

Syed Eram Abbas Rizvi

Member of the Institute of Physics

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Qualifications

- 1993 – 97** Queen Mary and Westfield College
PhD thesis: Bose-Einstein Correlations in Deep Inelastic Scattering at HERA
- 1990 – 93** Manchester University BSc. Physics 1st class honours

Appointments

- 2010 –** Senior Lecturer, Particle Physics Research Centre (PPRC) – Queen Mary
- 2003 – 10** Lecturer, full time, PPRC – Queen Mary, University of London
- 1998 – 03** Postdoctoral research associate, University of Birmingham
- 1997 – 98** Research fellow, DESY Research Laboratory, Hamburg

Teaching 2010-2013

- **PHY302 Nuclear Physics and Astrophysics:** sole module organiser since 2006
Level 5 core module: 3 lectures/week and exercise classes, 113 students (2012/13)
Assessment: in-class debate, coursework, two exams
Within the school I have pioneered the regular use of an electronic voting system in lectures, video recordings and pod-casts of all lectures, and introduced the use of invited external lecturers in teaching this module including an NHS radiologist, a fusion plasma physicist and an international nuclear security analyst. These innovations have resulted in high student feedback – 93% in 2012/13.
- **PHY4103 Scientific Measurement:** one of two module organisers since 2005 (not 2010)
Level 4 core module: 1 lecture/week, lab sessions 12 hours/week; 102 students (2012/13)
My proportion of contact hours is 4 hours/week
Assessment: coursework, experiment reports
I have mentored four academics as co-organisers in this module since 2008 taking on a higher proportion of administrative workload and management of 10 demonstrators and 2 technicians.
- **PHY300 Synoptic Physics:** one of four module organisers, 2010
Level 6 core module: 1 tutorial/week (4 students/group), 50 students (2010)
Assessment: summative assessments in each session
I had 2 contact hours per week discussing and solving general physics problems.
- **Analysis Methods:** sole module organiser 2004-2012
U. of London PhD core module, 20 students enrolled 2011/12
Teaching: 4 lectures
Assessment: summative assessments in each session
This is a module I developed in 2000 and was invited to deliver annually to 100 international PhD students at the DESY particle physics accelerator laboratory, Hamburg. I proposed this be added to the University of London intercollegiate PhD course in particle physics in 2004. In October I mentored a postdoc, who then took on the course in the last session.
- **PHY913/709 Undergraduate Projects:** project supervisor since 2004
Level 6/7 core module, typically 3 students supervised annually
Teaching: 1 hour weekly supervision/student
Assessment: oral exam, written report
In 2012/13 I innovated using external contacts to jointly supervise projects giving students access to environments outside QMUL. The current external supervisors are from King's College Department of War Studies, and the Parliamentary Office of Science and Technology. In 2010 I acted as external supervisor for a student at the University of Cambridge.

Academic Supervision

PhD Student	Dates	Supervisor role	Comments
Elisa Piccaro	10/2008 – 08/2012	Primary	PhD awarded 10/2012
Jack Goddard	10/2009 –	Primary	Thesis submission April 2012
Rob Hickling	10/2010 –	Primary	
Marc Cano Bret	10/2011 –	Primary	
Lewis Armitage	10/2012 –	Primary	

With four current PhD students I have the largest number of research students within the PPRC

Postdoc	Dates	Comments
Dr Joseph Lilley	02/2012 –	Physics measurement of proton structure at the LHC. Analysis is under internal review within ATLAS.
Dr John Morris	10/2011 –	Developed Level 1 Calorimeter Trigger enhancements implemented by ATLAS in online data-taking, Jan 2012
Dr Dan Traynor	01/2004 – 2010	H1 collaboration (300 members) physics analysis

I have developed my own group and currently work with two postdocs on the ATLAS experiment at the Large Hadron Collider (LHC) working in two streams to deliver physics results, and detector enhancements, which benefit the entire experimental collaboration.

