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A nuclear convergent close-coupling formalism

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\noindent{\underline{The 12th International Conference on Nucleus-Nucleus Collisions, June 21-26, 2015, Catania, Italy}}

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\begin{center}
% insert the title of your abstract here
{\large \bf A nuclear convergent close-coupling formalism}
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% insert the authors here. The presenter is underlined
\underline{P. R. Fraser}[1], A. Kadyrov[1]
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% these are the corresponding institutions
{\em [1] ARC Centre for Antimatter-Matter Studies, Curtin University, Australia} \\
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% write your abstract here
Increased understanding of unstable nuclei is of great importance for
problems in cosmology and astrophysics, and while a vibrant
international community has emerged to study these systems through
scattering processes, full understanding of the effects of the
high-energy continuum on such processes remains elusive.
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The popular continuum discretised coupled-channels (CDCC) [1,2] method of nuclear physics, and the successful convergent close-coupling (CCC) [3,4] approach of atomic physics, both consider scattering of composite two- or three-body projectiles unitary or strongly bound targets. In CDCC, projectiles are loosely-bound nuclei and targets are stable, usually heavier, nuclei. In CCC, scattering is studied between hydrogen-like atoms and electrons or protons, as well as their antimatter counterparts. In the systems of interest for both models, not only is a set of discrete states relevant, but also the high-energy continuum. To consider it in calculations, the continuum must be, in some convincing way, 'discretised'.

Indeed, there are similarities between atomic and nuclear problem-solving techniques which are yet to be capitalised upon. The CCC method, having been greatly successful in atomic physics, has much to contribute to nuclear scattering problems, having overcome several mathematical, numerical and physical problems still faced in CDCC. These include a two-centre approach for stripping reactions [5]. Details of the approach will be presented, along with preliminary results.

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[1] M. Yahiro \emph{et al.}, Prog. Theor. Exp. Phys. 01A206 (2012)

[2] N. Austern \emph{et al.}, Phys. Rep. {\bf 154}, 125 (1987)

[3] I. Bray and A.T. Stelbovics, Phys. Rev. Lett. {\bf 69}, 53 (1992)

[4] I. Bray and A. T. Stelbovics, Phys. Rev. {\bf A46}, 6995 (1992)

[5] A. S. Kadyrov \emph{et al.}, Ann. Phys. {\bf 324}, 1516 (2009)

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Primary author: Dr FRASER, Paul (Curtin University)

Co-authors: Prof. KADYROV, Alisher (Curtin University); Prof. BRAY, Igor (Curtin University)

Presenter: Dr FRASER, Paul (Curtin University)

Track Classification: Reactions and Structure - Unstable Nuclei