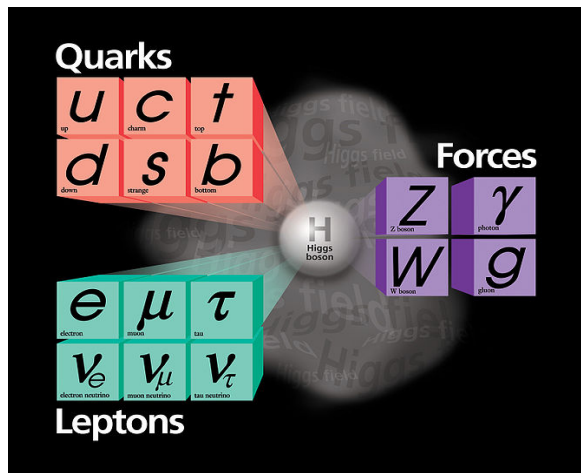


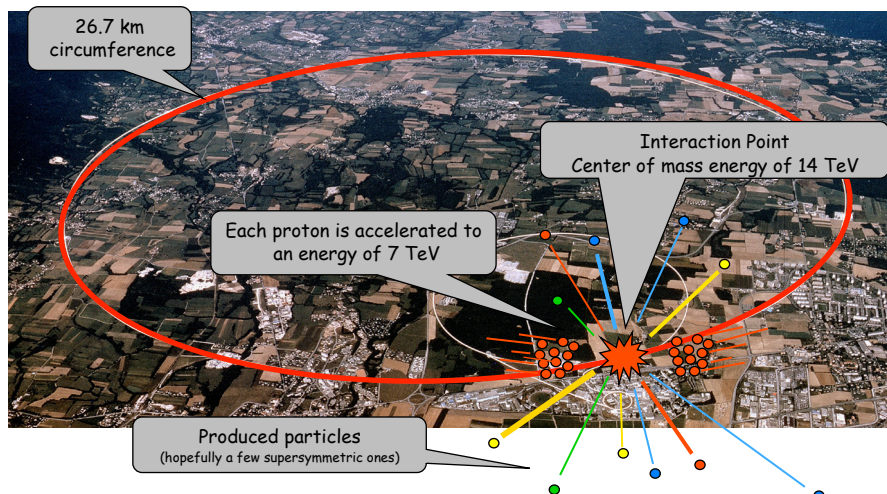
Standard Model@LHC

Prof. E. Barberio
Prof. G. Taylor,
Dr. P. Urquijo



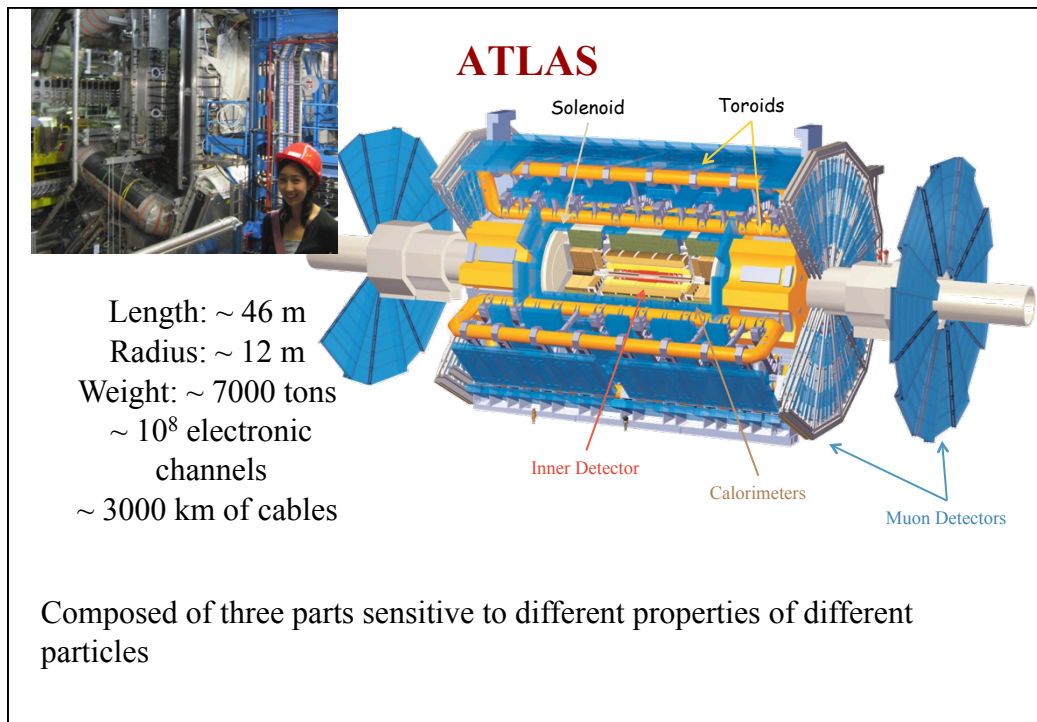
- Successful theory of fundamental interactions
- Survived numerous experimental tests
- Only missing the Higgs boson
- LHC built to look for the Higgs and Physics beyond the Standard Model

