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Constraining the 19Ne(p,γ)20Na Reaction Rate Using Direct Measurements at DRAGON

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\AUTHORS{\underline{R. S. Wilkinson}[1], G. Lotay[1,2], C. Ruiz[3], G. Christian[4], C. Akers[5], W. N. Catford[1],\\ A. A. Chen[6], D. S. Connolly[3], B. Davids[3], D. A. Hutcheon[3], D. Jedrejcic[7], A. M. Laird[5],\\ A. Lennarz[3], E. McNeice[6], J. Riley[5], M. Williams[3,5]}

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\AFFILIATION{1}{Department of Physics, University of Surrey, Guildford, GU2 7XH, UK}
\AFFILIATION{2}{National Physical Laboratory, Hampton Rd, Teddington, Middlesex TW11 0LW, UK}
\AFFILIATION{3}{TRIUMF National Laboratory, Vancouver, British Columbia V6T 2A3, Canada}
\AFFILIATION{4}{Texas A\&M University, College Station, Texas 77843, USA}
\AFFILIATION{5}{University of York, Heslington, York YO10 5DD, UK}
\AFFILIATION{6}{McMaster University, Hamilton, Ontario, Canada}
\AFFILIATION{7}{Colorado School of Mines, Golden, Colorado, USA}
}
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% Enter contact e-mail address here.

\centerline{Contact email: {\it r.wilkinson@surrey.ac.uk}}

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Determining proton radiative capture reaction rates in explosive stellar environments is of critical importance for our understanding of the chemical evolution of the Milky Way. One particularly significant rate is that of the ^{19}Ne(p,γ)^{20}Na reaction. This reaction is expected to strongly influence the final ejected abundance of ^{19}F in oxygen-neon (ONe) novae[1], as well as providing a key step in the breakout sequence from the hot-CNO cycles into the rp process in Type I X-ray bursts[2]. In these stellar environments, the ^{19}Ne(p,γ)^{20}Na reaction is thought to be dominated by a single, narrow resonance, 457 keV above the proton emission threshold in ^{20}Na[3]. The exact nature of this resonance has been a matter of significant scientific debate for over 30 years and, as such, has resulted in large uncertainties in the ^{19}Ne(p,γ)^{20}Na reaction rate. In order for us to fully understand the latest observational data obtained from ONe novae and X-ray bursts by modern telescopes, it is essential that the uncertainty of this reaction rate is reduced. A direct measurement of the ^{19}Ne(p,γ)^{20}Na reaction has been recently performed at TRIUMF National Laboratory, Canada, using the DRAGON recoil separator. Results of the strength of the 457 keV resonance from this study, as well as its contribution towards the ^{19}Ne(p,γ)^{20}Na reaction rate at ONe novae and X-ray burst temperatures, will be presented; and its implications for nucleosynthesis in such explosive stellar environments will be discussed.
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[1] C. Iliadis et al, Astrophysical J Suppl. Ser. \textbf{142}, 105 (2002);

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[2] R. K. Wallace and S. E. Woosley, Astrophysical Journal Suppl. Ser, \textbf{45}, 389 (1981);

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[3] J. P. Wallace, P. J. Woods, G. Lotay et al, Physics Letters B \textbf{712}, 59 (2012).}
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Primary author: Mr WILKINSON, Ryan (University of Surrey)

Co-authors: Prof. CHEN, Alan (McMaster University); Dr LAIRD, Alison (University of York); Dr LENNARZ, Annika (TRIUMF); Prof. DAVIDS, Barry (TRIUMF); Prof. RUIZ, Chris (TRIUMF); Dr HUTCHEON, Dave (TRIUMF); Dr JEDREJCIC, David (Colorado School of Mines); Dr CONNOLLY, Devin (TRIUMF); Mrs MCNEICE, Elaine (McMaster University); Dr LOTAY, Gavin (University of Surrey); Prof. CHRISTIAN, Greg (Texas A&M University); Mr RILEY, Jos (University of York); Mr WILLIAMS, Matthew (University of York); Prof. CATFORD, Wilton (University of Surrey)

Presenter: Mr WILKINSON, Ryan (University of Surrey)

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