The Lund-Oslo Node

Johan Bijnens
Lund University

bijnens@thep.lu.se

http://www.thep.lu.se/~bijnens
Where are we?

Here we are

**Lund:**
Department of Theoretical Physics
Lund University

**Oslo:**
Department of Physics
University of Oslo
**People**

**Senior**
Johan Bijnens, Lund
Jan Olav Eeg, Oslo

**Postdoc**
Edisher Lipartia, Lund, until 30/9/2003
Timo Lähde, Lund (Young Researcher) 1/10/2003-30/9/2005

**Ph.D. Students**
Aksel Hiorth, Oslo, PhD May 2003
Pierre Dhonte, Lund, PhD June 2004
Fredrik Borg (Persson), Lund, PhD January 2005
Niclas Danielsson, Lund, from 1/9/2003
Karim Ghorbani, Lund, from 1/9/2003

**Master Students**
Olof Strandberg, Lund, Thesis February 2003
Anders Pinzke, Lund, Thesis June 2004
Kjetil Eide, Oslo, ongoing
Jon Atle McDonald Sørensen, Oslo, ongoing
<table>
<thead>
<tr>
<th>Blue = network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lund</td>
</tr>
<tr>
<td>Granada</td>
</tr>
<tr>
<td>Barcelona</td>
</tr>
<tr>
<td>Karlsruhe</td>
</tr>
<tr>
<td>Bern</td>
</tr>
<tr>
<td>Vienna</td>
</tr>
<tr>
<td>ECT*</td>
</tr>
<tr>
<td>Glasgow</td>
</tr>
<tr>
<td>Oslo</td>
</tr>
<tr>
<td>CERN</td>
</tr>
<tr>
<td>Trieste</td>
</tr>
<tr>
<td>Zagreb</td>
</tr>
<tr>
<td>Ljubljana</td>
</tr>
</tbody>
</table>

**Note:** and many discussions on topics of common interest with Paris, Valencia, Marseille, Amherst, Caltech, Rome, Bonn, Uppsala, . . .
Main Strengths

- **Lund**
  - Chiral Perturbation Theory at High Order
  - Nonleptonic Weak Decays (light quarks)
  - Various nonperturbative methods in matching long and short-distance effects for light quark physics

- **Oslo**
  - Nonperturbative Aspects of heavy Quark Physics
  - In particular: Heavy-light Chiral Quark Model
Main Achievements

**Chiral Perturbation Theory (ChPT)**

- $K_{\ell 3}$ at two loops *(Lund-Barcelona)*
- Scalar Form Factors, $\pi\pi$ and $\pi K$ at two loops also in three flavour ChPT *(Lund, Lund-Barcelona)*
- ChPT and Lattice QCD $\Rightarrow$ Timo Lähde *(Lund Young Researcher)*
- Isospin Breaking in $K \rightarrow 3\pi$ Decays *(Lund)*

These calculations play a role in many aspects of the network activity and interact strongly with the work done at many other nodes.

**Paris**: Spontaneous symmetry Breaking: $2 \leftrightarrow 3$ light quarks
**Vienna, Rome, Valencia, ...** Precise determination of $V_{us}$

**Rome**: $K \rightarrow 3\pi$ experiment and theory

**Bern, Vienna**: Predictions for $\pi K$ atoms

**Bern, Paris**: Dispersive work on $\pi\pi$, $\pi K$
Main Achievements

• **Nonleptonic Weak Decays (light quarks)**
  - $K \rightarrow 3\pi$: see above
  - $B_K$ and other weak matrix-elements: see below

• **Nonperturbative Matching**
  - Ladder resummation approximation (**Lund-Granada**)
  - Conflicts Short-distance Constraints $\Leftrightarrow$ resonance saturation approaches (**Lund-Granada**)
  - Updates on $B_K$ and some QCD higher order corrections in the relevant matrix elements (**Lund-Granada**)
  - Some work on electromagnetic matrix elements (Lund)

Again these play a role in many aspects of the network activity and interact strongly with the work done at many other nodes.

