Philip Adsley

CONTACT INFORMATION

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EDUCATION

University of York, York, U.K.

Ph.D., Nuclear Physics, 2009-2013

- Thesis Topic: "Testing indirect methods of calculating the $^{15}O(\alpha,\gamma)^{19}Ne$ reaction rate"
- Advisor: Brian R. Fulton

Peterhouse, University of Cambridge, Cambridge, U.K.

M.Sci., Natural Sciences (2.i), 2009

PROFESSIONAL EXPERIENCE

May 2019-: Claude Leon Fellow, University of the Witwatersrand and iThemba LABS, South Africa

Leading the development and construction of the new focal-plane detector for the K600 magnetic spectrometer, and the construction and commissioning of a new low-energy nuclear-physics beamline at the Tandetron, iThemba LABS, Faure. Leading the in-house research programmes on hydrogen burning and explosive nuclear astrophysics, and the isovector giant-dipole resonance with the K600 magnetic spectrometer and high-purity germanium detectors.

Analysis of existing experimental data including high-resolution coincidence of ^{24}Mg to constrain the behaviour of the $^{12}C+^{12}C$ reaction. Leading a research group of experimenters and theorists (nineteen scientists at fifteen institutions in eight countries) investigating dipole transitions in *sd*-shell nuclei and the connection to the toroidal and asymmetric modes of dipole excitations.

January 2019-March 2019: Research Visitor, iThemba LABS, South Africa

Invited to iThemba LABS as a research visitor in anticipation of taking up the Claude Leon Fellowship. Preparation of research proposals and initial development work on the new low-energy focal plane for the K600 magnetic spectrometer.

October 2016-November 2018: Postdoctoral Fellow, IPN Orsay, France

Main focus on spectroscopy for nuclear astrophysics. Leading and analysis of experiments using the Orsay Enge Split-Pole and an array of silicon detectors, and the Munich Q3D spectrograph. Leading a international team of scientists (fourteen scientists with affiliations at nineteen different institutions across five countries) within the ChETEC COST action reanalysing important reaction rates for the *s*-process. Contributed a talk to the the ALTO 2.0 workshop on the future of experimental nuclear astrophysics. Development of open-access theoretical tools for calculation of resonance parameters.

March 2014-September 2016: Postdoctoral Research Fellow, University of Stellenbosch and iThemba LABS, South Africa

Principal scientists for the new double-sided silicon detector array for use with the K600 magnetic spectrometer (the CAKE). Led a number of experimental studies focussing on nuclear clustering and nuclear astrophysics (iThemba LABS proposals PR242, PR244, PR254). Involved in the proposal, design and commissioning of the coupling of HPGe detectors to the K600 magnetic spectrometer (the BaGeL).

Accepted Experimental Proposals

Proposals which have already resulted in publications are omitted from this list.

TRIUMF

- S1801: J Henderson, P Adsley: Isospin symmetry in loosely bound states: Mirrored transfer reactions (due to run northern-hemisphere summer 2020)
- S1805: P Adsley, N de Séréville: Constraining the origin of pollution in globular clusters by measuring important proton radiative-capture reactions using the DRAGON (first half ran November 2019, analysis in progress; second half hopefully in northern-hemisphere summer/autumn 2020)

IPN Orsay

- N-SI-112: F Hammache, P Adsley: Study of the astrophysical reactions ^{22}Ne$(\alpha, n)^{25}$Mg and ^{22}Ne$(\alpha, \gamma)^{26}$Mg using the α-transfer reaction ^{22}Ne(^{7}Li,$t)^{26}$Mg (due to run in 2020)
- N-SI-100: P Adsley: Structure of ^{27}Si and the destruction of ^{26}Al in classical novae (ran in 2018, analysis is progress)