LHC



Confirmation

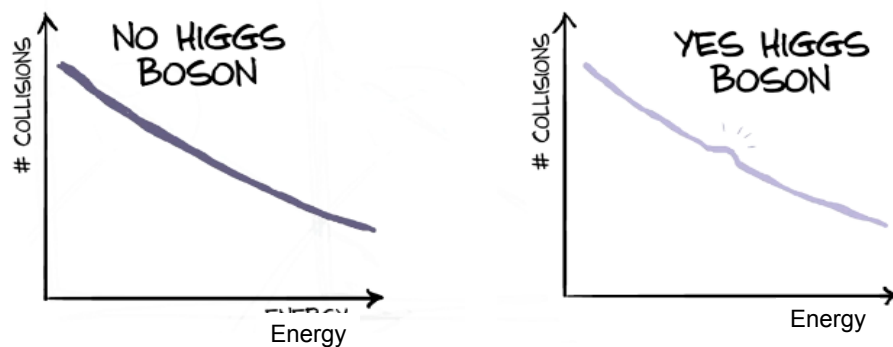
Experiment



The Higgs: What do we look for?

We look at all the products of the collisions

Basic idea is to figure out the energy of all the produced particles and see what particles could have been there...





2013 Nobel prize



François Englert

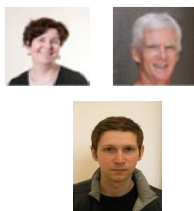


Peter W. Higgs

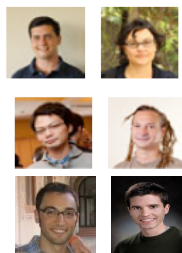
The Nobel Prize in Physics 2013 was awarded jointly to François Englert and Peter W. Higgs *"for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider"*

University of Melbourne team in the Higgs analyses

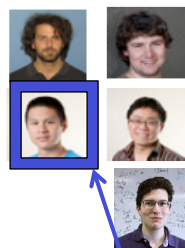
Academics



Postdocs

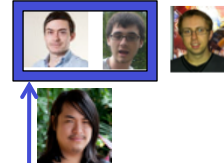


PhDs



Graduated

Masters



Now PhD

<http://www.coepp.org.au/>

For more information you can look at the ATLAS detector story on: <http://atlas.ch>

Higgs properties measurements

The Higgs has been discovered, now we need to measure its properties

We have a crucial role in the most important Higgs analyses in run 2:

1. Higgs CP in Higgs decaying into $\tau\tau$: there is only one Higgs?
2. Associate production HW, HZ : still not observed! Need to confirm if we really did see the Higgs.
3. Htt not yet observed and is very important: is the universe in a stable or meta-stable state?
4. WWWW scattering: Is the SM the ultimate theory?

Neutrino Masses

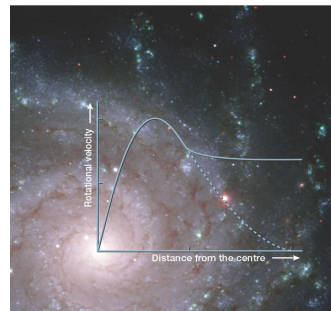
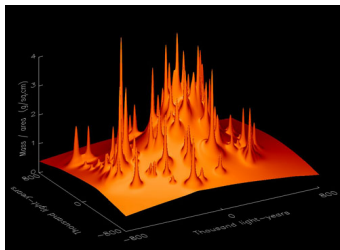
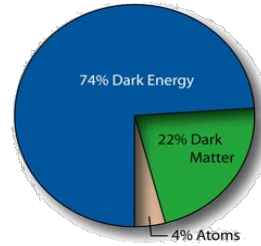
Why neutrinos have masses? Not in SM!