**Barcelona, Marseille, Valencia, Paris**
Main Achievements

Heavy Quark Physics

- Heavy-Light Chiral Quark Model (Oslo)
- Applications to various Decays (Oslo-Zagreb)
- Estimates of nonfactorizable contributions (Oslo-Ljubljana-Zagreb)

Again these play a role in many aspects of the network activity and interact with the work done at many other nodes.

Rome, Paris
Training

The training has several aspects

- Young Researcher: Benefits both ways: institute plus researcher
- PhD: Collaboration Meetings provide good place to meet students working on similar topics. I.e. only theory group in Sweden/Norway working in this part of phenomenology. Also provides an overview of what happens in Europe in this area.
- PhD, Master: School: More introductory version of above
- PhD: Often first talk in international meeting

Visits to collaboration meetings or schools by:
T. Lähde, F. Borg, P. Dhonte, E. Lipartia, K. Eide, J.A. McDonald Sørensen, N. Danielsson
Networking

Research/Collaboration inside network

- J. Prades and E. Gámiz (Granada) to Lund (frequently)
- G. Ecker (Vienna), A. Pich (Valencia) to Lund
- T. Lähde (Lund) to Helsinki (network)
- J. Bijnens to Oslo, Berne, Granada

Mainly paid from other sources

Collaboration Meetings: Attended by the two seniors and several younger ones every time.

Provide an opportunity to meet collaborators, others working in the same area on a regular and more specialized basis than otherwise possible.

Consumes the networking part of the budget plus supplementary funds.
Overview

**Budget:**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Young researcher</td>
<td>59500</td>
<td>13 months, will get 24</td>
</tr>
<tr>
<td>Networking</td>
<td>21450</td>
<td>10750 (Lund) 10700 (Oslo)</td>
</tr>
<tr>
<td>Overhead</td>
<td>14050</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95000</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Benefits:**

Very difficult to get young researcher otherwise
Very important for our small group to stay well connected
Travel supplemented by other funds shows the importance

**Problems:**

EU administration versus Swedish administration:
bookkeeping/reports take quite some time
Constant battle for overhead: faculty/central take all
sometimes indirectly more
Extra costs due to money arrival often after spending


15. **Scalar Form Factors to** $O(p^6)$ in $SU(3)$ **Chiral Perturbation Theory**, J. Bijnens and P. Dhonte, -, -, Presented at CHIRAL DYNAMICS 2003 Theory and Experiment Bonn/Germany, September 8-13, 2003, published in the proceedings.


29. **On the colour suppressed decay modes to** $\overline{B}^0_d \rightarrow D_s^+D_s^-$ and $\overline{B}_s^0 \rightarrow D^+D^-$, J.O. Eeg, S. Fajfer, A. Hiorth, *Phys. Lett. B* 570 (2003) 46-52


31. **On the singlet penguin in** $B \rightarrow K\eta'$ **decay**, J.O. Eeg, K. Kumericki, I. Picek, Proceedings of 9th Adriatic Meeting, Dubrovnik, Croatia,
32. **A Heavy-Light Chiral Quark Model applied to** $B - \bar{B}$ **mixing,** $B \rightarrow D\eta'$, $B \rightarrow D\bar{D}$, **and** $D^* \rightarrow D\gamma$. Jan O. Eeg, Invited talk at “QCD@work”, Conversano, Italy june 2003, to appear in the proceedings.


35. **Isospin Breaking in** $K \rightarrow 3\pi$ **Decays III: Bremsstrahlung and Fit to Experiment,** J. Bijnens and F. Borg LU TP 04-40, hep-ph/0501163

36. **Decay Constants of Pseudoscalar Mesons to Two Loops in Three-Flavor Partially Quenched $\chi$PT,** J. Bijnens and T.A. Lähde LU TP 05-1, hep-lat/0501014

37. **The** $B_K$ **Kaon Parameter in the** $1/N_c$ **Expansion,** J. Prades, J. Bijnens and E. Gámiz, LU TP 05-3, hep-ph/0501177, Invited talk given by J.P. at “Large $N_c$ QCD Workshop”, 5-9 July 2004, Trento, Italy