The decentered magnetic dipole - a challenge for modelling

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The magnetic dipole reveals itself by modulation of the observed integral magnetic field strength in the rotational course of the star as an oblique rotator, defining the magnetic poles as topographic features fixed at the surface of the star. Assuming a central dipole, the phase curve of the integral magnetic field strength would be a sinusoidal one. The obviously existing deviations from the sinusoidal form J. D. Landstreet in 1970 explained by the heuristic assumption of a decentered magnetic dipole, which enables one to describe most of the observed magnetic phase curves rather well. In 1954 A. J. Deutsch was the first to represent the surface field analytically by a truncated expansion of spherical harmonics, which can be coordinated to dipoles, quadrupoles, etc. However, since for every degree n the number of parameters grows with \(2n+1\), we have for a dipole 3 parameters, for dipole+quadrupole 8 parameters, etc. Truncating after the octupole yields 21 parameters. For modelling, these parameters would be taken as generating magnitudes, the physical meaning of which is not defined. This is, indeed, a challenge for modelling!

We recommend to use for the calculation the straight-forward way from the origin of the magnetic dipole as a generating magnitude on the physical base of the potential theory and the mathematical base of vector algebra. This is the foundation of modelling stellar magnetic field structures by using the method of the Magnetic Charge Distribution (MCD), proposed by the authors in former publications.