

# Magnetic Doppler Imaging: numerical experiments and application to $\alpha^2$ CVn

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**Abstract.** Numerical experiments designed to evaluate the performance of the new Magnetic Doppler Imaging code `Invers10` are described. Numerous test runs showed that given high-resolution observations in 4 Stokes parameters, the code is capable of reconstructing abundance and magnetic field vector distributions simultaneously and without any prior assumptions about the magnetic field geometry. At the same time, we found that in order to achieve reliable reconstruction using only circular polarization data, it is necessary to impose additional constraints on the possible magnetic field geometry. We implemented those constraints in the form of a new regularization function and successfully applied the modified version of the code to the Magnetic Doppler Imaging of  $\alpha^2$  CVn.