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Deflection direction reconstruction using normalizing flows with an AGN-catalog

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Ultra high energy cosmic rays (UHECRs) coming from many different sources are deflected by the galactic magnetic field (GMF) before arriving at Earth. Every source type emits cosmic rays (CRs) with unique energies and compositions which are not known yet. This contribution focuses on UHECRs originating from positions of active galactic nuclei (AGN). Because of uncertain existing GMF models, a GMF model based on spherical harmonics is established. In order to find coherent deflection directions of UHECRs, here normalizing flows are used. The goal of this work is to find the optimal hyperparameters with which the network can reconstruct the GMF model best. Currently the results show that a big network with a higher maximum degree of spherical harmonic expansion, and therefore more trainable parameters, has a good performance. The next steps are the addition of background CRs to better mimic real data. Together with taking the exposure of the Pierre Auger Observatory into account, it will be seen which cINN works best for the purpose of finding the best reconstruction of the GMF.

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