The structure of $^8$B through measurement of $^7$Be+$p$ scattering


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We have measured $^7$Be+$p$ elastic and inelastic scattering cross sections at the Holifield Radioactive Ion Beam Facility (HRIBF) at ORNL. Beams of isotopically pure $^7$Be bombarded thin (100 $\mu$g/cm$^2$) polypropylene targets; scattered protons were detected in an array of silicon strip detectors. Cross sections were measured at 17 bombarding energies ranging from $E_{cm}=0.5$ to 3.4 MeV. The data at each energy were normalized using $^7$Be+Au elastic scattering from a combined target of polypropylene and gold.

The $^1$H($^7$Be,$p$)$^7$Be$^*$ reaction populating the 429-keV (1/2$^-$) first-excited state in $^7$Be was distinguished from elastic scattering by kinematics and was clearly observed for $E_{cm}>1$ MeV. This is the first measurement of $^7$Be+$p$ inelastic scattering and the measured excitation function shows clear evidence for a new positive parity state in $^8$B. A multi-level R-matrix analysis of the combined elastic and inelastic scattering cross sections was performed and properties of levels in $^8$B were determined. Results will be presented and compared to previous results from elastic scattering [1, 2] and theoretical expectations from both the shell model [3] and microscopic cluster models [4]. Differential cross sections for $^7$Be+$^{12}$C elastic scattering were also determined and will be presented in comparison to optical model calculations.