Academic Visitors: I have received several short term academic visitors since 2010 including

- Prof. Glenn Starkman (Case Western Reserve University, USA) – December 2011
- Dr Alan Cornell (University of the Witwatersrand, South Africa) – December 2011
- Prof. Amanda Cooper-Sarkar (Oxford University, UK) – September 2010
- Prof. Lance Dixon (Stanford University, USA) – October 2010

Invited Visits: I have been invited to visit collaborators for one week covering travel costs

- Dr Katerina Lipka (DESY Accelerator Laboratory, Hamburg, Germany) – July 2012
- Prof. Stanisław Mikocki (Institute of Nuclear Physics, Cracow, Poland) – September 2011

Highlighted Publications

Publications in which I have played a lead or central role. Citation counts for each entry are given as of Feb 2013. Publications in underlined typeface are those having received more than 100 citations to date. A full list of publications can be found in the **Appendix**.

Articles

1. *Inclusive Deep Inelastic Scattering at High Q^2 with Longitudinally Polarised Lepton Beams*
Journal of High Energy Physics 1209 (2012) p1-121, H1 Collaboration

This extensive analysis concludes the H1 Collaboration's proton structure programme measuring eight reactions using data collected over a five-year period. As project leader I co-ordinated the complete effort since 2003 leading an international team of 17 people from five institutes. The precise measurements in this paper form a legacy data set which are essential input for all high energy proton-proton reaction predictions at CERN's Large Hadron Collider, in particular for the predictions of Higgs boson production and other new particles, and are published in the highest impact factor journal of the field. 7 citations.

2. *Combined Measurement and QCD Analysis of Inclusive ep Scattering Cross Sections*
Journal of High Energy Physics 1001 (2010) p1-55, H1 and ZEUS Collaborations

My involvement was central in combining the H1 and ZEUS measurements by assessing the treatment of the experimental uncertainties and correlations with the ZEUS data. Several of the data sets used in the combination are measurements I performed - see [4,9,11,14] below. 288 citations.

3. *Jet Production in ep Collisions at High Q^2 and Determination of α_s*
Eur. Phys. J. C65 (2010) p363-383, H1 Collaboration
My role was to ensure these measurements were consistent with other H1 measurements made by myself and the H1 working group, and to ensure that detailed systematic uncertainties were treated coherently in both analyses. 50 citations.
4. *Measurement of Inclusive ep Scattering Cross Section at low Q^2 and x at HERA*
Eur. Phys. J. C63 (2009) p625-678, H1 Collaboration
This analysis was performed within the working group I convened and my role was to ensure the quality of the analysis before publication by providing regular and detailed scrutiny of the analysis as presented to the collaboration. 55 citations.
5. *BlackMax: A black-hole event generator with rotation, recoil, split branes, and brane tension*
Phys. Rev. D 77 076007 (2008) p1-32, D. Dai et al
In this publication a new simulation code was publicly released modelling quantum gravity effects and micro-black-hole production at the LHC. My input to this publication and to the project was to ensure the simulation code was fit for purpose and easily available to researchers in the field. I provided significant input in structuring the package, benchmarking and development. 78 citations.
6. *First Measurement of Charged Current Cross Sections with Longitudinally Polarised Positrons*
Phys. Lett. B 634 (2006) p173-179, H1 Collaboration
I led the complete measurement project. 33 citations.
7. *A Determination of Electroweak Parameters at HERA*
Phys. Lett. B 632 (2006) p35-42, H1 Collaboration
I helped direct this analysis and provided detailed scrutiny. 33 citations.
8. *Search for New Physics in eq Contact Interactions at HERA*
Phys. Lett. B 568 (2003) p35-47, H1 Collaboration
I provided scrutiny of the measurement, advice on experimental uncertainties and ensured consistency with other publications. 43 citations.
9. *Measurement and QCD analysis of Neutral and Charged Current Cross Sections at HERA*
Eur. Phys. J. C30, (2003) p1-32, H1 Collaboration
I led the complete measurement project. 267 citations.
10. *Search for Compositeness, Leptoquarks and Extra Dimensions in eq Contact Interactions*
Phys. Lett. B 479 (2000) p358-370, H1 Collaboration
I provided scrutiny of the measurement, and performed analysis cross checks. 64 citations.
11. *Measurement of Neutral and Charged Current Cross Sections in e^-p Collisions at High Q^2*
Eur. Phys. J. C19 (2001) p269-288, H1 Collaboration
I led the complete measurement project. 177 citations.
12. *xF3yZ in Charged Lepton Scattering*
Eur. Phys. J. Direct C3, N2 (2001) p1-8, E. Rizvi and T. Sloan
I performed the complete analysis. 7 citations.
13. *Measurement and QCD Analysis of Jet Cross Sections in Deep-Inelastic e^+p*
Eur. Phys. J. C19 (2001) p289-311, H1 Collaboration
I gave advice on experimental uncertainties and performed detailed cross checks. 99 citations.
14. *Measurement of Neutral and Charged Current Cross Sections in e^+p Collisions at Large Q^2*
Eur. Phys. J. C13, (2000) p609-639, H1 Collaboration
I performed the complete phenomenological analysis of the data. 231 citations.
15. *High Q^2 Deep Inelastic Scattering at HERA*
J. Phys. G 25, (1999) p1387-1409, A. M. Cooper-Sarkar et al
I wrote one chapter of this six chapter report. 10 citations.

