSION BEGINS

3:50-4:20 pm Coffee break

4:20-6:10 Parallel sessions:

Salon A: Precision Spectroscopy and the Proton Radius Puzzle (Chair: Mueller)

- D. Yost (Colorado State) "Frequency comb spectroscopy of the 1S/3S-3D transitions in H"
- C. Ji "Understanding The Proton Radius Puzzle: Nuclear Structure Effects in Light Muonic.."
- C. Peng "Proton Charge Radius (PRad) Experiment at Jefferson Lab"
- G. Drake "Electron Shake-up and Shake-off Following  $^6\text{He}$   $\beta$  Decay"
- J. Marton "Strong interaction studies with kaonic atom"

Salon B: Four nucleons (Chair: Barnea)

- A. Deltuva (Lisbon) "Reactions in the four-nucleon system above breakup threshold"
- R. Lazauskas "Description of four-nucleon collisions including the breakup"
- K. Kisamori "Study of tetra-neutron system via...reaction  $^4\text{He}(^8\text{He},^8\text{Be})4n$ "
- W. Leidemann "The resolution of resonances with the LIT method"
- P. Maris " $^4\text{He}$  and  $^6\text{Li}$  with consistent chiral interactions"

Salon C: Pairing in medium-mass nuclei (Chair: Mazumdar)

- M. Assie (IPN, Orsay) "Study of pairing and quartetting in medium mass nuclei"
- Y. Tzeng, "Contributions of chiral two- and three-nucleon interactions to closed shell nuclei"
- A. Kwiatkowski "High-precision atomic mass measurements for ... exotic nuclei"
- S. Kim "Spectroscopy of  $^{17}\text{C}$  via one-neutron knockout reaction"
- W. Horiuchi " $^5\text{B}$  calculation with Pauli constraint for shell- and cluster-structure in  $^{16}\text{O}$ "

Salon D: Few-hadron hypernuclei (Chair: Hiyama)

- P. Achenbach (Mainz) "Experimental investigations of the hypernucleus  $\text{H}_4\Lambda$ "
- S. Petschauer "Baryonic forces in SU(3) chiral effective field theory"
- N. Zachariou "Determination of Polarization Observables ... for FSIs in  $\gamma d \rightarrow K+\Lambda n$ "
- B. Gibson "Analysis of a possible  $nn\Lambda$  resonance"
- H. Kamada "A  $\Lambda n n$  three-body resonance"

5:30-7:50 pm Reception sponsored by the Few-body Topical Group of the APS

7:50 pm POSTER SESSION ENDS

Wednesday, May 20

9-10:30 am *The electroweak structure of few-nucleon systems*

Chair: G. Orlandini (Trento)

A. Antognini (PSI) "Spectroscopy of muonic atoms: atomic to nuclear & particle physics"

N. Fomin (Tennessee) "Hadronic weak interaction studies at the SNS"

S. Pastore (South Carolina) "Electromagnetic structure of light nuclei"

10:30-11 am Coffee break

11 am-1 pm *Nuclear forces twenty years after AV18*

Chair: R. Wiringa (Argonne)

S. Aoki (Kyoto) "Hadron interactions from lattice QCD"

A. Lovato (Argonne) "Electromagnetic and neutral-weak response functions of  $^4\text{He}$  &  $^{12}\text{C}$ "

J. Arrington (Argonne) "Recent results on short-range correlations in light nuclei"

D. Lee (North Carolina State) "Nuclear scattering from ab initio lattice simulations"

1 pm-... Lunch and free afternoon

6:30-9:30 pm Conference Banquet at the Penthouse at Wyndham Grand Chicago Riverfront Hotel

Thursday, May 21

8:30-10:20 am Parallel sessions:

Salon A: Large- $x$  physics (Chair: Cloet)

- R. Holt (Argonne) "Quarks in Few Body Systems"
- P. Reimer "Nuclear structure and the flavor dependence of the EMC effect"
- A. Bashir "From continuum QCD to hadron form factors"
- C. Chen "Higher-order effective fermion interactions and emergent symmetries"
- F. Gao "Leading twist Distribution Amplitudes of heavy-quark vector mesons"

Salon B: Strange and exotic matter (Chair: Gibson)

- Y. Sada (RCNP-Osaka) "Exclusive Analysis of the in-flight  $^3\text{He}(K^-, \Lambda p)n$  missing reaction to search for the  $K$ - $pp$  bound state"
- R. Kezerashvili "K-  $pp$  and K-  $K$ -  $p$  Clusters"
- D. Lonardoni "Strangeness in nuclei and neutron stars: a challenging puzzle"
- S. Ando " $^6_{\Lambda\Lambda}\text{He}$  in cluster effective field theory"
- I. Filikhin "Hyperon energy in  $^6\text{He}$  and  $^7\text{He}$ "

