What are the highest energies of interest?

- Flys Eye, Agasa, Auger arrays reach ~ few 10^{20} eV
- EUSO/OWL/?
  - If no GZK cutoff, may reach 10^{21} eV?
- IceCube reaches ~ $10^{15\text{-}18}$ eV, depending on flux,etc.
- Searches for radio waves from ν_e showers have published limits up to 10^{25} eV
  - What is the highest energy at which we have a good hope of detecting a ν?
  - What is the highest energy at which limits are of interest?

Studying Particle Physics with Showers

- How can we study the weak interaction in ν showers?
  - What do we learn from studying the Glashow resonance (νe → W)?
- What can we learn about QCD by studying air/water showers?
  - Forward particle production
  - Energy Flow
- What about effects of the medium that the shower develops in?

Searches for Exotica in Showers

- Searches for exotic single particles
  - Monopoles
  - Q-balls
  - fractionally charged particles
- SUSY – searches for upward going di-muons
  - Albuquerque, Burdman and Chako
- Can we search for other, more conventional exotica?
  - SUSY
  - Technicolor
  - Extra quarks, gluons, vector bosons, etc.

What do we need to learn from accelerator experiments & how can we ‘get there’?

- Forward particle production
  - Energy flow?
- Low-x structure functions

The Cosmos vs. Accelerators

The Cosmos

High Energy
Low Luminosity
Beam composition, energy not known *a priori*

Need huge detectors --> Limited sampling

Study overall event shape, very distinctive single particle signatures

Accelerators

Low Energy
High Luminosity
Well-known beam
Some polarized beams

Good detectors, weaker in the forward region

Study individual produced Particles
Reconstruct complex topologies