K_{e4} EuroDAΦNE Working Group

Meeting of June 29th and 30th, 1998, Bern

Summary of Work Programme

A very useful meeting was held at the University of Bern, organised by Jürg Gasser and Gilberto Colangelo, with 17 participants. There were 9 talks covering the background theory and past analyses of $K_{\ell 4}$ decays by Michael Pennington, the status of BNL E865 experiment by Stefan Pislak, the prospects for KLOE By Patrizia de Simone, the Roy equations for low energy $\pi\pi$ scattering — their solutions by Gilberto Colangelo, their driving terms by Ananthanarayan and uniqueness by G. Wanders, Pais-Treiman analysis and model-dependences by Jan Stern, $K_{\ell 4}$ form-factors in GχPT by Norman Fuchs and radiative corrections by Marc Knecht.

As a result of discussions, the following topics were identified for future work.

- **Radiative Corrections**. A group led by Marc Knecht will continue to work on this topic. Their first task is to estimate the low energy constants, and from these to get an idea of the cuts needed to minimise the effect of radiative corrections in K_{e4} decays.

  They will then continue to study radiative corrections for the series of decays $\pi_{\ell\ell}$, $K_{\ell\ell}$, $K_{\ell 3}$, $K_{\ell 4}$ using the effective field theory formulation.

  They will investigate summation techniques for Coulomb terms at low momentum q, where the effective expansion parameter becomes α/q.

- **$\pi\pi$ phases**.

  General parametrization techniques will be considered by G. Wanders.

  An *effective* effective range formula satisfying the Roy equations in terms of a single parameter, e.g. a_0^0, will be developed by Colangelo et al. and considered by Stern et al.

  An estimate of the errors on the Roy equation solutions from the uncertainties on the input data will be made.

  Both the last two items will be expressed in terms of the phase difference $\delta_0^0 - \delta_1^1$, so that this can be input directly into the K_{e4} analysis.

- **$K_{\ell 4}$ form-factors**. A need to understand the dependence of the form-factors F, G, H, R on s_ℓ and s_π and the related analytic structure of the form-factors was identified. The minimal suggestion was that F, G are linear in s_ℓ and s_π, H is constant and for $e\nu$ final state R can be neglected. Hans Bijnens agreed to estimate the dependences on s_ℓ and s_π.

  Isospin violating effects: understanding these is needed to relate the form-factors f, g, h in $K^\pm \to \pi^+\pi^-e^\pm\nu$, $K^\pm \to \pi^0\pi^0e^\pm\nu$ and $K_L \to \pi^0\pi^-e^+\nu$ decays. The first question is *are* $m_u - m_d$ *effects* wholly accounted for by using the appropriate phase-space factors for each process. Jürg Gasser agreed to think about this.