KNU THEORETICAL HADRON & NUCLEAR PHYSICS

Researches (MNT, KIDS and GPD) with Professor Yongseok Oh

Myeong-Hwan Mun

Soongsil university

14th APCTP-BLTP JINR Joint Workshop
Memorial Workshop in Honor of Prof. Yongseok Oh

Theoretical Study on the Production of New Neutron-rich Isotopes in Multi-nucleon Transfer Reactions

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Approved as a qualified thesis of Myeong-Hwan Mun
for the degree of Ph.D. by the Evaluation Committee

December 2014

Chairman Prof. Wooyoung Kim

Prof. Avazbek Nasirov

Dr. Youngman Kim

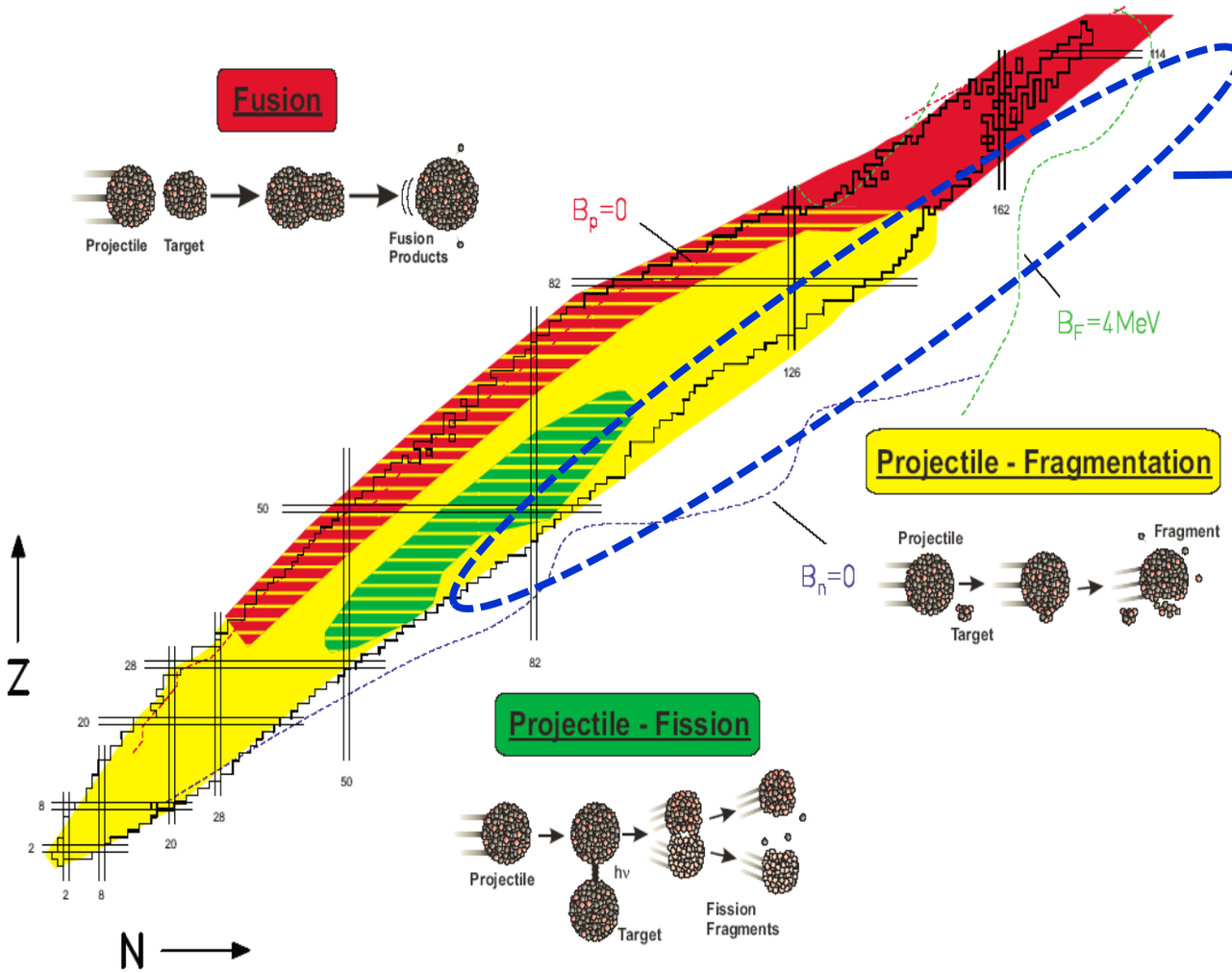
Prof. Hee-Jung Lee

Prof. Yongseok Oh

The Graduate School Council
