**RIBF and KEK WNSC Joint Nuclear Physics Seminar**

**Speaker: Dr. Taiki Tanaka**

(GANIL)

**Title: Dynamics of Heavy and Superheavy Element Synthesis: Transition from Deep-Inelastic Collisions to Fusion via Quasifission**

\*The seminar will be given in *English*

**Date:** From 13:30 on March 5, 2024

**Place:** Nishina Hall

*Abstract*

Mass-angle distribution (MAD) measurements of nuclear fission fragments have illuminated many aspects of the physical variables controlling quasifission [1-3]. This tool has been exploited to probe the dynamics of the nuclear fusion reactions used for synthesizing heavy and superheavy elements. A fundamental understanding of quasifission, and how it can be minimized, is sought to optimize the synthesis of new superheavy isotopes.

In this seminal, I will discuss our recent results related to the quasifission process. A new experimental method [4,5], involving the subtraction of two measured MADs, has enabled the first direct determination of the dependence of the fast quasifission sticking time, zeptsecond ($10^{-21}$ sec) order, on the angular momentum, $Lℏ$, as well as obtaining new information on fast quasifission mass evolution. The results are consistent with a transition from slow quasifission (and fusion) at the lowest $L$, through fast quasifission at intermediate $L$, to deep-inelastic collisions at the highest $L$. Time-dependent Hartree-Fock theoretical calculations [6] show good agreement with the experimental relationship between the sticking time and $L$.

I will also introduce our future studies of quasifission at GANIL utilizing the Variable Mode Spectrometer (VAMOS++) and inverse kinematics method. The approach enables us to study the isotopic-dependent reaction dynamics in zeptsecond order, which can be a probe to study the correlations of neutron-proton equilibration [6], kinetic energy dissipation, shell effect [7], and even-odd effect [8].

[1] J. Toke *et al*., Nucl. Phys. A **440**, 327 (1985).

[2] W. Q. Shen *et al*., Phys. Rev. C **36**, 115 (1987).

[3] D. J. Hinde *et al*., Phys. Rev. Lett. **101**, 092701 (2008).

[4] T. Tanaka *et al*., Phys. Rev. Lett. **127**, 222501 (2021).

[5] T. Tanaka *et al*., Phys. Rev. C **107**, 054601 (2023).

[6] C. Simenel *et al*., Phys. Rev. Lett. **124**, 212504 (2020).

[7] C. Simenel *et al*., Phys. Lett. B **822**, 136648 (2021).

[8] D. Ramos *et al*., Phy. Rev. C **107**, L021601 (2023).

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