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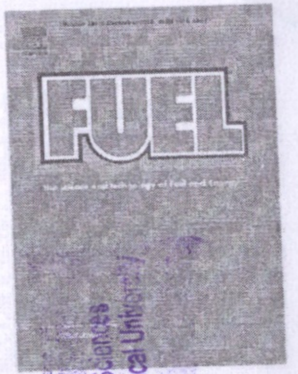

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INDIANA UNIVERSITY

DEPARTMENT OF CHEMISTRY

College of Arts and Sciences
Bloomington

November 1, 2019

Dr. Varinderjit Singh
Assistant professor
Department of Physical Sciences
IKG Punjab Technical university
Jalandhar, INDIA

Dear Varinderjit,

I am delighted to extend an invitation to you to join my laboratory as a Visiting Faculty in the Department of Chemistry at Indiana University, Bloomington. This invitation is based upon our continued scientific discussions over the past year by e-mail and skype. I believe that your visit would allow us more effectively pursue our mutual scientific interests. Your visiting appointment would be for an initial 12-month period beginning January 6, 2020 and ending January 5, 2021. If mutually agreeable this offer could be extended for a second year. The minimum annual salary would be $50,000 plus University employee benefits. The following webpage (http://www.indiana.edu/~uhrs/benefits/index.html) will provide you with details regarding IU employee benefits.

In your position as Visiting Faculty, you will participate in the full range of research activities undertaken by the group including analysis of existing experimental data as well as assisting with the planning and execution of experiments as funded by our Department of Energy grant. Your PhD in nuclear physics, training, and former experience in the group qualify you for this position.

The department will sponsor you for J-1 visa status during the period of your appointment. Please note that this offer must also gain final administrative approval and is subject to the University's receipt of verification of your credentials and other information required by law, and on your furnishing the federally required documentation showing that you are a citizen or permanent resident of the United States or an authorized alien entitled to be employed in the U.S. for the period of your appointment. Indiana University participates in the U.S. Department of Homeland Security's E-Verify Program to confirm employment eligibility. Upon acceptance

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Chemistry Building 800 E. Kirkwood Avenue Bloomington, IN 47405-7102 fax (812) 855-8300 www.chem.indiana.edu

of your offer, you will receive an email containing information on employment eligibility verification and the E-Verify process. This appointment is also conditional on a positive outcome of a background check, a part of the appointment process for all faculty and staff at the University. The background check will be initiated and completed through eLink, the default web based system, once all appointment-related paperwork has been submitted to the Business Office.

Certain benefit plan enrollments must be made within 30 days of your date of hire. These include medical and dental plans, the IU Tax Saver Benefit Plan, and Personal Accident Insurance. Enrollments for these plans received after 30 days from your hire date cannot be processed and Open Enrollment is the next opportunity to enroll with an effective date of the following January 1.

Sincerely,

Romualdo de Souza
Provost Professor
Professor of Chemistry and Physics
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Rapid Communications | Editors' Suggestion

Probing the fusion of neutron-rich nuclei with re-accelerated radioactive beams

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We report the first measurement of the fusion excitation functions for ^{39,47}K + ^{28}Si at near-barrier energies. Evaporation residues resulting from the fusion process were identified by direct measurement of their energy and time of flight with high geometric efficiency. At the lowest incident energy, the cross section measured for the neutron-rich ^{47}K-induced reaction is $\approx$6 times larger than that of the β-stable system. This experimental approach, both in measurement and in analysis, demonstrates how to efficiently measure fusion with low-intensity re-accelerated radioactive beams, establishing the framework for future studies.

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The recent coincident detection of gravitational waves in GW170817 [1] and a γ-ray burst in GRB170817A [2] marks the first observation of a binary neutron star merger [3,4]. The delayed optical emission spectrum that followed indicated the presence of heavy elements in the neutron star ejecta [5]. This result clearly established binary neutron star mergers as an important, potentially primary, site for heavy element nucleosynthesis. Ejecta resulting from the tidal disruption of the neutron stars as they merge reflects both their initial composition as well as the reactions that occur during the merger. Understanding the composition of the neutron stars is thus an important question in understanding heavy element nucleosynthesis.

Insight into the composition of some neutron stars prior to merging may be realized by considering the case of accreting neutron stars [6]. Heavy elements in the outer crust of an accreting neutron star are produced by fusion reactions [7,8]. Some of the resulting heavy nuclei become neutron rich through electron-capture reactions [9]. It has been proposed that fusion of neutron-rich nuclei occurring in the outer crust may be enhanced relative to their β-stable counterparts providing an important heat source that triggers an x-ray superburst [10].

As a nucleus becomes increasingly neutron rich, the extent of the neutron density distribution increases. Consequently, even if the density distributions were frozen through the fusion process the fusion cross section would increase in response to the larger geometric cross section. However, the fusion process is not static but dynamic. The decreased average binding energy of the outermost neutrons with increasing neutron number and the existence of low-energy collective modes act to make neutron-rich nuclei more polarizable. This increased polarizability, which can be viewed as the prelude to neutron transfer, increases the likelihood for fusion to occur. Thus, both static and dynamic factors impact the fusion cross section. By examining the fusion cross section with an increasing neutron number for an isotopic chain and observing an increase beyond the geometric expectation, one might extract the increased role of dynamics. Such general expectations are borne out by microscopic time-dependent Hartree-Fock calculations [11].

To determine how fusion evolves for increasingly neutron-rich nuclei in an isotopic chain, it is advantageous to measure fusion at near-barrier energies. It is in this near and sub-barrier regime that one is most sensitive to the shape of the barrier which reflects both structure and dynamics. A new generation of radioactive beam facilities [12–14] with the capability of high-quality re-accelerated beams provides, for the first time, the opportunity to systematically address this question. These

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