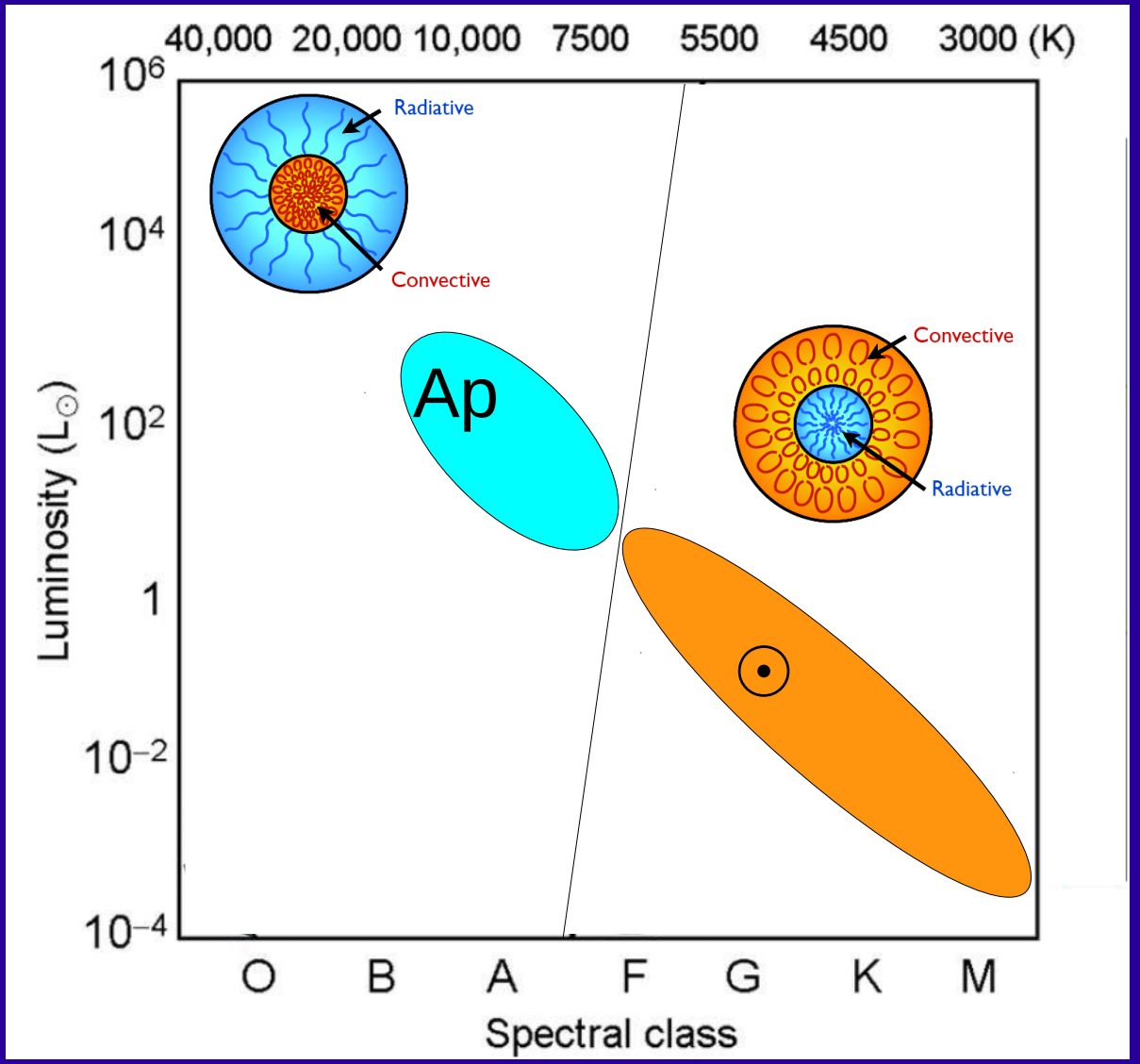
Magnetic fields across the H-R diagram

Maryline Briquet

ULg, Belgium

