CURRICULUM VITAE

ANWAR A BHATTI

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Education

Ph.D. 1991	University of Washington, Seattle, WA, USA.

Employment

2002-Present	Associate Professor, Rockefeller University.
1995-2002	Assistant Professor, Rockefeller University.
1991-1995	Research Associate, Rockefeller University.
2003-Present	Adjunct Professor, National Center for Physics, Quaid-i-Azam University Islamabad, Pakistan.

Leadership Positions

Group Leader, The Rockefeller University Group, CMS Collaboration,
Large Hadron Collider, CERN, Geneva, Switzerland.
Convener, All Hadronic SUSY Group, CMS Collaboration, April-2008-
Convener, Jet+MET Topology Group, LHC Physics Center, Fermilab, Nov-2007-
Convener, Jet Energy Corrections group CDF Collaboration, June-2001–March 2005.
Convener, QCD group CDF Collaboration, Jan-1999–Dec-2000.
Convener, Jet Studies sub-group at the DPF Snowmass Workshop, 1996.

Honors

First Position, M.Sc., Quaid-i-Azam University, Islamabad, Pakistan (1982).
Bronze Medal, B.Sc., University of the Punjab, Pakistan (1978).
Silver Medal, F.Sc., Sargodha Intermediate Education Board, Pakistan (1976).

Professional Affiliations

American Physical Society.
Division of Particles and Fields.
American Association for the Advancement of Science.

Personal Interests

Outside physics, I enjoy reading books and walking and hiking in wilderness.

Physics Research

The current theory of fundamental constituents of matter and their interactions, Standard Model (SM) is very successful in explaining most of the experimental facts but is still incomplete. Thus, many beyond the Standard Model (BSM) theories have been proposed. However, none of these BSM theories have been verified experimentally. The Large Hadron Collider (LHC), Geneva, Switzerland will provide a new energy regime where these theories can be tested. In 2005, I joined Compact Muon Solenoid (CMS), one of the two major experiment at LHC to test the BSM theories. I am the group leader of the Rockefeller University CMS group. I am, also, a member of the Collider Detector at Fermilab (CDF) collaboration since 1991. My work on these experiments is described below.

Compact Muon Solenoid (CMS) Experiment

Search for Supersymmetry particles: Supersymmetry (SUSY), the most popular BSM theory, symmeterizes matter particles and force carriers. SUSY predicts existence of particles which interact very weakly with matter and thus escapes the detector without leaving any signal. Existence of these particles can be inferred using the principle of the conservation of momentum. Thus the classic signature of Supersymmetry is a proton-proton collision event which contains multiple jets and a large imbalance in visible transverse momentum. Jets, collections of collimated particles, are manifestation of decay products of some of the SUSY particles. I am using this signature to search for SUSY particles. The same signature can also arise from some of the SM processes and various detector effects, making this search a very challenging endeavor. Our group is contributing to following aspects of this search.

- Trigger design to select the SUSY candidate events and software to analyze these events
- Measurement of background from invisible decays of Z boson
- Estimation of background from QCD multi-jet events

Search for substructure of quarks and dijet resonances: In one of the BSM theories, Standard Model's fundamental particles, quarks and leptons, are composite. The internal structure of the quarks can be probed at high energies available at the LHC. Following my work at CDF, I am measuring the inclusive jet cross section which is sensitive to the quark substructure. Some other BSM scenarios predict existence of new heavy particles which decay into quarks or gluons and appear as a pair of jets in the detector. I am searching for these resonances by measuring the deviation of dijet mass spectrum from the smooth SM background.

Calibration of the calorimeter and determination of the jet energy scale: A very important aspect of a high energy physics experiments is the calibration of the detectors. I wrote the initial procedure to determine jet energy scale of the CMS detector. Because of my past experience, I am an important member of the team working on this very important task.

I am, also, a member of the calorimeter simulation task force which is evaluating the current status of the simulation and estimating the uncertainty on jet energy scale due to possible deficiencies in the current simulation.

Collider Detector at Fermilab (CDF) Experiment

Precision Tests of Quantum Chromodynamics : At the CDF, I mainly worked on precision tests of Quantum Chromodynamics (QCD) which is the theory of strong interaction, and a part of SM. These precision tests are important and interesting because, apart from testing the limits of our understanding, they provide essential information about the possible backgrounds which needs to be understood when we look for the last missing piece of the Standard Model, the Higgs particle, or BSM physics. These measurements include:

1. search for W/Z boson decaying into jets (2008) (submitted to Phys. Rev. **D**),
2. measurement of inclusive jet cross section in Run II(2006),
3. ambient energy in minimum bias and hard interaction events (2004), **24** citations.
4. determination of strong coupling constant α_s (2001), **29** citations,
5. measurement of inclusive jet cross section at Run IB (2001), **93** citations,
6. tests of QCD scaling violations by comparing scaled inclusive jet cross section at $\sqrt{s} = 630$ and $\sqrt{s} = 1800$ GeV (A. Akopian's Thesis, 1999), unpublished,
7. measurement of dijet production with central rapidity gaps (1998), **78** citations,
8. measurement of diffractive dijet production (1997), **97** citations,
9. measurement of inclusive jet cross section at Run IA (1996), **302** citations,

In addition to these precision tests, I searched for **BSM particles decaying into dijets**. This dijet analysis is complete and is under collaboration review.
Jet Energy and Resolution Studies: In my opinion, at the CDF, an accurate determination of the jet energy scale and improvement of the jet resolution and an efficient identification of b-quarks are the three most important ingredients to improve the accurate measurement of top mass and search for new particles such as the Higgs boson. These two studies are the main focus of current Tevatron run. I devoted most of my time in 2001-2005 toward determining the jet energy scale and improving the jet resolution and laid a solid foundation for precision measurements at the CDF. As a convener of the jet energy correction and resolution group from June 2001 to March, 2005, I supervised many graduate students and postdoctoral research associates on many different aspects of jet energy scale determination. Because of this work, the uncertainty on **top quark mass improved from 6.2 GeV (2004) to 2.9 GeV (2005), the best single experiment measurement**, resulting in more stringent constraint on the mass of the Higgs boson allowed in the Standard Model.

Mentoring and Teaching Experience

Graduate Students

- Alexander Akopian, Rockefeller University, Ph.D., CDF.
- Christina Mesropian, Rockefeller University, Ph.D., CDF.

Post Doctoral Fellows

- Kenichi Hatakeyama, Rockefeller University, CDF.
- Gheorghe Lungu, Rockefeller University, CMS.
- Ming Yan, Rockefeller University, CMS.

Mentoring

- Gene Flanagan, Michigan State University, Ph.D., CDF.
- Valeria Tano, Michigan State University, Ph. D.,CDF.
- Mehmet Vergili, Cukurova University, MS, LPC/CMS.
- Pelin Kurt, Cukurova University, Turkey, Ph.D., LPC/CMS.
- Huseyin Topakli, Cukurova University, Turkey, Ph.D., LPC/CMS.
- Seema Sharma, TATA Institute,India, Ph.D., LPC/CMS.
- New York area high school summer students 1993, 1997-2002.

Mehmet worked on jet energy calibration using dijet balancing technique and finished his MS in December, 2006. Pelin has worked in jet fragmentation studies and is currently working on photon-jet balancing studies. Huseyin is working on validation of CMS calorimeter response and Z+jet studies.

In addition, as convener of CDF QCD and CDF Jet Energy Scale and Resolution groups, I interacted with many graduate students and post doctoral fellows on many different analyses.