Testing the K^--nucleus interaction in $(K^-_{\rm stop}, \pi)$ reactions

A. Cieplý[a], E. Friedman[b], A. Gal[b] and J. Mareš[a]

[a] *Nuclear Physics Institute, CZ-250 68 Rez near Prague, Czech Republic*
[b] *Racah Institute of Physics, The Hebrew University, Jerusalem 91904, Israel*

Several models of the low-energy K^--nucleus interaction predict quite different depths for the K^--nucleus potential, while fitting reasonably well the kaonic atom data. We propose [1] to study reactions initiated by stopped K^- in order to resolve this ambiguity.

We present an up-to-date analysis of Λ-hypernuclear production yields in the $(K^-_{\rm stop}, \pi^-)$ and $(K^-_{\rm stop}, \pi^0)$ reactions. While the former process has been a standard tool in hypernuclear spectroscopy for a long time, the experimental results on the latter are just forthcoming [2]. In the calculation based on the DWIA approach [1] we focus attention on the sensitivity of the calculated capture rates to the initial-state kaon wave function.

Table 1 summarizes results obtained for the production of the 1^- hypernuclear ground states off ^{12}C. Different K^- nuclear optical potentials, ordered by their central depth, were used to generate the kaonic wave function. The 'chiral' potential is the relatively shallow chirally motivated potential of Ref. [1] and the 'DD' deep potential is due to the density dependent phenomenological model [3]. The 'effective' potential was obtained as a best-fit $V_{\rm opt} = t_{\rm eff}\,\rho$ standard form. Since these potentials were obtained within *global* fits to the available K^--atomic data, we also included another potential of the $t\rho$ form ('^{12}C') to fit exclusively the carbon data.

The results listed in Table 1 indicate that the deeper the K^- optical potential is, the lower the calculated rate becomes. These calculated rates are considerably lower than the measured value ([4] and references listed therein). Several uncertainties (pion distortion, adopted value for in-medium branching ratios) have to be reduced before more definitive conclusions could be drawn.

Table 1: Calculated capture rates on ^{12}C per stopped K^- (in units of 10^{-3}) to the summed $p_N \to s_\Lambda$ 1^- excitations in $^{12}_{\Lambda}$C and $^{12}_{\Lambda}$B for various K^- optical potentials.

final $^{A}_{\Lambda}$Z	chiral	effective	^{12}C	DD	exp. [4]
$^{12}_{\Lambda}$C	0.231	0.169	0.089	0.063	0.98 ± 0.12
$^{12}_{\Lambda}$B	0.119	0.087	0.046	0.032	

References

[1] A. Cieplý, E. Friedman, A. Gal, and J. Mareš, Nucl. Phys. **A696** (2001) 173.
[2] Brookhaven AGS Exp. E907 (1994), spokespersons: E.V. Hungerford, J.C. Peng.
[3] E. Friedman, A. Gal, and C.J. Batty, Nucl. Phys. **A579** (1994) 518.
[4] H. Tamura, R.S. Hayano, H. Outa, and T. Yamazaki, Prog. Theor. Phys. Suppl. **117** (1994) 1.