Abstract

We propose to investigate the subthreshold photoproduction of the three lowest mass vector mesons, $V = \rho^0$, ω, and ϕ mesons. In the subthreshold energy region, defined here as the energy region below the $\gamma + N \rightarrow V + N$ reaction threshold on the free nucleon, VMD-driven vector meson production is suppressed and the influence of hadronic matter on the masses of the vector mesons is emphasized. This method is the optimum vehicle for the study of in-medium modifications and, specifically for the ρ^0 meson, experimental evidence already exists for a dramatic reduction in m_{ρ^o}, which is dependent on the incident photon energy or the $\rho^0 - N$ relative momentum. This points to a potentially new and unexpected aspect: different regions of phase space enhance, alternatively, the $\rho^0 - N$ and $\rho^0 - A$ interactions and this approach is particularly attractive as a means to separate nucleonic from nuclear (mean field) effects. This assertion will be tested for the $\rho^0 \rightarrow \pi^+\pi^-$ channel and the study will be extended also to the unexplored domains of the $\omega \rightarrow \pi^+\pi^-\pi^0$ and $\phi \rightarrow \pi^+\pi^-\pi^0$ vector mesons. In addition, the hypothesis of vector mesons forming bound states in nuclei will be explored.

An attractive nuclear target for this investigation is ^3He. The minimum trigger requirement is the detection of two charged particles (with an open neutral trigger). We request 420 hours of nominal tagger photon beam ($10^7 \gamma/s$) in Hall B, in the tagged photon region between 320 MeV and 1520 MeV, of which 150 hours can be collected in the already approved *g3* period.

This is a Hall B Collaboration experiment.