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A complete kinematics approach to study multi-particle final state reactions

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Many-particle final state reactions can provide information on the structure of excited nuclear states and their decay mechanism. Progress in detector technology is making it possible to measure such many-particle final states in complete kinematics thereby opening up new possibilities for data analysis. Reaction channels indistinguishable to the incomplete measurement can be separated allowing for new interesting physics cases to be studied.

As an example, I will demonstrate how information on the structure and decay mechanism of excited states of C^{12} can be extracted from complete kinematics data on the reactions $B^{10}(He^3, paaa)$ and $B^{11}(He^3, daaa)$. Notably, we have been able to identify new gamma transitions between unbound states in C^{12} through use of the missing-energy method.

Similar studies with radioactive beams have, so far, been impractical mainly because of insufficient beam intensities, but should become possible at the new RIB facilities.

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