

Search for Dirac Magnetic Monopole Production in High Energy Heavy Ion Collisions*

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Extensive searches for monopole pair production in e^+e^- , pp , and $\bar{p}p$ collisions have been performed at various high energy colliders. In each of these, an upper limit on its production cross section has been placed. In all these collisions, the monopole pairs are expected to be produced via Drell-Yan mechanism. In AA collisions, the thermal production of monopole pairs has also been predicted in addition to Drell-Yan.

We exploit a useful feature of the BP-1 track-recording glass: its sensitivity can be tuned by a suitable choice of chemical etchants. Our detector consisted of 17 sheets of BP-1 glass and a Pb target. Two of the BP-1 plates were placed in front of the target and 15 downstream. For particles with $Z/\beta > 84$, we measured their instantaneous values of Z/β along their paths. With measurements of Z/β as a function of penetrating depth, we were able to determine Z and β .

In a search for Lee-Wick matter, we found nine events with $Z/\beta > 82$. All of them were slowing particles ($\beta < 0.79$) from interactions of beam particles with pipe or air. None of the candidates has dE/dx that matches that predicted for a magnetic monopole with $n = 2$.

Based on a null result in $\sim 10^9$ interactions of 11 A GeV Au with a Pb target, we can place an upper limit on its production cross section: $2 \times 10^{-32} \text{ cm}^2$. No one has realistically calculated the cross section for monopole production. The

Drell-Yan cross section serves as a rough point of reference for production of monopole pairs via an intermediate massive virtual photon, multiple virtual photons, or gluon-gluon fusion.

At BNL AGS, we are currently analyzing a new search in $\sim 10^{11}$ Au on Pb interactions at ~ 11 A GeV. With this new experiment, we expect to achieve an improvement of ~ 2 orders of magnitude in sensitivity. We have also proposed a new search at CERN SPS using the high intensity Pb beam at 160 A GeV.

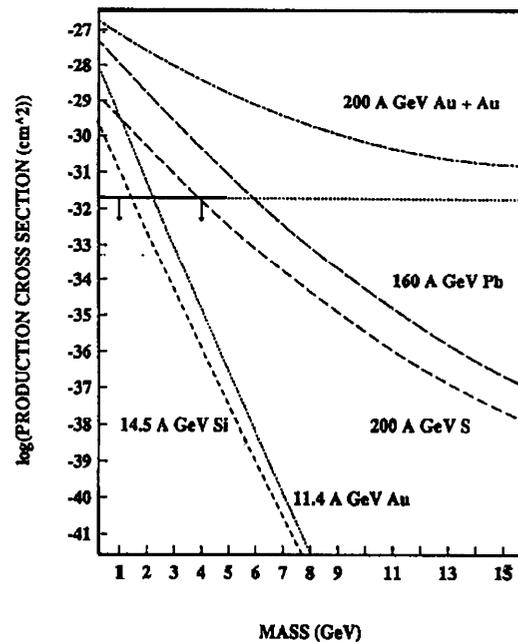


Figure – Upper limit to the production cross section for Dirac monopole pair in heavy ion collisions.

*Condensed from a paper in the Proceedings of 24th International Conference on Cosmic Rays, Rome, Italy 1 (1995) 845-848.