Detection of a magnetic field on HD108: clues to extreme magnetic braking and the Of?p phenomenon

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We report the detection of a magnetic field on the Of?p star HD108. Spectropolarimetric observations conducted in 2007, 2008 and 2009 respectively with NARVAL@TBL and ESPaDOnS@CFHT reveal a clear Zeeman signature in the average Stokes V profile, stable on timescales of days to months and slowly increasing in amplitude on timescales of years. We speculate that this timescale is the same as that on which Ha emission is varying and is equal to the rotation period of the star. The corresponding longitudinal magnetic field, measured during each of the three seasons, increases slowly from 100 to 150G, implying that the polar strength of the putatively-dipolar large-scale magnetic field of HD108 is at least 0.5kG and most likely of the order of 1-2 kG. The stellar and wind properties are derived through a quantitative spectroscopic analysis with the code CMFGEN. The effective temperature is difficult to constrain because of the unusually strong HeI4471 and HeI5876 lines. Values in the range 33000-37000 K are preferred. A mass loss rate of about 1e-7 Msun/yr (with a clumping factor f=0.01) and a wind terminal velocity of 2000 km/s are derived. The wind confinement parameter eta_star is larger than 100, implying that the wind of HD108 is magnetically confined. Stochastic short-term variability is observed in the wind-sensitive lines but not in the photospheric lines, excluding the presence of pulsations. Material infall in the confined wind is the most likely origin for lines formed in the inner wind. Wind-clumping also probably causes part of the Ha variability. The projected rotational velocity of HD108 is lower than 50 km/s, consistent with the spectroscopic and photometric variation timescales of a few decades. Overall, HD108 is very similar to the magnetic O star HD191612 except for an even slower rotation.

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