16. Bose-Einstein Correlations in Deep Inelastic ep Scattering at HERA

Z. Phys. C75, (1997) p437-451, H1 Collaboration

I performed the complete analysis. 19 citations.

17. A Study of the Fragmentation of Quarks in ep Collisions at HERA

Nucl. Phys. B445, (1995) p3-24, H1 Collaboration

I performed calculations providing theory corrections to the measured data. 57 citations.

Articles Accepted for Publication

18. Measurement of angular correlations in Drell–Yan lepton pairs to probe Z/γ^* boson transverse momentum at $\sqrt{s}=7$ TeV

Physics Letters B (publication accepted Jan 2013) p1-22, ATLAS Collaboration.

I was appointed to an independent Editorial Board team of four expert senior physicists tasked with performing a rigorous 10 month internal review of the complete analysis and provide oversight of publication process on behalf of the 3000 co-author members of the ATLAS Collaboration.

Reviews Accepted for Publication

19. The quark and gluon structure of the proton

Reports on Progress in Physics (scheduled March 2013) p1-108, E. Rizvi & E. Perez

This invited review was well received by colleagues (pre-print released August 2012), and journal referees who noted it as “*an excellent and comprehensive review... deserving prompt publication*”, and is double the typical length for this high impact review journal. The work was split evenly with my co-author.

Research Grants

STFC grants in Experimental Particle Physics (EPP) awarded on overlapping 3-5 year basis with Head of Group as PI. Attributed value based on FTE proportion awarded on grant.

Title	Dates	Principal Investigator	Co-investigators	Total Value	Attributed Value
STFC – EPP Consolidated Grant	01/10/12 30/09/16	Prof. S. Lloyd	9 PPRC academics	£3.21 M	£408 K
EPSRC–QM International Collaboration	08/08/11 31/03/12	Dr S. E. A Rizvi	–	£2500	–
Inst. Of Physics – Meeting Support	30/06/11 31/12/11	Dr S. E. A Rizvi	–	£500	–
STFC – EPP Rolling Grant	01/10/10 30/09/14	Prof. S. Lloyd	9 PPRC academics	£2.67 M	£297 K
STFC – EPP Rolling Grant	01/10/09 30/09/10	Prof. S. Lloyd	9 PPRC academics	£1.09 M	£121 K
STFC – EPP Rolling Grant	01/10/06 30/09/11	Prof. S. Lloyd	9 PPRC academics	£5.50 M	£611 K

External Recognition

- 2013** ▪ Invited to deliver post-graduate winter school lectures “Quantum Gravity at the LHC”, European COST Framework action, University of Sussex.
- 2012 –** ▪ Appointed as independent expert to four ATLAS Editorial Boards internally reviewing analyses for publication.
- 2012** ▪ REF dry run research outputs rated 4*, 4*, 4*, 3*.
- 2012** ▪ Invited plenary speaker at International Workshop, Rio de Janeiro, Brazil.
- 2011** ▪ Invited plenary speaker at International Conference, Spa, Belgium.
- 2009 – 13** ▪ Four appointments as external PhD examiner to Universities of Oxford, Manchester and Liverpool.
- 2007 – 13** ▪ Four appointments as internal PhD examiner to UCL, RHUL, QMUL.

