Results on mass composition of cosmic rays as measured with LOFAR

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We present an updated analysis of the mass composition of cosmic rays in the energy range of $10^{16.8}$ to $10^{18.3}$ eV. It is based on measurements with the LOFAR telescope of the depth of shower maximum, X_{max} (see also the PRD publication under **Arxiv:2103.12549**) We review the improvements to the simulation-based reconstruction setup, as well as the selection method to obtain a minimally biased X_{max} dataset. Results include estimates of the mean and standard deviation of the X_{max} distribution. A statistical analysis at distribution level has been done as well, using a four-component model of light to heavy nuclei. It confirms our previous results showing a significant low-mass fraction in this energy range.

The radio technique has advanced enough that multiple observatories are publishing results on X_{max}. As the array layouts and methods vary, it is interesting to compare the approaches, in light of the observed differences in the X_{max} results. We therefore show additional information on bias tests used in the X_{max} reconstruction and sample selection process.

An important discussion topic is the apparent difference in the average X_{max} result between LOFAR, TALE and others on one side, and Pierre Auger Observatory on the other. The former happen to be in the northern hemisphere, while Auger is in the south. However, conclusions about a possibly physical north-south asymmetry can only be made if the differences in array setups and analysis methods, and especially fiducial sample selection, are sufficiently well understood.
In the proceedings, we show some additional cross-checks with respect to sample selection and possible residual bias.