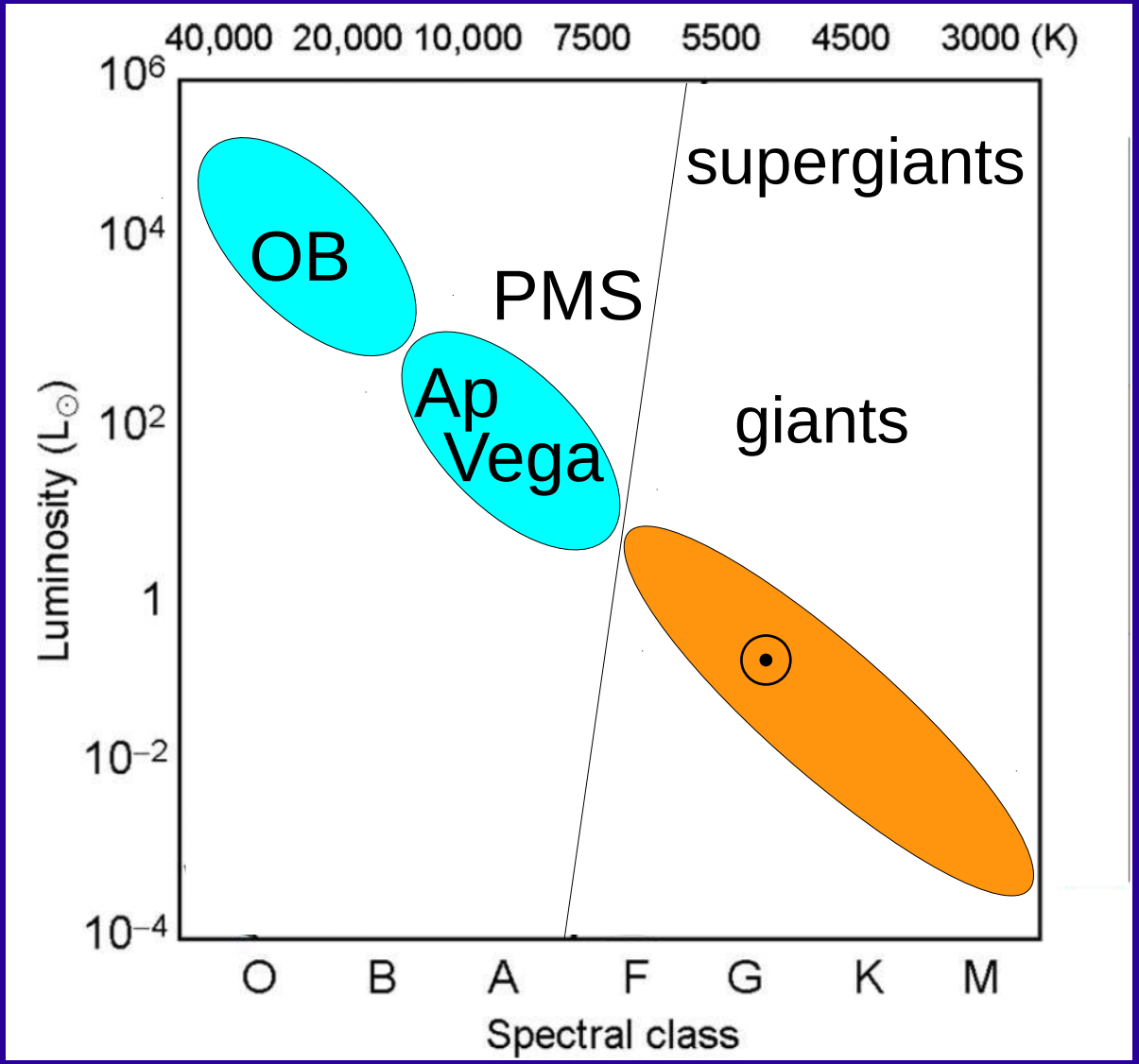
Magnetic fields across the H-R diagram
as observed some time ago