Salon C: Efimov effect and collisions (Chair: Khaykovich)

- R. Doerner (Frankfurt) "Observation of the Efimov state of the Helium trimer"
- Y. Yan "Incorporating exact two-body propagators for zero-range interactions in N-body..."
- J. d'Incao "Three-body physics in strongly correlated spinor condensates"
- J. Perez-Rios "Reactivity in ion-neutral high density media"
- S. Oryu "Effective Screened Coulomb Potential from  $e^-e^-$  to  $^{208}\text{Pb}$ - $^{208}\text{Pb}$  Systems"

Salon D: Halos around  $A=20$  (Chair: Aprahamian)

- N. Orr (Caen) "Exploring the structure of the most neutron rich boron and carbon isotopes"
- T. Frederico "Momentum distributions in light halo nuclei and structure constraints"
- B. Acharya "Properties of  $^{22}\text{C}$  at Leading Order in Halo Effective Field Theory"
- I. Mazumdar "Finite-range & zero-range interactions to study halo nuclei: a comparative..."
- Z. Ren "Investigation of  $^{23}\text{N}$  in a three-body model"

10:20-10:50 am Coffee break

10:50-12:40 pm Parallel sessions:

Salon A: Novel structure and states (Chair: Qin)

- B. Zou "Some Recent Progress on Hyperon Resonances"
- V. Baru "Light-quark mass dependence of the  $X(3872)$  as a molecular state"
- G. Krein "Mesonic decay of charm hypernuclei  $\lambda c$ "
- M. Mai "Recoil corrections in antikaon-deuteron scattering"
- F. Braghin "Higher-order effective fermion interactions and emergent symmetries"

Salon B: Electromagnetic probes of light nuclei (Chair: Leidemann)

- S. Bacca (TRIUMF) "Theory of electromagnetic reactions on light nuclei"
- B. Schlimme "Deuteron form factor measurements at low momentum transfer"
- D. Rozpedzik "Electron and photon scattering on deuteron with the improved chiral NN..."
- G. Laskaris "Photodisintegration of  $^3\text{He}$  with double polarizations"
- V. Sulkosky "Results on Double-polarization Asymmetries in the Quasielastic  $^3\text{He}(e, e'd)$ ..."

Salon C: Connecting few- and many-body physics (Chair: Schulz)

- S. Riemann (Lund) "Confined Bose-Einstein condensates under rotation: From the few-body to the thermodynamic limit"
- D. Hudson-Smith "Inducing Resonant Interactions in Ultracold Atoms with an Oscillating..."
- P. Johnson "Nonuniversal effective interactions for harmonically trapped ultracold atoms"
- K. Daily "Few-body systems in the adiabatic hyperspherical representation"
- R. Wooten "Few-body treatment of the quantum Hall system"

Salon D: Relativity (Chair: Frederico)

- W. Polyzou (Iowa) "Relativistic Few-Body Methods"
- M. Hadizadeh "The Relativistic Three-Nucleon Bound State in Three-Dimensions"
- V. Karmanov "Direct Bethe-Salpeter solutions in Minkowski space"
- S. Leitaó "Quarkonia and heavy-light mesons in a covariant quark model"
- A. Shebeko "Clothed Particles in QED and QCD"

12:40-2:20 pm Lunch break

2:20-3:50 pm *The nucleon as a few-body problem*

Chair: M. Pennington (JLab)

I. Cloet (Argonne) "Perspectives on hadron structure from continuum QCD"

H. Gao (Duke) "Experimental progress and status on nucleon form factors"

V. Mokeev (JLab) "Studies of excited nucleon state structure with CLAS and CLAS12"

3:50-4:20 pm Coffee break

4:20-5:50 pm *Nuclear reactions as a few-body problem*

Chair: C. Elster (Ohio)

K. Jones (Tennessee) TBA

H. Simon (GSI) "Exploring the proton and neutron-rich continuum"

A. Spyrou (Michigan State) "Neutron-neutron correlations in the decay of light neutron-unbound nuclei"



Friday, May 22

8:30-10:20 am Parallel sessions:

Salon A: Novel facilities and methods (Chair: El-Bennich)

- J. Qiu (Iowa State) "Electron-ion collider: taking us to the next QCD frontier"
- T. Keppel "Exploring Pion and Nucleon Structure with Tagged Structure Functions"
- G. Eichmann "Two-photon physics from the quark level"
- Y.-X. Liu "Few-body methods and results for hadrons in medium"
- H. Sanchis-Alepuz "Glueballs in the Dyson-Schwinger framework: Asymptotics & ..."