- 2003 – 12** ▪ Appointed H1 collaboration Physics Working Group Convenor responsible for analysis quality and steering all proton structure measurements to publication – 13 papers published, with group membership of 30 international physicists.
- 2008** ▪ Invited to deliver post-graduate summer school lectures “Parton Density Functions”, Helmholtz Alliance Lecture Series, DESY, Berlin.
- 2006 – 08** ▪ Invited to join H1 Collaboration Executive Committee: ten senior physicists advising collaboration management on all matters related to the running, operation and funding of the experiment.
- 2005 – 06** ▪ Invited twice as tutor at the High Energy Physics Graduate Summer School for 80 UK particle physics graduate students – two week residential programme.
- 2004** ▪ Invited Working Group Convenor at the International Workshop on Deep Inelastic Scattering, Slovakia with 300 participants.

Research Administration

- 2011** ▪ Sole organiser of international workshop on TeV Scale Gravity, with 50 participants worldwide, including South Africa, USA, Taiwan and Europe.
- 2007** ▪ Sole organiser of three day Working Group Meeting for 30 international collaborators from H1 at QMUL.
- 2000 – 03** ▪ DESY Laboratory Graduate Student Lectures: Methods & Techniques in Experimental Particle Physics, annually given to 100 international students.
- 2001** ▪ Organised H1 Collaboration meeting over five days at the University of Birmingham for 100 collaborators.

Research Activity

[Refs. indicate highlighted publications]

ATLAS Proton Structure Measurements: 2010 –

I have assembled and lead a 14 member team of ATLAS physicists, including five academics from Italy, Germany, Canada, and the UK (Liverpool & QMUL) to measure the Low Mass Drell-Yan process. The Editorial Board team of four appointed senior academic experts is now in the concluding phase of reviewing the analysis and publication draft I have written for submission to the Journal of High Energy Physics. I have authored an extensive 110p internal technical report detailing the measurement which has been released to all 3000 ATLAS co-authors for review. My leadership role in this field has been recognised by the STFC grant panel review in 2009 and 2012.

ATLAS Level 1 Calorimeter Trigger Development: 2011 –

The Level 1 Calorimeter Trigger is a critical component of the ATLAS detector, which decides online if a data collision event, should be rejected or recorded at 75 kHz rate, thus mistakes in the online trigger cannot be rectified to recover data. In particular the “missing ET” trigger (MET) is one important trigger component used in the discovery of the new Higgs-like boson. Together with my postdoc and student I developed and tested a trigger configuration resulting in a factor of ten improvement in the background rejection without sacrificing efficiency of recording interesting physics data. The proposed configuration was implemented for the complete 2012-13 data run and used in the Higgs boson searches. I am now continuing this work with a second student to achieve further performance enhancements.

BlackMax: 2007 –

This project is a collaboration of 11 theoreticians and experimentalists from seven international institutes to produce a state-of-the-art simulation of quantum gravity models and micro-black hole production at the LHC, initially published in [5]. In 2010 I took leadership of the project and under my direction the simulation code has been adopted by the ATLAS and CMS collaborations and cited in their publications. The group is now working to include new effects and updated models in preparation for the higher energy LHC operation due to commence in 2015.

ATLAS Search for Quantum Gravity: 2012 –

My knowledge of quantum gravity models from the BlackMax project leads naturally to an experimental search. The large ATLAS data set collected in 2012-13, and the improved “missing ET” trigger is ideal for searching for such new physics effects. Together with my PhD student we now lead the search for micro black hole production. Such searches at the highest attainable LHC

energies are also very sensitive to uncertainties in the structure of the proton, where my additional expertise is valued. We aim to produce a publication by the autumn.

H1 Proton Structure Measurements: 1997 – 2012

This project has been the main focus of my research activity within the H1 collaboration of 300 physicists and is published in [1,6,9,11,14]. Since 2003 I led a 17-member team from five institutes measuring the polarised High Q^2 Proton Structure Functions. I co-ordinated all aspects of the analysis: ensuring high data-taking quality during five years of accelerator operation; detailed statistical data analysis; 20 intermediate results released at conferences; phenomenological studies; and lead author of the final publication [1]. I have achieved a first ever measurement of one structure function and a factor of two reduction in the experimental uncertainty compared to earlier unpolarised measurements [6,9,11,14]. With no new accelerators planned, this legacy data set will not be superseded for at least a decade. During this time all future studies will derive from this measurement, including the HERAPDF group activity.

