Search for strange quark matter in cosmic rays

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Abstract

There have been several reports of exotic nuclear fragments, with highly unusual charge to mass ratio, in cosmic ray experiments. Although there exist experimental uncertainties which make them, at best, only candidate "exotic" events, it is important to understand what they could be, if they are eventually confirmed. Among other possible explanations, some authors have interpreted them to be lumps of strange quark matter (strangelets). A major problem with such an interpretation is that to reach the earth's surface, they must possess unusually high penetrability through the terrestrial atmosphere. We show that a recently proposed mechanism for the propagation of strangelets through the earth's atmosphere, together with a proper account of charge capture and ionisation loss, would solve this problem. We also argue that this could lead to viable strategies for definitive detection of strange quark matter in cosmic ray flux using a ground based large area array of passive detectors.