Experimental Elementary Particle Physics at UA: Current Searches

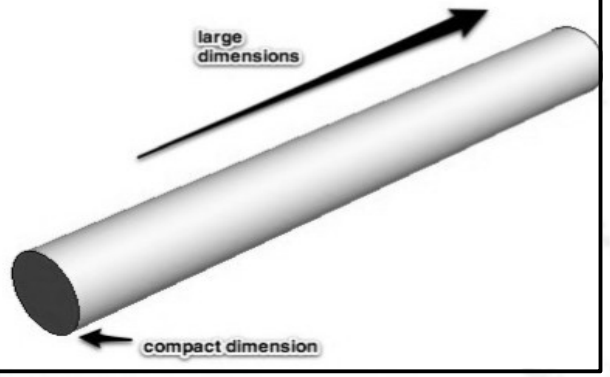
Here at the UA, we are searching for the existence of new particles that could indicate extra dimensions or supersymmetry. Using the ATLAS detector at the Large Hadron Collider in Europe, we are testing the predictions of *theoretical* particle physicists by searching for new particles as massive as 2,000 times the hydrogen atom!

Our search for new particles include:
Higgs, Stops, Charged Higgs, Z'-Boson, Preons and Kaluza-Klein Gluons

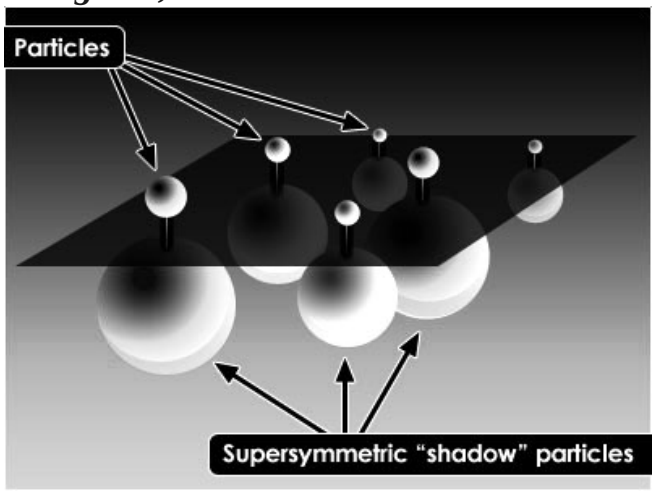
What if the quarks and electrons were themselves made of even **smaller particles**? These preons or quips would explain properties of the known particles. ***We are searching for preons/quips.***

$$L_{qqqq}(\Lambda) = \frac{\eta g^2}{2\Lambda_q^2}\overline{\Psi}_q^L \gamma^\mu \Psi_q^L \overline{\Psi}_q^L \gamma_\mu \Psi_q^L$$

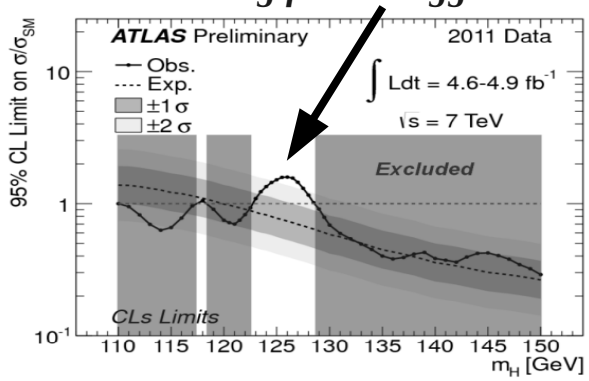
There may exist tiny **extra dimensions** in space-time. Excited gluons would indicate the presence of these extra dimensions. ***We are searching for Kaluza-Klein gluons.***