Salon B: Nucleon-nucleon scattering (Chair: Howell)

- E. Epelbaum (Ruhr U., Bochum) "Chiral nuclear forces: recent developments"
- R. Navarro Perez "The Falsification of Nuclear Forces"
- M. Piarulli "Minimally non-local nucleon-nucleon potentials in  $\chi$ EFT at order  $Q^4$ "
- Z. Bagdasarian "Nucleon-Nucleon Scattering at Small Angles, measured at ANKE-COSY"
- A. Gasparyan "Nucleon-nucleon scattering in the  $^1S_0$  partial wave in the modified..."

Salon C: Advances in the three-body problem (Chair: Kievsky)

- O. Rubtsova (Moscow State) "Quantum Scattering Theory in a Discrete Representation"
- R. Sekine "Solving time-dependent few-body Schrödinger equation with basis expansion..."
- V. Eremenko "About Faddeev-AGS equations for (d, p) reactions on heavy nuclei"
- V. Suslov "The general configuration-space Faddeev formalism for studying pd scattering"
- A. Lovell "Two neutron decay of  $^{16}\text{Be}$ "

Salon D: Efimov physics in nuclei? (Chair: Freer)

- A. Nicholson (Berkeley) "Universal noise and Efimov physics"
- J. Kirscher "On the pion-mass dependence of light nuclei"
- G. Orlandini "Is the  $0+$  resonance of the  $\alpha$ -particle a 'breathing mode'?"
- M. Shalchi "Scaling functions of  $2n$  separation energies of  $^{20}\text{C}$  with finite-range potentials"
- J. Vanasse "Pionless EFT analysis of three-nucleon scattering at low energy"

10:20-10:50 Coffee

10:50-12:40 Parallel sessions:

Salon A: Hadronic reactions and structure (Chair: Krein)

- E. Downie (George Washington) "The  $A_2$  nucleon polarizability program at MAMI"
- C. Fritsch "Studies on  $\eta$  meson production in dpcollisions at the ANKE spectrometer"
- N. Huesken "Studies on  $\eta$  meson production and...with WASA-at-COSY"
- S.-X. Qin "Practical corollaries of transverse Ward-Green-Takahashi identities"
- J. Segovia "Strong diquark correlations inside the proton"

Salon B: Weak interactions and symmetry violation (Chair: Bacca)

- M. Schindler (S.Carolina) "Hadronic parity violations in a few-body systems"
- D. Samart "Parity-violating nucleon-nucleon potential in the  $1/N_c$  expansion"
- Y. Uzikov "Proton-Deuteron Scattering and Test of Time-Reversal Invariance"
- F. Myhrer "Neutrino pion production off deuteron"
- J. Golak "Break-up Channels in Muon Capture on  $^3\text{He}$ "

Salon C: Low-dimensional systems (Chair: Riemann)

- M. Saffmann (Wisconsin) "Coherence and entanglement of few-atom ensembles"

J. Levinsen “Strong-coupling ansatz for the 1D Fermi gas in a harmonic potential”  
D. Blume “Static and dynamic properties of one-dimensional ultracold few-atom systems”  
N. Harshman “Few-Body Symmetries and Algebraic Solvability in One-Dimensional Traps”  
A. Volosniev “Simulating Effective Spin Chains with Strongly Interacting Atomic Gases”

Salon D: Into the continuum with ab initio methods (Chair: Lee)

A. Gezerlis (Guelph) “Chiral 2N and 3N interactions and quantum Monte Carlo applications”  
I. Shin “ ${}^6\text{Li}$  in ab initio approach: no core full configuration and Gamow shell model”  
K. Wendt “Infrared extrapolations for the no-core shell model”  
F. Raimondi “Ab initio many-body calculations of single-nucleon transfer reactions with ...”  
J. Hwang “Study of  ${}^{19}\text{C}$  by one-neutron knockout”

12:40-2:20 pm Lunch break

2:20-3:50 pm *Meson spectroscopy*

Chair: T. Keppel (JLab)

M. Pennington (JLab) “Precision focus on the meson spectrum opens new window on QCD confinement”  
C.-P. Shen (IHEP-Beijing) “Recent empirical developments in the study and understanding of XYZ states”  
E. Braaten (Ohio State) “Towards a Theoretical Understanding of the XYZ Mesons from QCD”

3:50-4:05 pm Coffee break

4:05-5:35 pm *Few-body physics in cold atomic gases: beyond the Efimov effect*

Chair: C. Chin (Chicago)

M. Gattobigio (Nice) “Universality in Efimov physics: exploration in the N-body sector”  
H. Zhai (Tsinghua) “Few-body problem in spin-orbit coupled quantum gases”  
R. Grimm (Innsbruck) TBA

5:35-5:45 pm Closing