Do Magnetic Fields Actually Inflate Low-Mass Stars?

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Abstract

Magnetic fields have been hypothesized to inflate the radii of low-mass stars—defined as less than 0.8 solar masses—in detached eclipsing binaries (DEBs). I evaluate this hypothesis using the recently introduced magnetic Dartmouth stellar evolution code. I will briefly review the formalism by which a magnetic perturbation is included in the Dartmouth stellar evolution code. The models suggest that magnetic suppression of thermal convection can inflate low-mass stars that possess a radiative core and convective outer envelope. A scaling relation between X-ray luminosity and surface magnetic flux is used to estimate the surface magnetic field strength of the DEB stars. Model predictions are consistent with the estimates from X-ray emission, supporting the notion that magnetic fields may be inflating these stars. However, the magnetic models are unable to reproduce the radii of fully convective stars in DEBs. Instead, I propose that the model discrepancies below the fully convective boundary are related to metallicity.

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