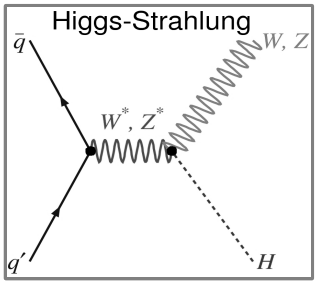


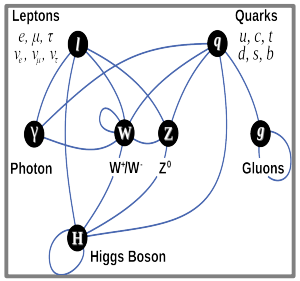
SUSY theory predicts a partner particle for every known particle: selectrons, photinos, and many more. If experimentally verified, SUSY theory could help explain dark matter, and even the nature of gravity. ***We are searching for stops, charged higgs, charginos, and neutralinos.***



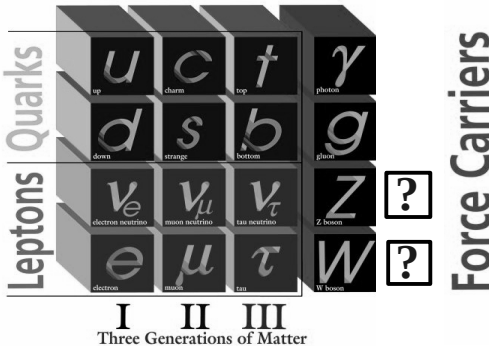
What causes particles to have mass? The **Higgs mechanism** is the favored explanation, but has not been verified. ***We are searching for the higgs boson.***



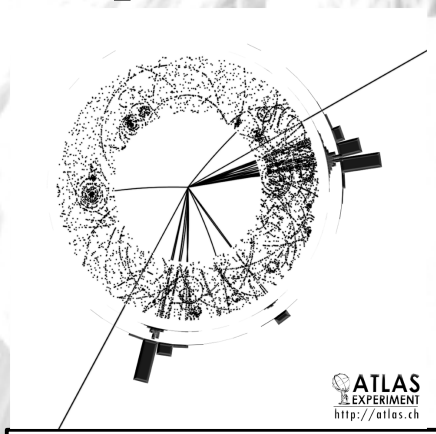


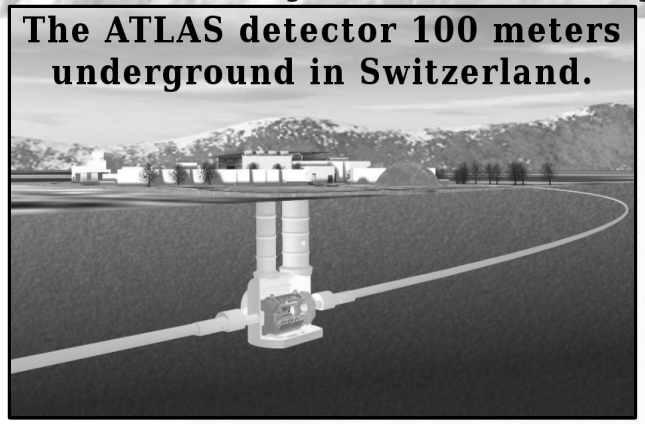


Many new theories predict **extra forces** and thus heavy new force particles (bosons). ***We are searching for the leptophobic Z-prime boson.***



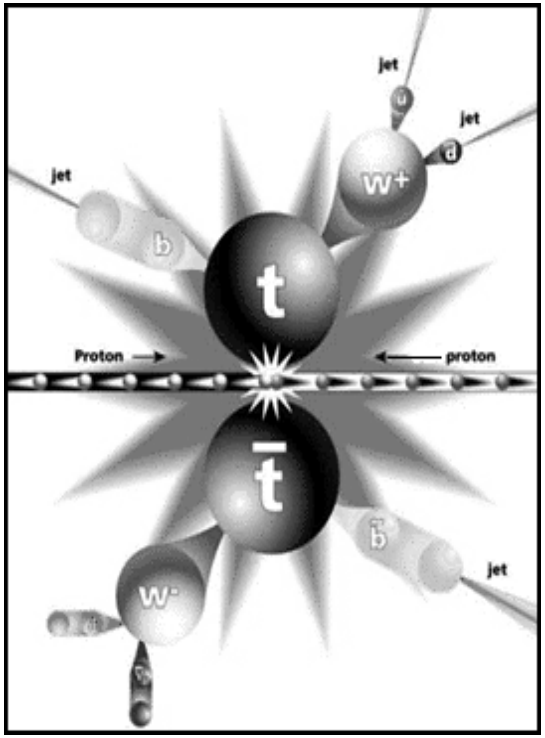
Experimental Elementary Particle Physics at UA: Physics Description