HERAPDF: 2008 –

I am a founder member of HERAPDF group of about 20 working members aiming to produce precise combinations of published H1 and ZEUS proton structure measurements and accurate extractions of phenomenological parameters. My detailed knowledge of H1 measurements is a central contribution to the project. In the first phase the group produced one highly cited paper [2]. With the completion of my H1 measurements published in [1] the second phase of the HERAPDF programme is underway, where my contribution is to help understand the detailed statistical treatment of the data in the combination process. The analysis is due for publication this summer.

Knowledge Transfer and Consultancy

- 2012** ▪ I provided consultancy to the Gatsby Charitable Foundation, set up by Lord Sainsbury, offering my views of assessment in science practical work for schools. The aim of the project is to provide recommendations to the main Awarding Bodies in England (AQA, Edexcel, OCR) to help them improve how science practical work is assessed at GCSE and at A Level.
- 2013 –** ▪ Given my expertise in nuclear physics, the Parliamentary Office of Science and Technology requested my advice for a House of Commons Library research paper entitled “*Iran’s Nuclear Programme: Current State of Affairs and Prospects for Change in 2013*”. I am currently advising Parliament on specifics of the uranium fuel cycle and the production and uses of certain radioisotopes.

Contributions to School, Faculty and College

School of Physics & Astronomy

- 2013 –** ▪ Director of Graduate Studies
- 2010 – 12** ▪ Deputy Director of Graduate Studies
- 2009 –** ▪ Recruitment Committee Member
- 2007 –** ▪ Undergraduate Admissions Director
- 2008 – 12** ▪ PhD Admissions Director for the Particle Physics Research Centre
- 2005 – 07** ▪ Deputy Admissions Director

Faculty of Science and Engineering

- 2013 –** ▪ S & E International Recruitment & Partnerships Advisory Group
- 2012 –** ▪ S & E Admissions and Recruitment Working Group

College

- 2009 & 11** ▪ Graduate Student Complaints Panel Member

Outreach Activity

- 2013** ▪ Live interview on BBC World Service
- 2011 & 12** ▪ Invited to deliver six-part Royal Institution Lecture Series in Particle Physics
- 2012** ▪ Discovery of the Higgs – Talk to QMUL Undergraduate Physics Society
- 2011** ▪ Interview for CNN

- 2010** ▪ Nominated for British Science Association Lecture Awards
- 2010** ▪ Particle Physics Lecture to London school teachers, QMUL
- 2010** ▪ High Energy Physics – Talk to Exeter Physics Society

Undergraduate Admissions Director: Since 2007 I manage a team of three staff together with one co-director, and am responsible for recruitment, and the setting and attaining of annual targets. Growth in undergraduate cohort sizes and improvement in incoming student quality are key elements of departmental strategy, and ones that I have been vigorously engaged with. During this period I have:

- increased applications by 47% to end of last cycle August 2012;
- implemented a staged entry tariff increase from BBC to ABB for 2012 BSc entrants;
- increased the fraction of applicants placing QM as “firm choice” from 12% to 20%;
- increased enrolments from 58 to 149 this academic year, the highest in 2 decades;
- increased applications by an additional 28% compared to February 2012.

Many factors influence these statistics including quality of open days, student experience at interviews, web site information, and league table rankings. I aim to build upon these successes and to maintain a high national ranking position for the department. In September 2012 my work in this area was recognised by the College through the Staff Contribution Scheme, for which I was nominated by the Head of School.

PhD Admissions Director: For four years I have undertaken this role for the PPRC and have:

- achieved a steady increase in annual applications from 12 to 32;
- sustained a doubling of enrolments to 4 students annually, with 6 in 2012/13;
- ensured a 4-year PhD submission rate of 75%, and increasing as legacy cases resolve.

This work has a direct impact on the overall research assessment of the College and our reputation as a leading institute for research. Maintaining this is a challenge and requires identifying and harnessing new funding streams. As **Director of Graduate Studies** I intend to strengthen the School’s position by expanding the use of existing overseas scholarships e.g. China, Pakistan, and targeting new sources e.g. Brazil, Ukraine, Russia.

Outreach Activity: I have developed my outreach activity giving media interviews and speaking about my research to the general public. I was approached by the Royal Institution of Great Britain in spring 2011 and asked to give an inaugural series of six 90-minute evening lectures on particle physics. This project was very well received and I was asked to repeat the series in summer 2012.

Professional Development

Conferences 2010-2013

A list of recent conferences and workshops attended.

