V. Ravindran

Research Summary:

The fixed order QCD predictions often have limitations in applicability due to the presence of various logarithms that become large in some kinematic regions which otherwise can be probed by the experiments. The standard approach to probe these regions is to resum the class of such large logarithms supplemented with fixed order results. This can almost cover the dominant kinematic region of the phase space. Recently, we have extracted soft distribution functions for Drell-Yan and Higgs production processes using mass factorisation theorem and the perturbative results that are known upto three loop level and are found to be maximally non-abelian. We have shown that these functions satisfy Sudakov differential equations. The formal solutions to such equations and also to the mass factorisation kernel upto four loop level are presented. We have obtained the threshold resummation exponents upto three loop using the soft distribution function which are important to study the effects of resummation. We have also predicted threshold enhanced QCD corrections to inclusive processes such as Deep inelastic scattering, Drell-Yan process and Higgs productions through gluon fusion and bottom quark annihilation processes using the resummed cross sections. Generalising our approach, we have demonstrated a similar resummation of soft gluons can be done for the energy distribution of bottom quarks in the Higgs decay as well as for the hadroproduction in l^+l^- annihilation processes and differential distributions of DY pairs and Higgs. We have shown that these higher order threshold QCD corrections improve the theoretical predictions for the Higgs Boson production through gluon fusion at hadron colliders which is one of the discovery mode of the most wanted particles in high energy physics.

Publications:

1. J. Blumlein and V. Ravindran. *$O(\alpha_s^2)$ timelike Wilson coefficients for parton-fragmentation functions in Mellin space,* Nucl.Phys.**B749**:1-24(2006), arXiv:hep-ph/0604019

2. M. C. Kumar, P. Mathews and V. Ravindran. *PDF and scale uncertainties of various DY distributions in ADD and RS models at hadron colliders,* Eur.Phys.J.**C49**:599-611(2007), arXiv:hep-ph/0604135,

3. J. Blümlein and V. Ravindran. *QCD threshold corrections to Higgs decay and to hadroproduction in l^+l^- annihilation,* Phys.Lett.**B640**:40-47(2006), arXiv:hep-ph/0605011,

4. V. Ravindran, J. Smith and W. L. van Neerven, *QCD threshold corrections to di-lepton and Higgs rapidity distributions beyond* N^2LO, Nucl. Phys. **B767**, 100-129(2007), arXiv:hep-ph/0608308

Conference/Workshops Attended:

1. Workshop on LHC Physics, TIFR, Mumbai,India,September 2-8,2006

Visits to other Institutes:

1. Lorentz Institute, University of Leiden, Leiden, The Netherlands, June 1st to August 30th 2006,
2. Nikhef, Amsterdam, The Netherlands, August 2006.
3. LPTHE,Paris, July 27,28, 2006.
4. KEK, Tsukaba, Japan, November 1st to December 31st 2006
5. Wako,RIKEN, Tokyo, Japan, December 13-14,2006
6. Kyoto University, Japan, December 20-22, 2006

Invited Lectures/Seminars:

1. *Sudakov resummation and Threshold corrections to inclusive processes in QCD* , Department Seminar, LPTHE , Paris, July 2006.
2. *Sudakov Resummation for Higgs production* , Institute Seminar, Nikhef , Amsterdam, August 2006.
3. *Two lectures on Perturbative Quantum Chromodynamics*,Workshop Talk,TIFR, Mumbai, September 2006.

Other Activities:

1. Taught a course on "Perturbative QCD" in SERC school held in University of Hyderabad, January, 2007.
2. Taught a semester course on "Atomic, Molecular and Nuclear Physics" at HRI, 2007.
3. Guided a summer student.