Anisotropy of Protons and Light Primary Nuclei in Cosmic Rays Measured with the Alpha Magnetic Spectrometer on the ISS

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Executive summary

In the last years, AMS has provided precise measurements of cosmic ray fluxes, which have revealed many unexpected features that cannot be fully explained within the current understanding of cosmic rays acceleration and propagation.

In particular, the measurement of the proton and light primary nuclei fluxes show a progressive hardening above 200 GV. Some explanations of this observation include: modifications to the transport models, different acceleration mechanisms at the source, and local sources.

The different mechanisms proposed to account for these observations may have distinct implications in the arrival directions of CRs. In particular, a nearby source would imprint a sizable anisotropy in the arrival direction of high rigidity protons and light primary nuclei. Therefore, the measurement of the anisotropy may provide additional information to these features.

A measurement of the anisotropy of protons and light primary nuclei (helium, carbon and oxygen) in galactic coordinates has been carried out by the AMS-02 experiment on the ISS using 9 years of data. The results obtained for these particle species show no deviation from isotropy and 95% C.I. upper limits on the dipole amplitude have been established. In particular, the proton dipole amplitude is $\delta < 0.32\%$ above 200 GV. On the other hand, upper limits of $\delta < 0.32\%$, $\delta < 1.62\%$ and $\delta < 1.69\%$ for helium, carbon and oxygen, respectively, are obtained above 200 GeV.