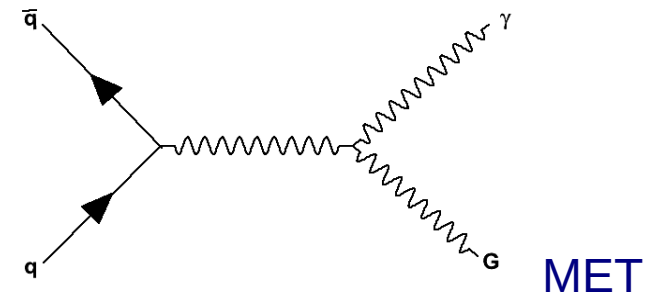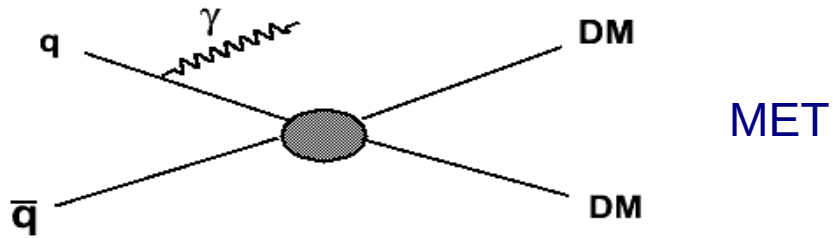# *Search for*
Dark Matter and Large Extra Dimensions in pp Collisions Yielding a Photon and Missing Transverse Energy
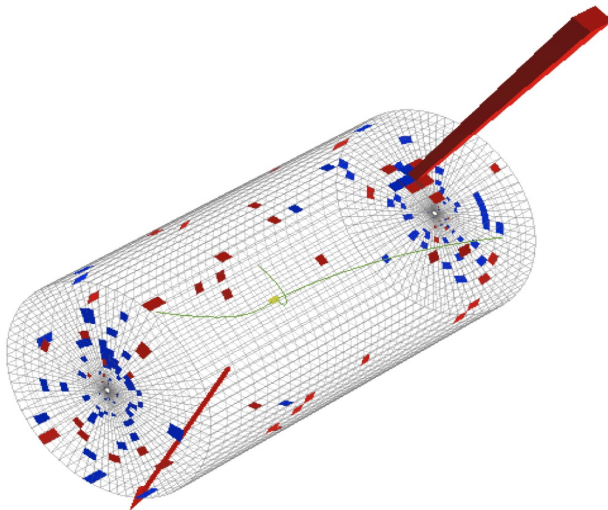
Bhawna Gomber

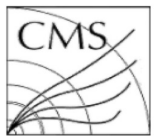*SINP Kolkata, INDIA*

On Behalf of the CMS Collabaration

PHYSICS IN COLLISION 2012

MET
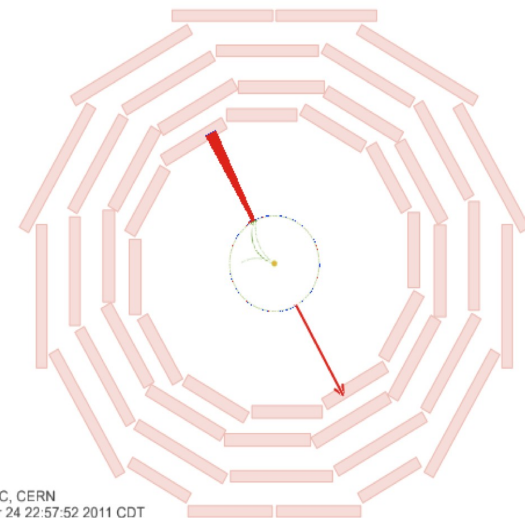
MET

➔ Signature for both Dark Matter and Large Extra Dimensions

CMS Experiment at LHC, CERN
Data recorded: Sun Apr 24 22:57:52 2011 CDT
Run/Event: 163374 / 314736281
Lumi section: 604

CMS Experiment at LHC, CERN
Data recorded: Sun Apr 24 22:57:52 2011 CDT
Run/Event: 163374 / 314736281
Lumi section: 604

Monophoton- Backgrounds

- Backgrounds estimated from MC and data-driven (DD) techniques
- Backgrounds from pp collisions
  - $pp \to Z\gamma \to \nu\nu\gamma$ irreducible background (MC)
  - $pp \to W \to e\nu$ electron mis-identified as photon (DD)
  - $pp \to jets \to \gamma + MET$ one jet mimics photon, MET
         from jet mis-measurement (DD)
  - $pp \to \gamma + jet$ MET from jet mis-measurement (MC)
  - $pp \to W\gamma \to l\nu\gamma$ charged lepton escapes detection (MC)
  - $pp \to \gamma\gamma$ one photon mismeasured to give MET (MC)

- Backgrounds unrelated to pp collisions
  - Shower induced by cosmics (DD)
  - Neutron-induced signals (DD)
  - Beam Halo (DD)

