During the recent years a considerable attention has been given to the study of the continuum spectrum in the inclusive reactions. In contrast, still very little is known about the continuum spectrum in the exclusive \((a,ab)\) quasifree (QF) reactions. Thus far, it has been customary in the analyses of the knockout reactions to draw continuum background lines in an arbitrary manner. However, a Monte Carlo simulation showed\(^1\) that the contribution from the background to the momentum distribution can be structured and therefore there is a distinct possibility of misinterpreting it as being part of the quasifree spectrum. The present contribution introduces a method which for the first time allows a quantitative description of the continuum spectrum in the quasifree scattering.

Our model is based on the following simple physical picture illustrated by the inset in Fig. 1 for a \((p,2p)\) scattering. We postulate that the coincidence continuum spectrum results from the rescattering of the QF particles on the spectator (S) part of the target nucleus. Thus, in the case of the \((p,2p)\) scattering for example, the process of forming the continuum is initiated by a QF collision which excited a two particle-one hole \((2p-1h)\) doorway state having both protons unbound. Upon elevating the Fermi level are removed from the QF kinematic loci. The above ideas can be implemented by extending the formalism of the Feshbach, Kerman, and Koonin\(^4\) statistical theory of the multi-step direct two-body thus feeding the QF particle loci, or into more complicated p-h configurations involving a multiple scattering of the two protons on the S nucleus, thus feeding the continuum PEQ spectrum. Notice that, in contrast with Rogers and Saylor,\(^3\) we are concerned here with the particles which, as a result of rescattering, are removed from the QF kinematic loci.

The above ideas can be implemented by extending the formalism of the Feshbach, Kerman, and Koonin\(^4\) statistical theory of the multi-step direct two-body
Thus, we assume that the energy averaged coincidence continuum cross section can be expressed as a convolution of the QF cross section with two chains of subsequent rescattering probabilities, one for each particle. We showed that, in the case of the $(p, 2p)$ scattering, it is physically reasonable to further express the rescattering chains in terms of the probability that the two protons from the QF step, with energies $E_1$ and $E_2$ at angles $\theta_1$ and $\theta_2$ will inelastically scatter to the final angles $\theta_1$ and $\theta_2$ with energies $E_1$ and $E_2$. We assume that these probabilities are related to the cross section for inelastic (IN) scattering on the S nucleus by the expression

$$\frac{d^2\sigma_{\text{IN}}}{dE_1 dE_2} \cdot \frac{1}{2\pi \sigma_{\text{TOT}}(E_1)}$$

where $\sigma_{\text{IN}}(E_1)$ is the $\theta_1$- and $E_1$-integrated inelastic scattering cross section of the $i$th proton with incident energy $E_1$ and $\theta_1 = |\theta_1 - \phi_1|$ is the inelastic scattering angle.

In order to expedite the test of these theoretical ideas we consider here the case when the rescattering of one of the QF particles can be neglected. The $(e, e'p)$ scattering is an example where this should be an excellent approximation. For such situations, the energy averaged coincidence continuum cross section is given by the expression

$$\langle \frac{d^3\sigma}{d\theta_1 d\theta_2 dE_2} (\theta_1, \phi_1, \theta_2, E_2) \rangle$$

$$= \int d\theta_2 \sin \theta_2 \int \frac{d^3\rho_{\text{QF}}}{d\theta_1 d\theta_2 dE_2} (\theta_1, \phi_1, \theta_2, E_2) \sigma_{\text{TOT}}(E_2)^{-1}$$

$$\cdot \frac{d^2\sigma_{\text{IN}}}{dE_1 dE_2} (E_1, \theta_1, E_2),$$

where the QF cross sections, corresponding to the initial instant when particles are not yet lost from the QF kinematic loci, assume distorted waves for the incident particle and particle 1 and plane waves for the particle 2.

For the purpose of this contribution we consider the average yield in a 40 MeV wide slice through the two-dimensional $(p, 2p)$ spectra centered at $\langle E_1 \rangle = 130$ MeV, for two angles $\theta_1 = -12^\circ$ and $-30^\circ$ and several positive angles $\theta_2$. The coincidence data are provided by our recent coplanar measurement of the $^58\text{Ni}(p, 2p)^{57}\text{Co}$ reaction using 198 MeV protons from IUCF, and the inelastic scattering cross sections are provided by the available experimental data for $E_2=62\text{-MeV}$ protons on $^{54}\text{Fe}$. Assuming that the rescattering of the $p_1$ proton with $E_1 > E_0/2$ is mostly at small angles, we will neglect the contribution to the continuum at positive angles $\theta_2$ coming from the QF protons initially emitted at negative angles $\theta_1$. Thus, the conditions which we have chosen will allow us to test the above simplified procedure for calculating the continuum spectrum in the $(p, 2p)$ scattering. An obvious prerequisite for solving the convolution integral is a correct evaluation of the doorway stage $\sigma_{\text{QF}}$ cross section. Since this is not an observable, we derive the occupancy probabilities of the neutron orbits from the comparison of a DWIA calculation with the data corresponding to the particles detected on the QF loci shown in Fig. 1. The convolution integral assuming that most of the continuum particles come from the $0f_{7/2}$ and $1s_{1/2}$ neutron shell model orbits is compared with the data in Fig. 2. The remarkable agreement which is obtained argues for further pursuing the ideas introduced here.
Figure 2. A calculation (full line curves) of the continuum spectrum from the $^{58}$Ni$(p, 2p)^{57}$Co reaction at $E_p=198$ MeV. The data correspond to the average yield in a slice through the two-dimensional energy spectra as explained in the text. The agreement in magnitude is reflected by the ratios $N_{\text{exp}}/N_{\text{theor}}$.

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