A natural way to explain the small mass of neutrinos: Seesaw mechanism or Zee-Babu models → new particles at the LHC energies

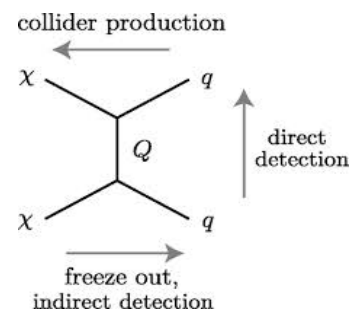
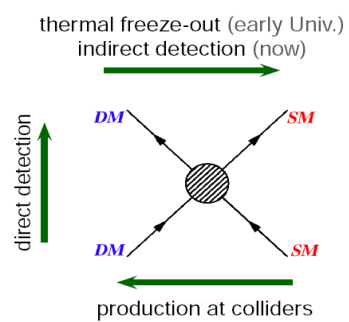


Can be a combined project with Ray Volkas

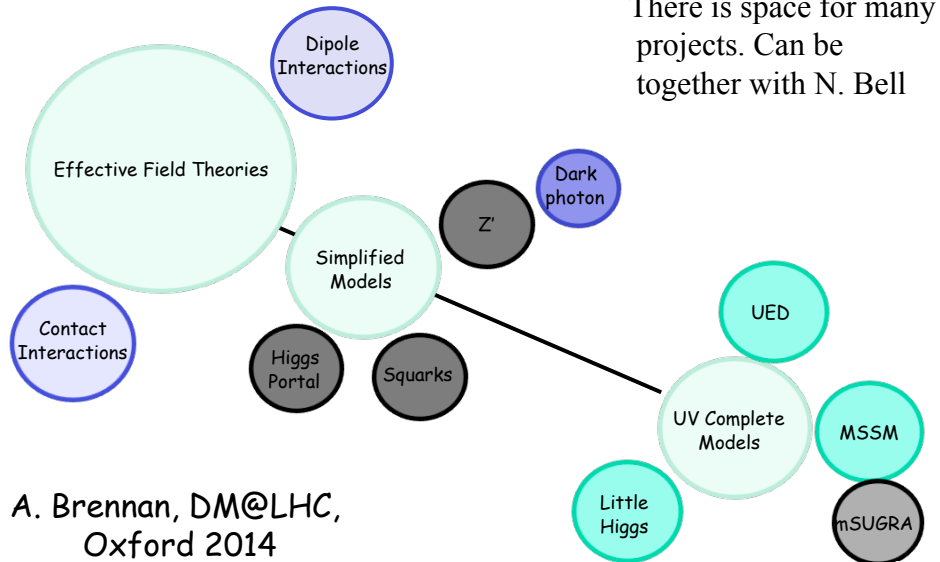
Dark Matter



Hunting dark matter

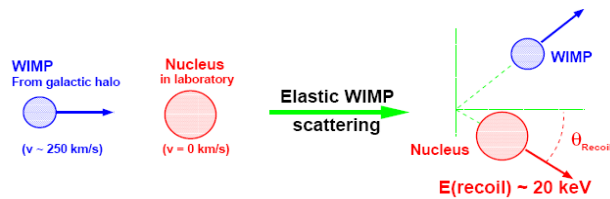


Models of dark matter@ Collider



Dark matter direct detection

elastic scattering on nuclei of the detector



Optimal sensitivity for $M_{\text{WIMP}} \sim M_{\text{RECOIL}}$

