

NITheCS COLLOQUIUM: Universality of the Elemental Abundances

Prof Nico Orce (University of the Western Cape)

Monday, 30 October 2023 | 16h00 – 17h00 SAST

Venue: in person* and online

* Neelsie Cinema, Stellenbosch University

--- Cheese and wine will be served at the venue ---

ABSTRACT

Why do we observe the same amounts of gold, silver or platinum in our nearby universe? The abundance pattern of the heavy stable elements from barium to lead in the most metal-poor stars – produced by rapid neutron captures in colossal stellar explosions such as neutron star mergers - follows the scaled abundance pattern in our Sun. Given that our Sun formed billions of years after these metal-poor stars, from gas that was enriched by many stellar generations, this astonishing concurrence suggests a rather well-defined origin of heavy elements beyond iron. Whether this may be only an artifact of nuclear properties or it may point to a single cosmic site with astrophysical conditions that are generated uniformly throughout cosmic time remains an open question. In a recent article in the Monthly Notices of the Royal Astronomical Society, we provide an answer to this long-sought conundrum by uncovering a decrease of the binding energy as the neutron to proton ratio of a nuclear system increases at the high temperatures occurring during these stellar explosions, potentially closing in the reaction network in stellar nucleosynthesis and yielding the universal formation of heavy elements. As Victor Weisskopf put it, the material basis of the world in which we live is a product of the laws of nuclear physics.

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BIOGRAPHY



Nico Orce is a nuclear physicist whose passions are quality science and true transformation. Nico's research mainly involves fundamental and applied nuclear physics, but also astronomy and mathematical modelling. He has broadly explored the nuclear chart using a wide variety of nuclear techniques and theoretical calculations, and discovered new types of collective excitations and shell phenomena in nuclei. Nico is leading research proposals at different laboratories and observatories around the world, including MANDELAb, iThemba LABS, SALT, MLL, TRIUMF and CERN, and has secured research funds worth > R50M. He is the leading Investigator and spokesperson of the GAMKA spectrometer, chair of the Tastes of Nuclear Physics, Referee of most nuclear physics journals, and Honorary Visiting Professor at the

University of York. Nico has graduated 20 MSc and PhD students with research projects generally approved by international committees. His students have travelled the world to gain hands-on experience, presented at international conferences, run their own experiments in world-class facilities such as TRIUMF and CERN and led publications in top international journals such as Physics Letters B and Nature Communications.

For more info: <http://nuclear.uwc.ac.za/>