Monophoton- Search Details

- Require a photon in an event :
  - High energy photon : $p_T(\gamma) > 145$ GeV/c
  - In the central part of the detector : $|\eta| < 1.4442$
  - Veto events with nearby tracks
  - Veto events with significant electromagnetic calorimeter activity ($\Delta R < 0.4$)
  - Veto events with significant hadronic activity ($\Delta R < 0.4$, $E_{HCAL}/E_{ECAL} < 0.05$)
  - Shower shape consistent with photon : $\sigma_{i\eta i\eta} > 0.013$
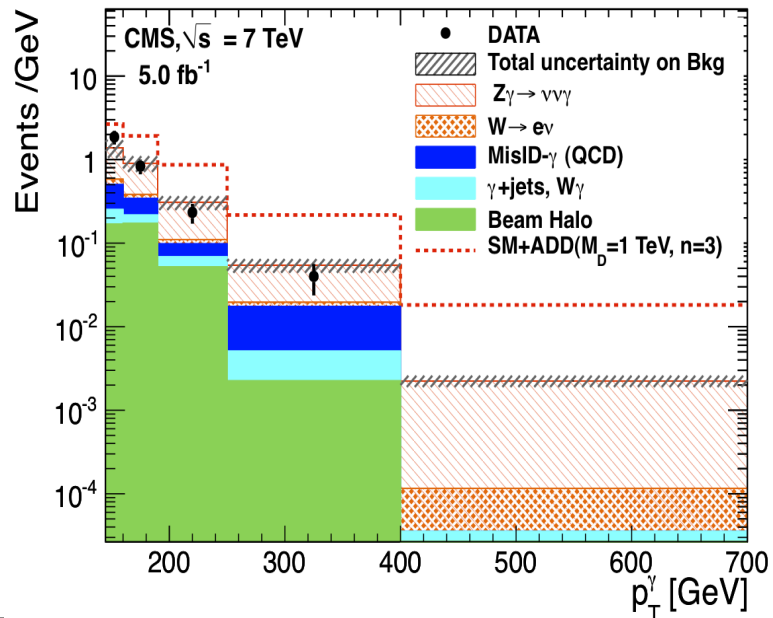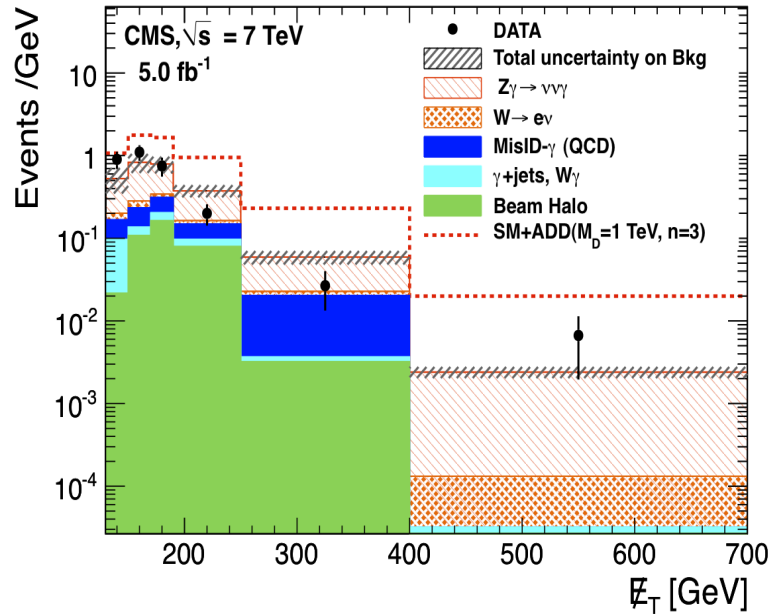 - All reconstructed vertices are used for isolation calculations

- MET >130 GeV

- Remove events with excessive activity
  - No central jet : veto events with
    $p_T(jet) > 40$ GeV/c and $|\eta_{jet}| < 3.0$

