TABLE I: Percent ratio of total quasielastic (p,n) cross section from measurements of Doehring *et al.* [37], to estimated nuclear geometric cross section, $\sigma_{(\mathrm{p,n})}/\sigma_g$, where $\sigma_g = \pi\, R^2\, [1 - V_C(R)/E]$.

E_p	Target Nucleus			
	^{48}Ca	^{90}Zr	^{120}Sn	^{208}Pb
(MeV)	($R = 4.33\,\mathrm{fm}$)	($R = 5.44\,\mathrm{fm}$)	($R = 6.03\,\mathrm{fm}$)	($R = 7.32\,\mathrm{fm}$)
25	2.47	1.26	1.44	1.62
35	2.14	0.74	0.75	0.75
45	1.68	0.62	0.69	0.50

and u are radial wavefunctions for the initial and final channels.

The question whether a coupled-channel approach, combining the initial and final channels for a QE (p,n) reaction, within a Schrödinger equation set [17, 19, 50], could bring in some tangible benefits over DWBA, may be addressed by examining data. In Table I, we show the ratios of total QE (p,n) cross sections from the measurements of Doehring *et al.* [37], to estimated geometric nuclear geometric cross sections, $\sigma_g = \pi\, R^2\, [1 - V_C(R)/E]$. The errors of the measured cross sections are about 10%, but the primary uncertainty in the ratios, that may be interpreted as probabilities for p-n conversion, are tied to the ambiguity in the choice of R for the geometric cross section. Here, we use the radii of the volume potential in KD parametrization, that tends to put the ratios on the high side. As alternative to total cross section ratio, one can examine normalized differential cross sections.

For the elastic or inelastic scattering of charged projectiles, it is common to normalize the differential cross sections with the Rutherford cross sections. This brings in different benefits. First, the magnitude range needed for presenting the cross section values shrinks. Second, when diffraction effects are moderate, one can visually identify the range of angles where Coulomb scattering dominates. Finally, when both the diffraction and refraction effects are moderate, one can interpret the ratio in terms of a transmission probability along a classical trajectory for staying within the entrance channel or for moving to another. Normalizing the charge-exchange cross sections with the Rutherford cross-section, to reap any benefits, is pointless, though, as charges in the final state are different than in the entrance state and only half of the Coulomb deflection, behind a differential Coulomb cross section, is accumulated when the particles approach each other and the other half when they move