Kyungpook National University

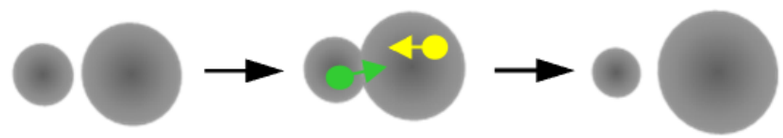
Production of new isotopes

- ✓ Fission of heavy nuclei
- ✓ Projectile fragmentation (PF)
- ✓ Fusion reactions
- ✓ Transfer type reactions



How to create nuclides with neutron numbers larger than in projectile or target?

Multi-nucleon Transfer reactions



PHYSICAL REVIEW C **89**, 034622 (2014)

Production cross section of neutron-rich isotopes with radioactive and stable beams

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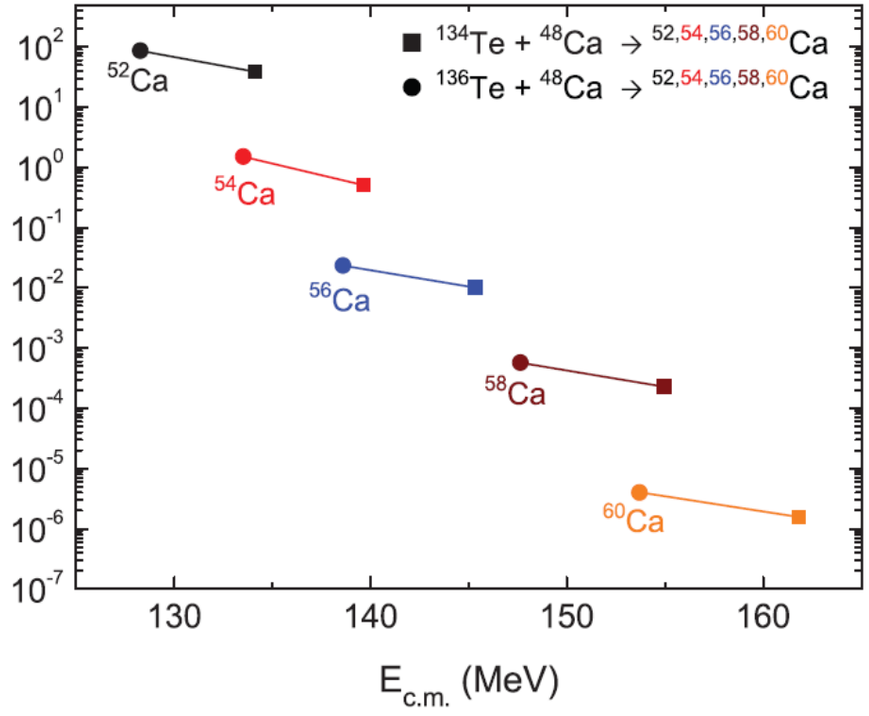

PHYSICAL REVIEW C **91**, 054610 (2015)

Toward neutron-rich nuclei via transfer reactions with stable and radioactive beams