20-27 th Oct 2012	International Workshop on Neutrino Interactions , Rio de Janeiro, Brazil	Invited plenary speaker
24-26 th Sept 2012	LHC Electroweak Working Group , Durham, UK	Invited speaker
8 th Oct 2012	PDF4LHC Workshop , CERN, Geneva, Switzerland	Invited speaker
4-11 th July 2012	International Conference on High Energy Physics , Melbourne, Australia	Invited talk
21-27 th July 2011	Europhysics Conference on High Energy Physics , Grenoble, France	Invited talk
4 th July 2011	PDF4LHC Workshop , DESY, Hamburg, Germany	Invited speaker
10 th April 2011	Dept. of Physics Seminar , University of Qatar, Doha, Qatar	Invited seminar
22-27 th May 2011	International Conference on Structure and Interactions of the Photon , Spa, Belgium	Invited plenary talk
26 th Jan 2011	NExT Phenomenology Institute Meeting , SEPnet Rutherford Lab, Oxfordshire, UK	Invited speaker
20 th Jan 2010	Dept. of Physics Seminar , University of Birmingham, Birmingham, UK	Invited seminar

Conferences Prior to 2010

List of conferences and workshops attended up to 2010.

1. European Physical Society Conference on High Energy Physics, Krakow, Poland, July 2009. Invited talk for H1 and ZEUS.
2. Helmholtz School on Parton Distribution Functions, DESY Zeuthen, Berlin. Invited speaker.
3. Institute of Physics Half Day Meeting on HERA Physics, Rutherford Lab, UK, June 2008. Invited speaker.
4. XVI. International Workshop on Deep Inelastic Scattering, London, UK, April 2008. Invited speaker for H1.
5. XXI. International Workshop on Weak Interaction and Neutrinos, Kolkata, India, January 2007. Invited speaker for H1 and ZEUS.
6. XII. International Workshop on Deep Inelastic Scattering, Strbske Pleso, Slovakia, April 2004. Invited speaker
7. Lake Louise 2004 Winter Institute on Fundamental Interactions, Alberta, Canada, February 2004. Invited speaker for H1 and ZEUS.
8. EPS Conference 2003, Aachen, Germany, July 2003. Invited speaker.
9. PhD Students Training, DESY, Germany, October 2000-04 annually. Invited speaker.
10. New Topics in QCD, Beijing, China, August 2002. Invited speaker for H1 and ZEUS.
11. European Physical Society Conference on High Energy Physics, Budapest, Hungary, June 2001. Invited talk for H1 and ZEUS.
12. Combining and Fitting HERA Data, Rutherford Lab, UK, July 2000. Invited speaker.
13. VII. International Workshop on Deep Inelastic Scattering, Liverpool, UK, April 2000. Invited talk for H1.
14. UK Collider Workshop, Durham, September 1999. Invited speaker.
15. University of Birmingham Seminar, April 1999. Invited speaker.
16. XII. Topical conference on Hadron Collider Physics, Mumbai, January 1999. Invited talk for H1 and ZEUS.
17. UK Phenomenology Workshop, Durham, October 1998. Invited speaker.
18. QCD Analyses of Structure Functions, Berlin, Germany, July 1998. Invited speaker.
19. V. International Workshop on Deep Inelastic Scattering, Brussels, Belgium, April 1998. Invited talk for H1.
20. Hadron XIII, Heidelberg, Germany, June 1997. Invited talk for H1.
21. Correlations And Fluctuations, Nijmegen, The Netherlands, June 1996. Invited talk for H1.

Professional Training

I have taken **professional training courses** in Fair Selection, Assessing Students, Time Management, E-Learning, Managing Research Projects, and E-Learning prior to 2010 in the Learning Institute. More recently I have also taken the following courses:

2013	Leadership Skills	Institute of Physics	3 hours
2012	Conducting Performance Appraisals	Institute of Physics	2 hours
2010	Basic Safety Training Level 1 & 2	CERN	2 hour
2010	Specific Risks in Hazardous Areas	CERN	1 hour
2010	Safety in the ATLAS Cavern	CERN	1 hour

In addition I have delivered the following lectures and presentations to the Learning Institute:

- 2010** Electronic Voting Systems: Experiences and Advantages
- 2010** Using Electronic Voting Systems
- 2008** Interactive Student Response Systems