LIGHT ION INDUCED CAPTURE REACTIONS AND APPLICATION TO ASTROPHYSICS

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The last five decades have seen the dominance of heavy-ion induced reactions in nuclear structure and reaction studies at low, medium and intermediate energy. This period also coincides with the gradual disappearance of accelerator facilities providing low energy, light ion beams. This paradigm shift has significantly impacted experiments with low-energy, light ions. Low energy, light ion beams have their own importance in nuclear structure and reaction studies, few-body nuclear physics, nuclear astrophysics etc. In addition to these standard fundamental problems in nuclear physics one very practical application of light-ion capture reactions is to generate high energy, monochromatic γ-rays , crucially important for calibration of high energy γ-ray spectrometers. In this talk we will present a set of our recent measurements using low energy proton beams to address different problems in nuclear structure studies and nuclear astrophysics. In the first part of the talk we will present our measurements of capture cross sections and astrophysical S factors for $p(^{10}B, ^{7}Be)\alpha$, $p(^{10}B, ^{11}C)\gamma$ reactions. These reactions have great significance in nucleosynthesis. These reactions, as will be explained in the talk, also have great practical importance in efforts towards clean, aneutronic energy production. We will also present our very recent data of cross sections and astrophysical S factors for the $p(d,^{3}He)\gamma$ reaction at energies of few hundred keV. The $p(d,^{3}He)\gamma$ reaction around few hundred keV beam energy is very important to understand the nucleosynthesis of ^{3}He in primordial Big Bang Nucleosynthesis (BBN). Finally, in the last part of our talk we will present very recent measurements of cross sections and angular distributions of gamma rays from the decay of excited states in $p(^{12}C,p')\gamma$ reaction. In these measurements the γ-rays have been measured with large volume Lanthanum Bromide detectors and much higher quality data have been generated than what is available in literature from previous measurements.