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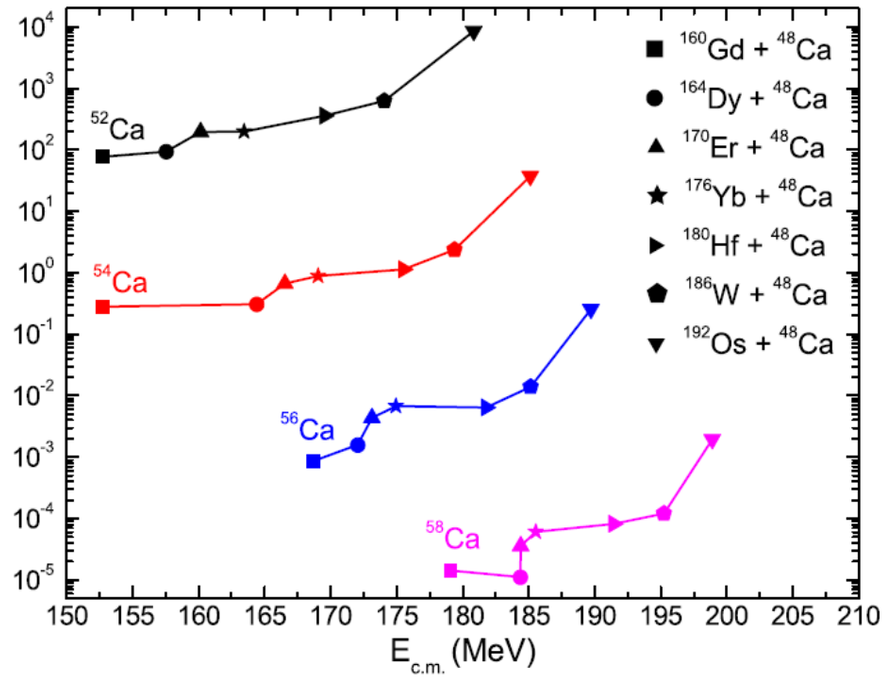
The possibilities of production of yet-undiscovered neutron-rich isotopes of Ca, Gd, Dy, Er, Yb, Hf, W, Os, Hg, Pb, and Th are explored in various multinucleon transfer reactions with stable and radioactive beams. The probable projectile-target combinations and bombarding energies to produce these neutron-rich isotopes are suggested for future experiments.



Nuclear Structure with a Generalized Nuclear Energy Density Functional

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The Graduate School Council
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Phys. Rev. C 97, 014312 (2018)

KIDS Energy density functional form

$$\mathcal{E}(\rho,\delta) = \frac{E(\rho,\delta)}{A} = \mathcal{T}(\rho,\delta) + \Sigma_{i=0}^{N-1} c_i(\delta)\rho^{1+i/3} \qquad \delta = \frac{\rho_n - \rho_p}{\rho}$$

$$\mathcal{T}(\rho,\delta) = \frac{3}{5}\left[\frac{\hbar^2}{2m_p}\left(\frac{1-\delta}{2}\right)^{5/3} + \frac{\hbar^2}{2m_n}\left(\frac{1+\delta}{2}\right)^{5/3}\right](3\pi^2\rho)^{2/3}$$

$c_i(\delta) = \alpha_i + \beta_i\delta^2$ to be determined by fitting to the observables

at zero temperature $k_F = (3\pi^2\rho/2)^{1/3}$ $k_{F_\tau} = k_F(1+\tau\delta)^{1/3}$

PHYSICAL REVIEW C **99**, 064319 (2019)

From homogeneous matter to finite nuclei: Role of the effective mass

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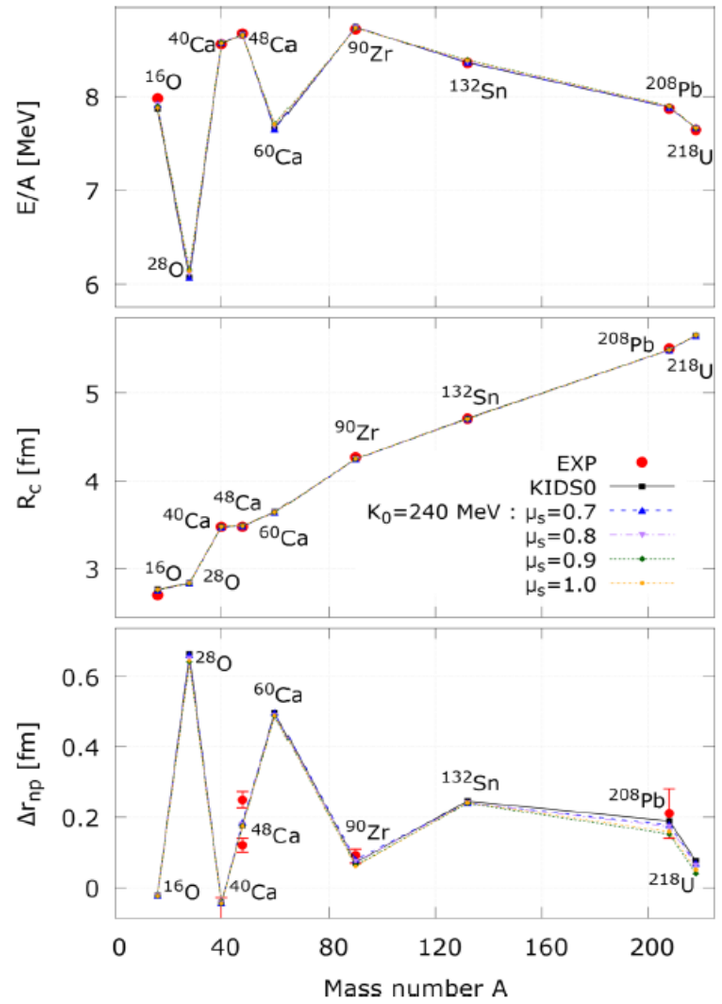