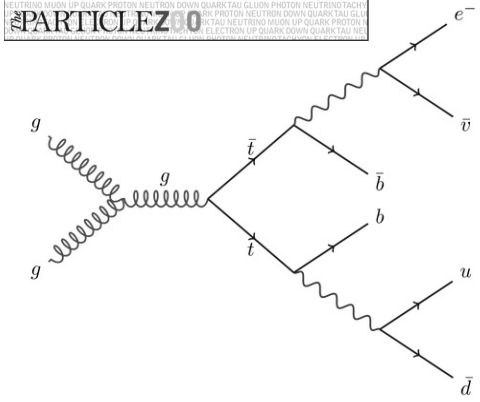



The ATLAS detector 100 meters underground in Switzerland.

Top Quark Physics:

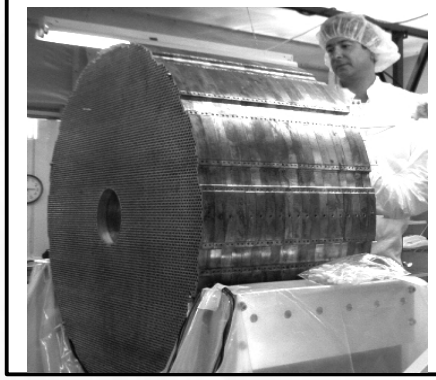
The top quark is the most massive of the known particles. (The top quark weighs as much as a gold atom!) At UA, we specialize in top quark physics. Most of the new particles we search for decay into top quarks, and we try to identify them using their children tops.

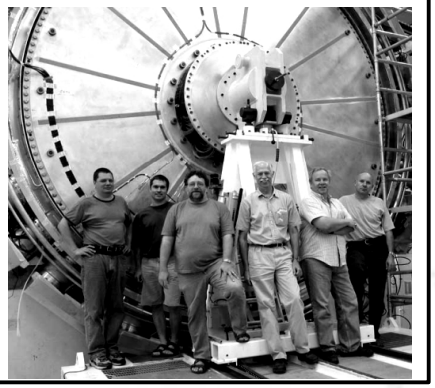




Electronics:

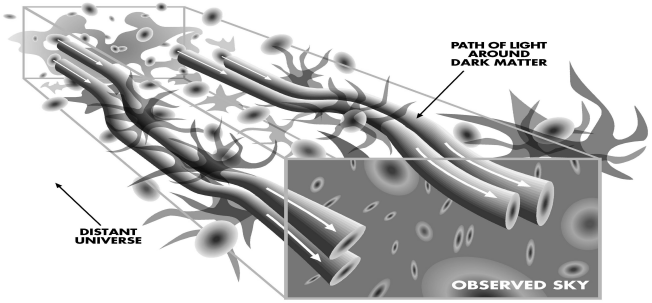
At UA, we both analyze data *and* build experiments. Our team built a radiation-hard particle detector called the Forward Calorimeter, and also electronics used to calibrate the Cathode Strip Chamber muon detectors.





Did you know...

83% of the matter in our galaxy is made of an unknown substance called *dark matter!* New particles discovered at ATLAS could explain what this dark matter is. We are also helping construct electronic equipment for the new Large Synoptic Survey Telescope that will help map the dark matter in the universe:



!!!!! Find fun resources at !!!!!

http://hep.physics.arizona.edu/FunResources.html