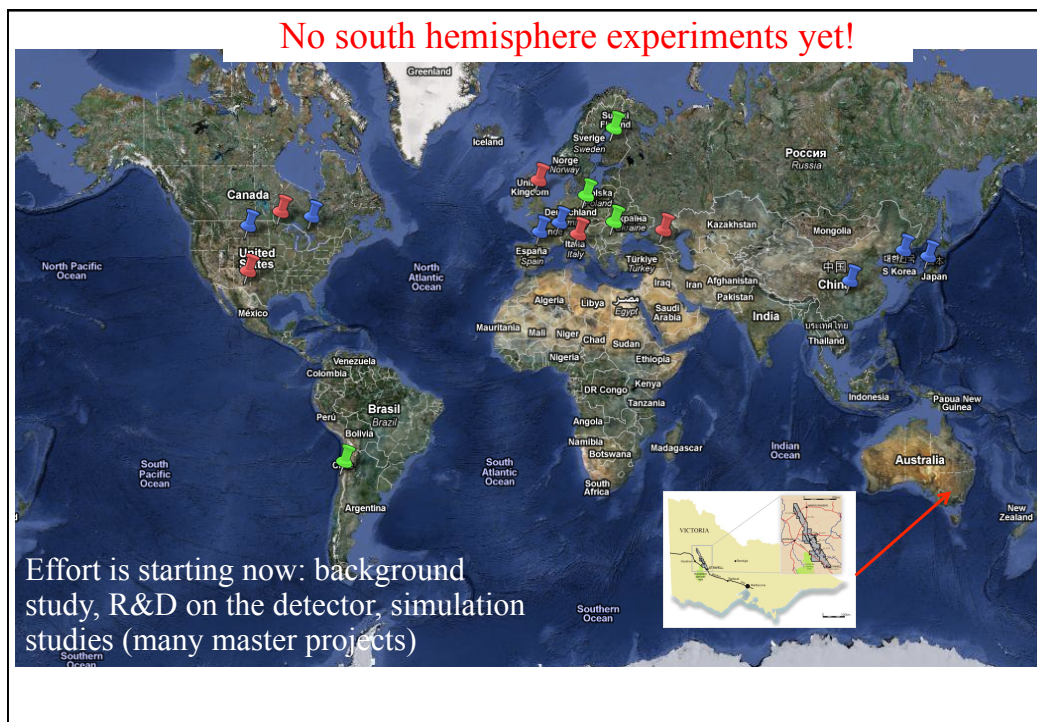
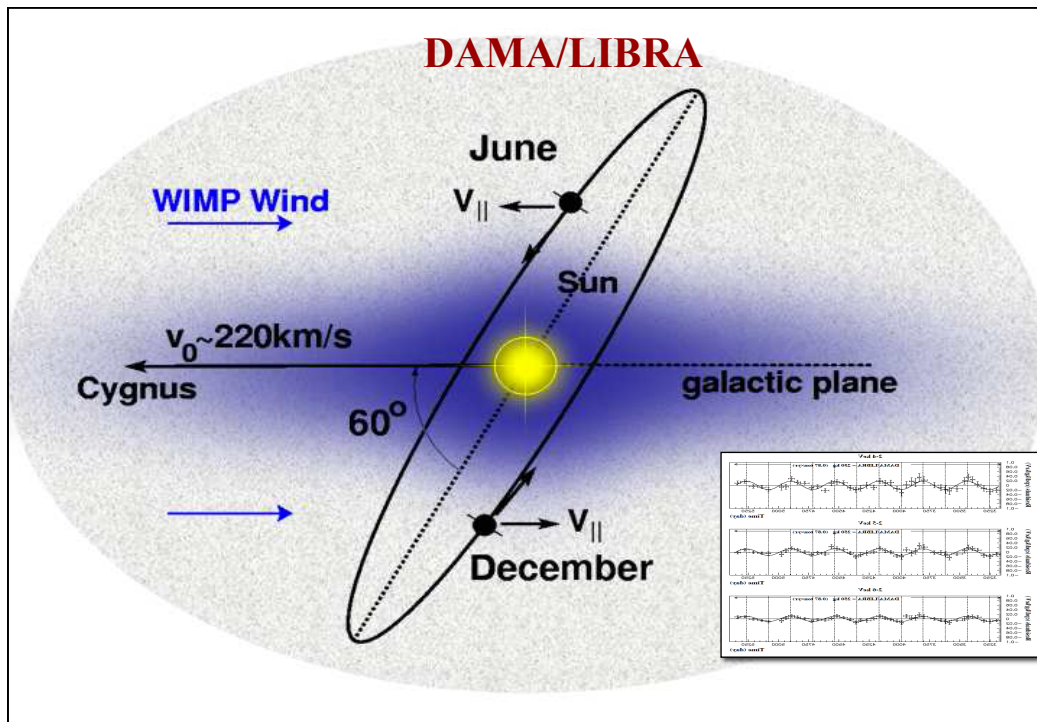
Low rate < evt/day/kg of detector → low background and large detector mass

Deep underground sites

Radio-purity of components

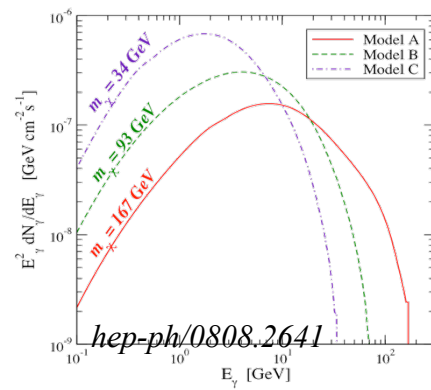
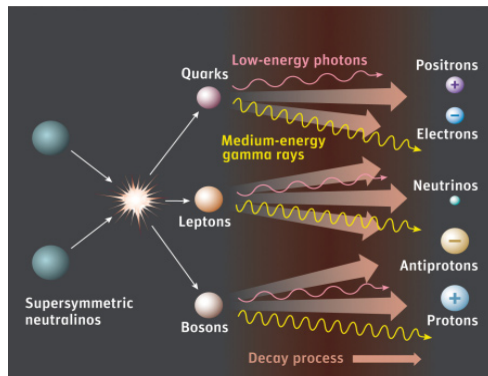
Active/passive shielding

Recoil energy ~ 20 keV → Low energy threshold



Link with astrophysics

Produce expected radio spectra a high redshift, study structure formation/21 cm signal



Possibility of a combined project with E. Barberio and S. Wyithe