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Investigating key reactions of nuclear astrophysics interest using the DRAGON recoil separator (I)

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Gaining insight into the astrophysical processes that govern nucleosynthesis in stellar scenarios requires a detailed understanding of the involved nuclear reactions. Radiative capture cross sections at typical temperatures of environments like novae, X-ray burst or supernovae are in many cases vanishingly small, thus making the reaction rates extremely challenging to access experimentally.
The DRAGON ({\bf D}etector of {\bf R}ecoils {\bf A}nd {\bf G}ammas {\bf O}f {\bf N}uclear reactions) recoil separator has been designed to recreate nuclear fusion reactions on radioactive as well as on stable nuclei of astrophysical interest in the laboratory, and to directly measure absolute cross sections of radiative capture reactions on protons and alpha particles.
In order to take advantage of the radioactive beams delivered by the TRIUMF-ISAC facility, which are often too short-lived to be used as target material for normal kinematics measurements, the reaction rates require to be studied in inverse kinematics. Ion beams at energies of 0.15 to 1.5 MeV/u impinge on the windowless gas target and γ-rays from the de-excitation of the compound nucleus are detected in the high-efficiency BGO array surrounding the target.
With 8 out of 10 radioactive beam experiments performed over the last one and a half decades, DRAGON still holds the record for the number of direct radioactive beam measurements of radiative capture.

In this presentation I will give an overview of the DRAGON recoil separator and outline its capabilities before presenting results of the most recent experiments; among them the direct measurement of the long debated strength of the $E_{c.m.}$ = 456 keV key astrophysical resonance in the ^{19}Ne(p,γ)^{20}Na reaction. The latter bypasses the production of ^{19}F observed in the ejected shells of oxygen-neon novae, and is further expected to play an important role in Type-I X-ray bursts during the "breakout" from the hot CNO cycles into a new set of thermonuclear reactions, known as the rp process.

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