  The procedure consists of estimating expected number of events from SM processes (and other backgrounds) and look for excess of events.
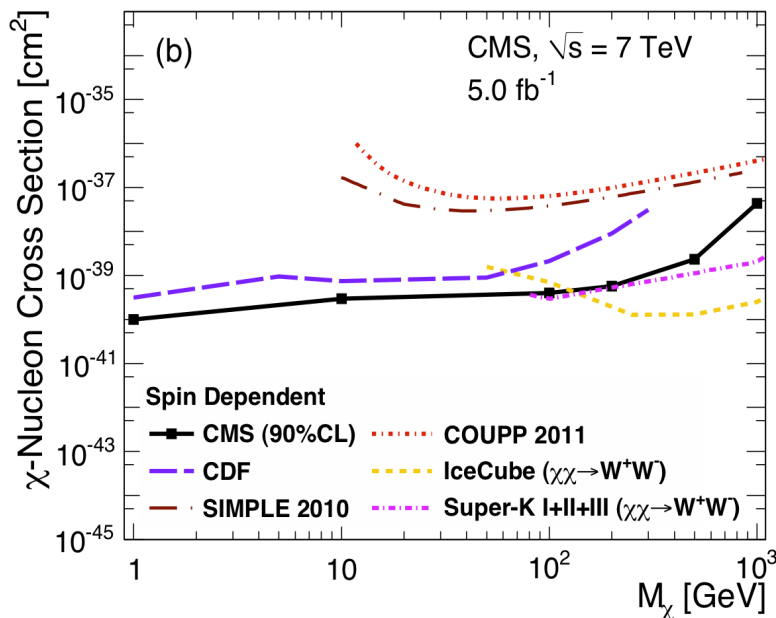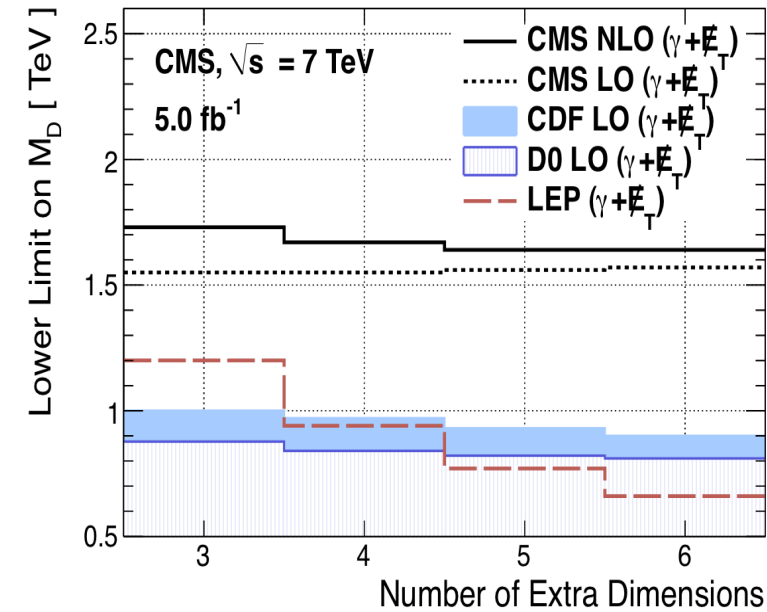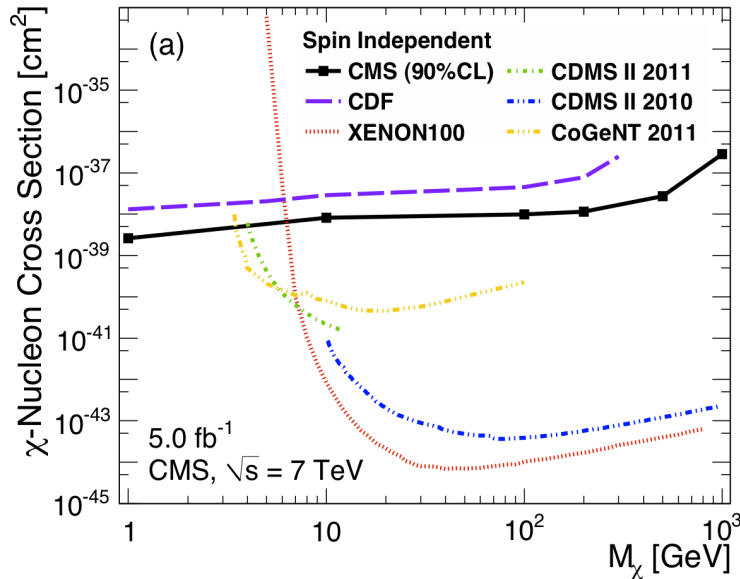 - Counting Experiment

Monophoton- Search Results

Sources	Estimate
Jet Mimics Photon	11.2 ± 2.8
Beam Halo	11.1 ± 5.6
Electron Mimics Photon	3.5 ± 1.5
$W\gamma$	3.0 ± 1.0
γ+jet	0.5 ± 0.2
$\gamma\gamma$	0.6 ± 0.3
$Z(\nu\nu)\gamma$	45.3 ± 6.9
Total Background	75.1 ± 9.5
Total Oberved Candidates	73

➢ *Background processes describes the data well and no excess is observed*

> ➤ *Presented searches for new physics in monophoton channel using 5.0 fb⁻¹ of data.*
> ➤*Results are consistent with the Standard Model.*
> ➤*For models with 3-6 large extra dimensions, our data exclude extra-dimensional Planck scales between 1.64 and 1.73 TeV at 95% C.L.*
> ➤ *Using models for the production of dark-matter particles (χ), we set 90% C.L upper limits of 13.6-15.4 fb on the χ production.*

THANK YOU