Low-energy K^- optical potentials: deep or shallow?

A. Cieplý[a], E. Friedman[b], A. Gal[b], J. Mareš[a]
[a]*Nuclear Physics Institute, 25068 Řež, Czech Republic*
[b]*Racah Institute of Physics, The Hebrew University, Jerusalem 91904, Israel*

The K^- optical potential ($V_{\rm opt}$) in the nuclear medium was evaluated self consistently from a free-space K^-N t matrix constructed within a coupled-channel chiral approach [1] to the low-energy $\bar{K}N$ data. The chiral-model parameters were fitted *simultaneously* to a select subset of the low-energy data and to the K^- atomic data throughout the periodic table. The real part of the resulting $V_{\rm opt}$ is relatively shallow, with central depth around -55 MeV, in rough agreement with other recent self consistent evaluations of $V_{\rm opt}$ [2,3]. It reproduces fairly well the K^- atomic data ($\chi^2/N \approx 2.2$), without requiring any additional phenomenological $t\rho$ term as was done recently in Ref. [4] ($\chi^2/N \approx 2.7$). In contrast, purely phenomenological [5] and RMF [6] approaches are capable of fitting the atomic data better ($\chi^2/N \approx 1.5$), but yield relatively deep potentials, with central depth about -180 MeV.

Different physical data input is required to distinguish between shallow and deep K^- optical potentials. The (K^-,π) capture from rest reaction could provide such a test, with rates differing by about a factor of two for the two types of $V_{\rm opt}$. A detailed exposition of these results is submitted for publication [7].

1. T. Waas, N. Kaiser and W. Weise, Phys. Lett. B 365 (1996) 12; 379 (1996) 34.
2. J. Schaffner-Bielich, V. Koch and M. Effenberger, Nucl. Phys. A 669 (2000) 153.
3. A. Ramos and E. Oset, Nucl. Phys. A 671 (2000) 481.
4. A. Baca, C. García-Recio and J. Nieves, Nucl. Phys. A 673 (2000) 335.
5. E. Friedman, A. Gal and C.J. Batty, Nucl. Phys. A 579 (1994) 518.
6. E. Friedman, A. Gal, J. Mareš and A. Cieplý, Phys. Rev. C 60 (1999) 024314.
7. A. Cieplý, E. Friedman, A. Gal and J. Mareš, nucl-th/0104087