iThemba LABS

- PR349: R Neveling, R Crespo, P Adsley, AA Cowley: Studies of Many-body strongly interacting Nuclear SYstems at iThemba LABS: ManyNuSYs @ iThemba LABS - studying the $(p, 2p)$ knockout reaction as a probe of nuclear structure (due to run in late 2020)
- PR337: P Adsley: Spectroscopy of resonances for hydrogen-burning nucleosynthesis in globular clusters and classical novae (was due to run early 2020 - delayed due to coronavirus)
- PR333: LM Donaldson, P Adsley: Spectroscopy of ^{39}Ca using the ^{40}Ca$(p, d)^{39}$Ca reaction (was due to run early 2020 - delayed due to coronavirus)
- PR320: LM Donaldson, P Adsley: Photo-absorption cross sections of 90Zr and 159Tb: resolving discrepancies between (p, p') and (γ, xn) reactions (due to run mid-2020 - delayed due to coronavirus)
- PR254: P Adsley, JW Brümmer: Measuring decays of excited states in 22Mg to improve X-ray burst light curve predictions (performed, JWB has finished PhD and paper is in preparation)
- PR242: A Long, P Adsley: Study of ^{44}Ti synthesis in core collapse supernovae through the investigation of α-unbound states in ^{48}Cr using the (p, t) reaction (performed, South African student Sifundo Binda analysing the data for postgraduate work)

Munich Q3D

- P Adsley, N de Séréville: The ^{30}Si(^{3}He,$d)^{31}$P reaction and globular clusters (performed, French student analysing the data for PhD)
- M Williams, P Adsley: Search for states in ^{23}Na above the proton threshold (performed, MW analysing the results)
- P Adsley: High-resolution study of states in ^{19}F - constraining isotopic hotspots in the Orgueil meteorite (performed, analysis forms part of a paper to be submitted July 2020)

Service Positions

Reviewer for Physics Letters B.

Maintain repositories for various reaction codes (DWUCK4/5, CHUCK3, AngCor) and provide support for users. Documentation and example cases being created for some of these reaction codes to provide a more useful resource to the community.

IOP student representative, Nuclear Physics Group 2012-2013.

SSC User Group Secretary, 2019-

SAIP Acting Secretary, 2016

Graduate Student Supervision

J Bekker (Wits): MSc*

S Binda (Wits): **MSc***

JW Brümmer (Stellenbosch): MSc, **PhD**

KCW Li (Stellenbosch): MSc, PhD

Bold: Primary Supervisor *: Current Student

In addition to this supervision, I have assisted numerous other postgraduate students and have given lectures on magnetic spectrometers and statistical analysis to the students based at iThemba LABS.

Selected list of Publications

Re-evaluation of the ^{22}Ne$(\alpha,\gamma)^{26}$Mg and ^{22}Ne$(\alpha,n)^{25}$Mg reaction rates; P Adsley *et al.*, ChETEC collaboration, Physical Review C, under review - linked to PR244 and Munich Q3D ^{26}Mg proposal

Status of the ^{24}Mg$(\alpha,\gamma)^{28}$Si reaction at stellar temperatures; P Adsley, AM Laird, Z Meisel; Accepted in Physical Review C, (June 2020) - linked to PR244 and Munich Q3D ^{26}Mg proposal

High-resolution study of levels in the astrophysically important nucleus ^{26}Mg and resulting updated level assignments; P Adsley *et al.*; Physical Review C (2018) - linked to Munich Q3D ^{26}Mg proposal

Re-examining the ^{26}Mg$(\alpha,\alpha)^{26}$Mg reaction: Probing astrophysically important states in ^{26}Mg; P Adsley *et al.*; Physical Review C 96 (5), 055802 (2017) - linked to iThemba LABS proposal PR244

Characterization of the proposed 4α cluster state candidate in ^{16}O; KCW Li, R Neveling, P Adsley *et al.*, Physical Review C 95, 031302(R) (2017)

α clustering in ^{28}Si probed through the identification of high-lying 0^+ states; P Adsley, DG Jenkins *et al.*, Physical Review C 95, 024319 (2017) - linked to iThemba LABS proposal PR244

