



IN2P3  
Les deux infinis



# M2 RESEARCH INTERNSHIP PROPOSAL

## Numerical determination of heavy $Qqq$ baryon wave functions

This research internship proposal belongs to a larger project whose final aim is the determination of the form factors of the vectorial and pseudovectorial  $\Lambda_b \rightarrow \Lambda_c$  transitions which could allow, for instance, the study of the existence and the effects of lepton flavour violation. These form factors are obtained using the Bakamjian-Thomas (BT) construction which ensures several important features such as a covariant structure for the transition amplitudes as well as the right properties in the limit where the mass of the heavy quark  $Q$  goes to infinity. However, in order to make numerical predictions, the knowledge of the heavy baryon wave functions is mandatory, but the BT formalism does not provide this knowledge. Hence, another way around must be used.

The goal of this research internship is to compute numerically, in the quark model framework, the  $Qqq$  baryon wave functions according to the following plan :

- 1° Familiarization with the formalism which will be used to tackle this 3-body problem (Jacobi coordinates, quantum numbers of the states, etc),
- 2° Study of the relativistic quark model dynamics which has been chosen to describe the three quark bound states ("*Baryons in a relativized quark model with chromodynamics*", Simon Capstick & Nathan Isgur, Phys. Rev. D **34**, 2809),
- 3° Writing of the code for the numerical determination of the wave functions.

The candidate should send to the supervisor a short CV including M1 (and if possible M2) grades. A letter of recommendation would also be appreciated.

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