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A new global nonlinear force-free coronal magnetic-field extrapolation code implemented on a Yin Yang grid.

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The solar magnetic field dominates and structures the coronal plasma and detailed insights are important to understand almost all physical processes. While direct routine measurements of the coronal magnetic field are not available, we have to extrapolate the photospheric vector field measurements into the corona. To do so, we developed a new code that performs state-of-the-art nonlinear force-free magnetic field extrapolations in spherical geometry.
Our new implementation is based on an optimization principle and is able to reconstruct the magnetic field in the entire corona, including the polar regions.
Because of the nature of the finite-difference numerical scheme used in the past, extrapolation close to polar regions was computationally inefficient. In the current code, the so-called Yin Yang grid is used.
Both the speed and accuracy of the code is improved compared to previous implementations. We tested our new code with a well known semi-analytical model (Low and Lou solution). This new Yin and Yang implementation is timely because the Solar Orbiter mission is expected to provide reliable vector magnetograms also in the polar regions within the following years. Thus, this code can be used in the future when these synoptic magnetograms are available to model the magnetic field of the solar corona for the entire Sun including the polar regions.