

COSMIC RAY “KNEE”: A HERALD OF NEW PHYSICS?

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We propose that the knee in the cosmic ray spectrum at energies $E \gtrsim 10^{15.5}$ eV is due to “new physics”, namely to a channel in the high energy (\gtrsim TeV in the CM) proton interactions hitherto unaccounted for in estimating the energies of the air shower cosmic rays. The new interaction transfers part of the primary particle’s energy to modes which do not trigger the experimental arrangement (neutrinos, lightest supersymmetric particle, gravitons) thus underestimating its true energy. We show that this underestimate leads naturally to the observed break (the “knee”) in the *inferred* cosmic ray spectrum. The suggestion we advance fits nicely to current theoretical extensions of the Standard Model (supersymmetry, technicolor, low scale gravity) where new physics at the TeV scale manifests with the distinct signature of missing energy. We present a simple model where the new physics proceeds via gluon fusion and assuming a single power law for the galactic ($E \lesssim 10^{18.5}$ eV) cosmic ray spectrum, we produce a good fit to the data in the $10^{14} - 10^{18.5}$ eV range. Our proposal should be testable in laboratory experiments (LHC) in the near future and, should it be proven correct, it would signal besides the presence of new physics in high energy interactions, a drastically different interpretation of the sources and acceleration of cosmic rays.