Test of ϕ renormalization in nuclei through ϕ photoproduction

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We propose an experimental procedure to find out the medium modifications of the ϕ meson. The reaction is inclusive ϕ photoproduction in nuclei, looking for K^+K^- pairs from the ϕ decay with total momentum smaller than 100-150 MeV/c, which are made possible at energies of present laboratories from center of mass ϕ backward production and the help of Fermi motion. The ϕ renormalization in matter has received attention in dilepton production reactions, like for other vector mesons trying to look for possible mass scalings, and also in heavy ion collisions since ϕ production has been advocated as one of the signatures for a possible transition to the quark gluon plasma. Another reason is the connection with the changes of kaons inside matter, a subject of intense debate due to strong deviations from the low density theorem already at very low densities, as evidenced by the needed attraction to reproduce kaonic atom data.
We have conducted a many body calculation of the mass distribution of the ϕ [1] adapted to the experimental setup of a recent JLAB experiment where the backwards ϕ photoproduction has been measured. Using recent results for the in medium properties of the ϕ [2], we find that the width of the invariant mass distribution for photoproduction on medium to heavy nuclei is larger than the free ϕ width by a factor of two or more.
Experiments to see this ϕ renormalization in nuclei with this method are planned at Spring8/Osaka[3].

References

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