

Let there be light shed on dark matter

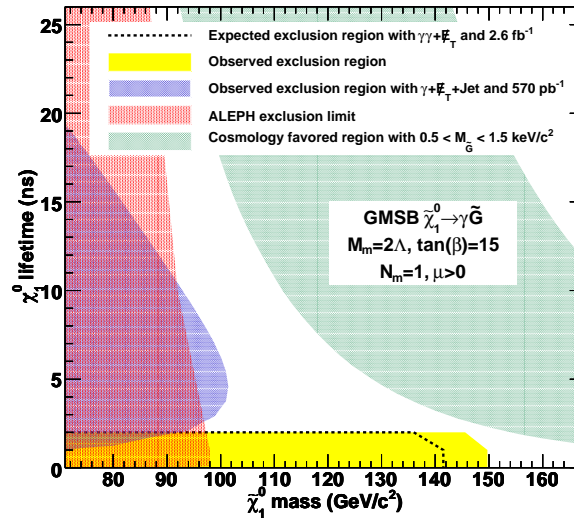


Figure 1: Physicists at CDF have searched for pairs of heavy Supersymmetric particles, called a "neutralino," each of which decays into a photon and a "gravitino", which can be a dark matter candidate. While no evidence of these new particle turned up, the new limits based on results from this search (yellow), and others (red and blue), are approaching the region favored in some cosmology models (green).

Many particle physicists and cosmologists believe that the dark matter that fills the Universe is a heavy particle, produced in the earliest moments of the Big Bang and still here today. However, an important possibility, consistent with some cosmological models and astronomical observations, is that they were created a few billionths of a second after the Big Bang and aren't very massive at all. Such particles are common in a theory known as "Gauge Mediated Supersymmetry Breaking." If this theory is true, then the Tevatron can produce supersymmetric particles, known as "neutralinos", which live for less than a few billionth of a second before decaying into a photon and a "gravitino", which escapes the detector completely (Physicists call this missing energy). It's this gravitino which is our dark matter candidate.

Physicists at CDF have teamed up again to search for evidence of this theory using two-photon events, taking advantage of lots more data from the high luminosity Tevatron running, a better understanding of the detector as well as their new photon timing system. Also new techniques for separating real and fake missing energy have been developed to separate out the unusual events where the gravitinos might have been produced and then escaped. The current data shows no hints for these super-duper-events. This new search is now the world's most sensitive version for short-lived neutralinos. These results, when combined with other recent searches for long-lived neutralinos are shown in the figure 1. What makes this complete searches are exciting is that we are rapidly approaching the cosmology favored region. Stay tuned, a discovery of dark matter may be just another billionth of a second away!