PHYSICAL REVIEW C **100**, 014312 (2019)

Analysis of nuclear structure in a converging power expansion scheme

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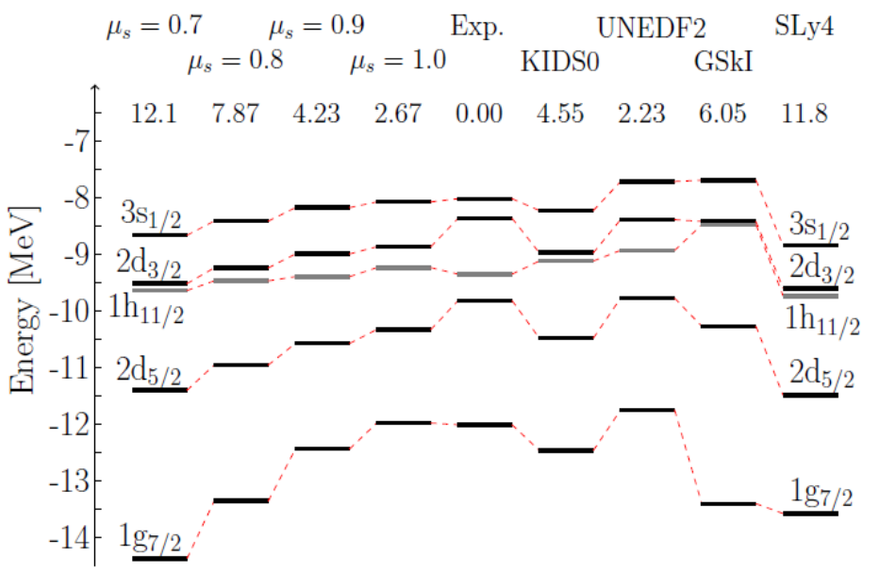

Benchmark 1+1 Dimensional Analysis of Virtual Meson Production and the Meson Form Factor in Light-Front Dynamics

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December 2021

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Prof. Seung-il Nam

Prof. Hyon-Suk Jo

Prof. Yongseok Oh

The Graduate School Council
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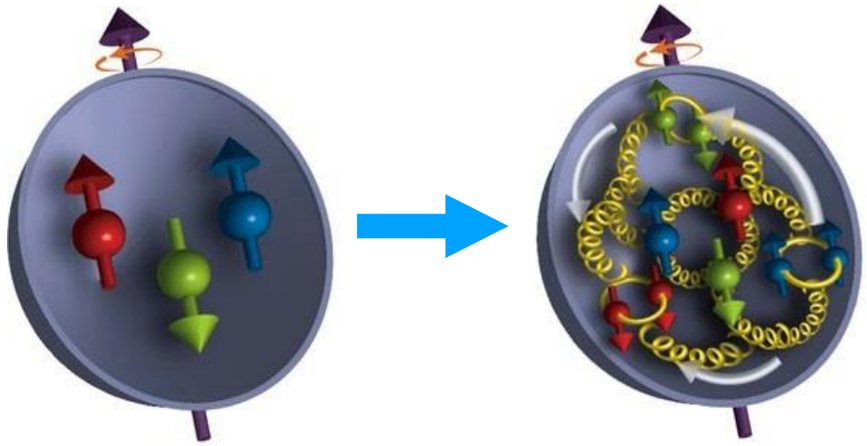
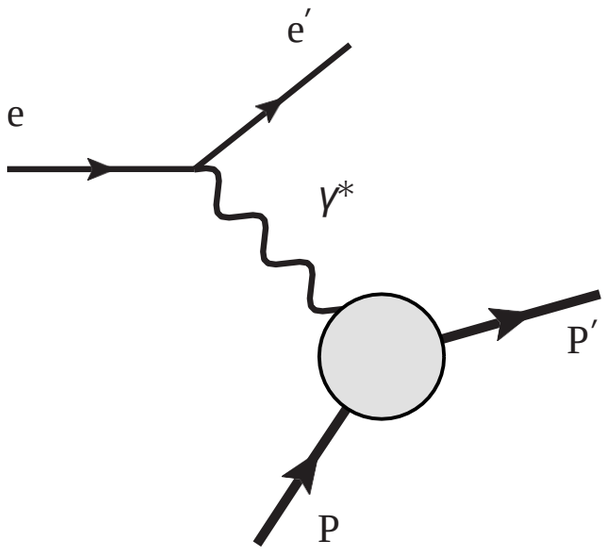
Hadron Structure

