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Coronal magnetic field extrapolation

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The solar corona is structured by the solar magnetic field and to understand physical processes in the solar corona it is key to get information about the coronal magnetic field. Due to the low plasma beta of the coronal plasma, the magnetic forces dominate and other plasma forces can be neglected in lowest order. In this approach the Lorentz-force vanishes and the magnetic field is force-free. Unfortunately we do not have routine direct measurements of the magnetic field in the solar corona, but in the photosphere, e.g. from SDO/HMI. These photospheric magnetic field measurements are then extrapolated into the higher layers of the solar atmosphere. Because of the high conductivity of the coronal plasma, EUV-images, e.g. from SDO/AIA or STEREO/SECCHI, outline the magnetic field lines and these coronal images are used to validate and improve coronal magnetic field models. The models provide the 3D-magnetic field structure and can be used to compute the free magnetic energy and helicity. Both quantities are important to understand the onset of coronal eruptions.