Nuclear Matter Distributions in $^{56, 58}$Ni, and ^{4,6,8}He inferred from Sum-of-Gaussian Analysis of Elastic Proton Scattering Data

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The investigation of direct reactions with radioactive beams in inverse kinematics has already been proven to be a valuable tool for providing important information on the structure of exotic nuclei. High-resolution measurements for proton elastic scattering on ^{4,6,8}He and ^{56,58}Ni have recently been performed by using the experimental technique of active targets, and, with even higher luminosities, using the new and innovative method of using stored and cooled radioactive beams interacting with thin internal targets at storage rings within the EXL (EXotic nuclei studied in Light-ion induced reactions at the NESR storage ring) project, at GSI, Darmstadt. Measured differential cross sections for the p-^{4,6,8}He and p-^{56,58}Ni elastic scattering were analyzed using the Glauber multiple scattering theory applying the (quasi) model-independent Sum-of-Gaussians (SOG) method, and the rms point matter radii and radial point matter densities were deduced. It is turned out that although the deduced radii of ^{4,6,8}He and ^{56,58}Ni are in close agreement with those from former analyses using model distributions, the matter density distributions from the SOG method provide more abundant information on the nuclear structure. In particular, the SOG-elucidated matter density difference between ^{56}Ni and ^{58}Ni will be presented and consequences for the understanding of nuclear structure in the vicinity of magic shells are briefly discussed.