Hadron (meson and baryon) is a composite system made of **quarks**, **anti-quarks**, and **gluons**, held together by **non-perturbative QCD interaction**.

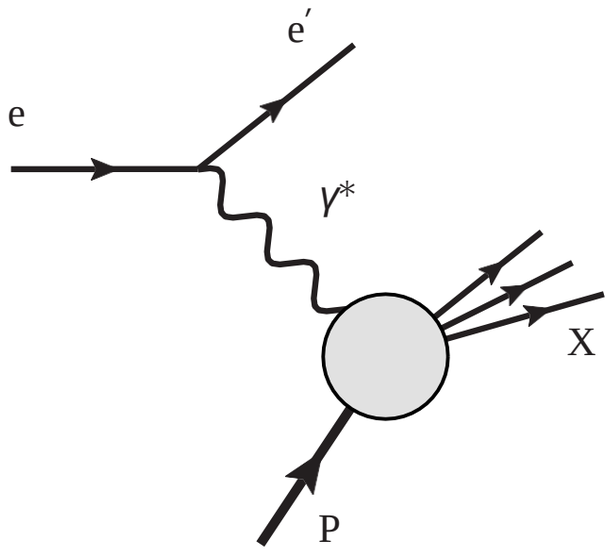




Elastic scattering

Density

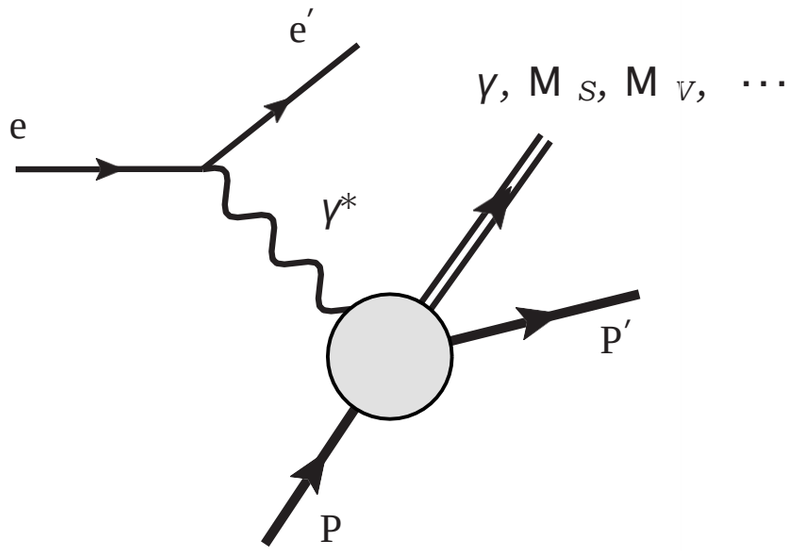
$$\langle P' | \bar{\psi}(0)\ \hat{\mathcal{O}}\ \psi(0) | P \rangle$$



Inclusive / Inelastic

Momentum

$$\langle P | \bar{\psi}(0)\ \hat{\mathcal{O}}\ \psi(y) | P \rangle$$



Exclusive / Inelastic

Angular momentum

$$\langle P' | \bar{\psi}(0)\ \hat{\mathcal{O}}\ \psi(y) | P \rangle$$

PHYSICAL REVIEW D **103,** 076002 (2021)

Light-front dynamic analysis of the longitudinal charge density using the solvable scalar field model in (1 + 1) dimensions

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PHYSICAL REVIEW D **105,** 096014 (2022)

Analysis of virtual meson production in a (1 + 1)-dimensional scalar field model

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