CAKE: the coincidence array for K600 experiments; P Adsley *et al.*; Journal of Instrumentation 12 (02), T02004 (2017)

In preparation as lead author

Isoscalar dipole transitions in ^{24}Mg, ^{26}Mg and ^{28}Si; P Adsley, V Nesterenko, M Kimura *et al.*

Investigating the ^{12}C+^{12}C reaction with coincidence spectroscopy of ^{24}Mg; P Adsley *et al.*

Charged-particle decays from excited states in ^{19}F: explaining isotopic anomalies in the Orgueil meteorite; P Adsley, F Hammache *et al.*

Research Projects

The first focus of my research is on pollution in globular clusters. The origin of globular clusters (how, when, where and with what initial masses they formed) remains the focus of much observational and theoretical effort, following the unexpected observation of multiple stellar populations in GCs. Knowing the age and origin of GCs is vital in understanding the process of galactic formation. This necessitates understanding of the evolution of stars within the GCs and the potential sources of the abundance anomalies observed.

Stellar simulations have identified important reactions which could contribute to abundance anomalies. I have led a number of experimental studies to determine these reaction rates. For some of the important reactions the available nuclear data are insufficient for estimates of the reaction rates or identification of astrophysically important states. The aim of this research programme is to determine the reaction rates of importance to globular-cluster pollution in two stages: γ-ray spectroscopy and charged-particle transfer reactions will be used to identify the key astrophysical states for subsequent targetted direct measurements of resonance strengths. The final outcome will be the removal of any significant uncertainty in the abundance patterns from the nuclear reaction network.

The second research strand is on neutron stars, which are promising laboratories of saturated nuclear matter. The recent observations of gravitational waves from neutron-star mergers are providing a new avenue of study. Observational studies of X-ray bursts and theoretical studies of the giant resonances provide information complementary to that derived from gravitational-wave observations.

Photoabsorption cross sections measured at various facilities show discrepancies between different real-photon, and between real- and virtual-photon measurements. The evolution of the isovector giant-dipole resonance properties with mass, deformation and isospin-asymmetry is now somewhat unclear as these are based on defective data. I am leading investigations of these discrepancies using virtual photoabsorption. With collaborators, I am developing novel proposals for activation measurements to determine the photoneutron cross sections obviating the necessity of neutron detection, providing independent validation of the photoabsorption cross sections.

Simulations of type I X-ray bursts have shown that the behaviour of the lightcurve can constrain the mass-radius relationship. It is not yet possible to to do this due to the uncertainties in the nuclear reaction rates. I have an ongoing research programme with a cross-displicinary team of scientists who are investigating important thermonuclear reaction rates, including experimental studies and re-evaluations of reaction rates. I am developing proposals to improve γ-ray spectroscopy of important nuclei with focus on using stable-beam experiments to improve the γ-ray spectroscopy of ^{60}Zn for the ^{59}Cu$(p,\gamma)^{60}$Zn reaction. Developments at FRIB will mean that there will soon be intense ^{59}Cu beams available which will allow resonance strengths for this reaction to be measured. Accurate information on the key resonances is not yet available but lead to targeted direct measurements. The ultimate goal is to remove the impact of nuclear-physics uncertainties on the lightcurve.

How do these research interests interact with those at York? There is currently not a focus on GCs in the nuclear-astrophysics research programme at York, despite the widespread interest in GCs in the wider astrophysical community and the important role that nuclear physics can play. While the astrophysical focus is different, many of the techniques used are shared with the existing nuclear-astrophysics programme.

The work on the IVGDR complements existing theory work being performed at the group in York and with the experimental work on saturated nuclear matter at Jefferson Lab.

The experimental work focussing on X-ray bursts will require *inter alia* experimental work with fast beams, with which I am not familiar. The York group contains experts on fast-beam experiments at MSU and GSI and this would be particularly beneficial for the development of these projects. Of particular focus will by the use of non-selective reactions with exotic beams to constrain reaction rates.