Chemically peculiar Ap stars

Sun and low-mass stars

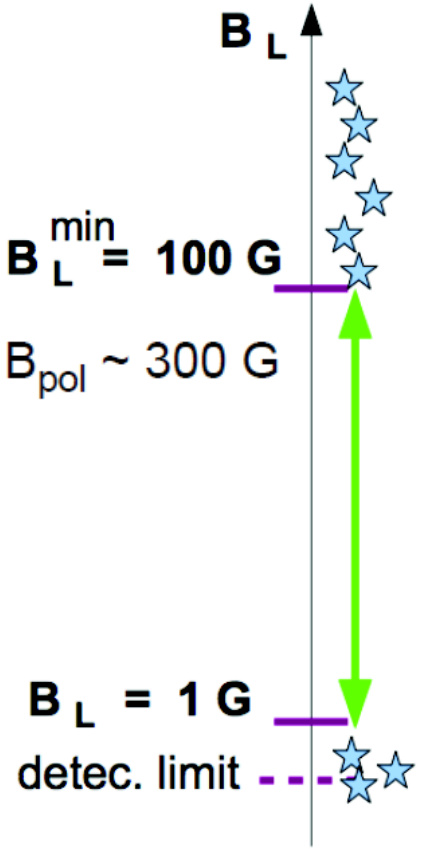
Magnetic fields across the H-R diagram
by high performance spectropolarimetry



FORS at VLT, ESPaDOnS at CFHT, Narval at TBL,
HARPSpol at ESO 3.6-m and other instruments of new generation

Intermediate-mass stars
Two classes of magnetism: Ap-like and Vega-like

Lignière et al. (2014)

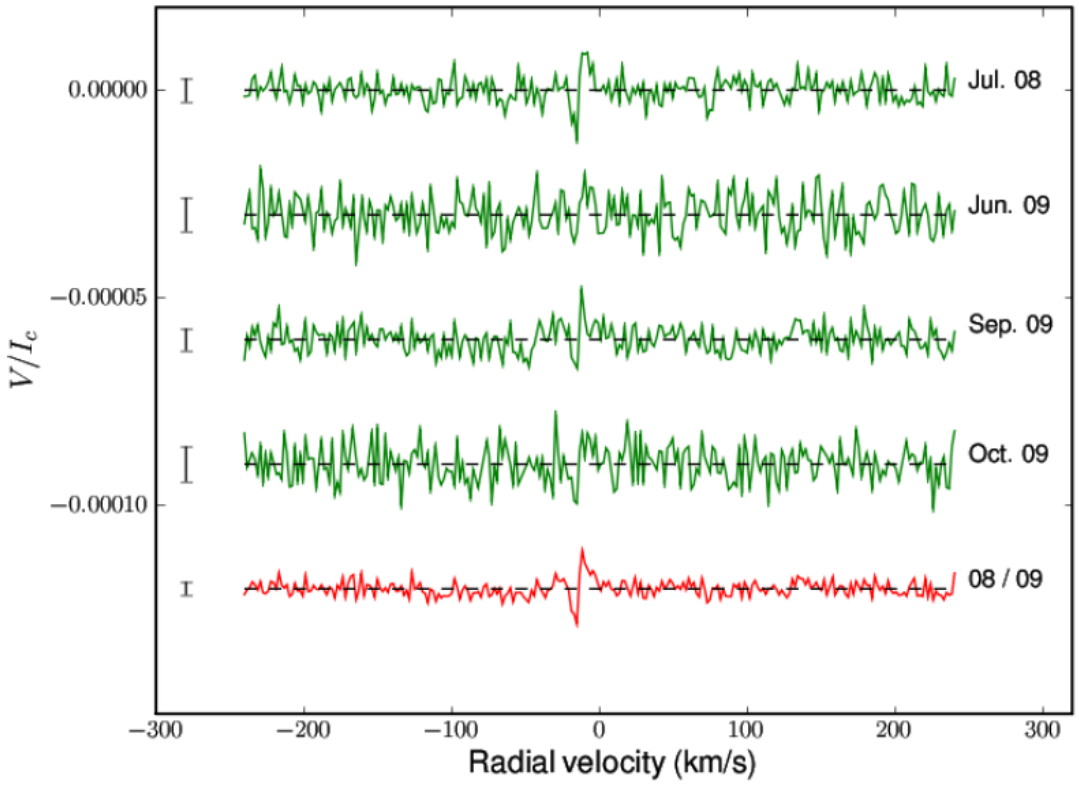


Ap/Bp magnetism
"strong" fields
in ~10% of stars

Magnetic desert

Vega-like magnetism
"ultra-weak" fields

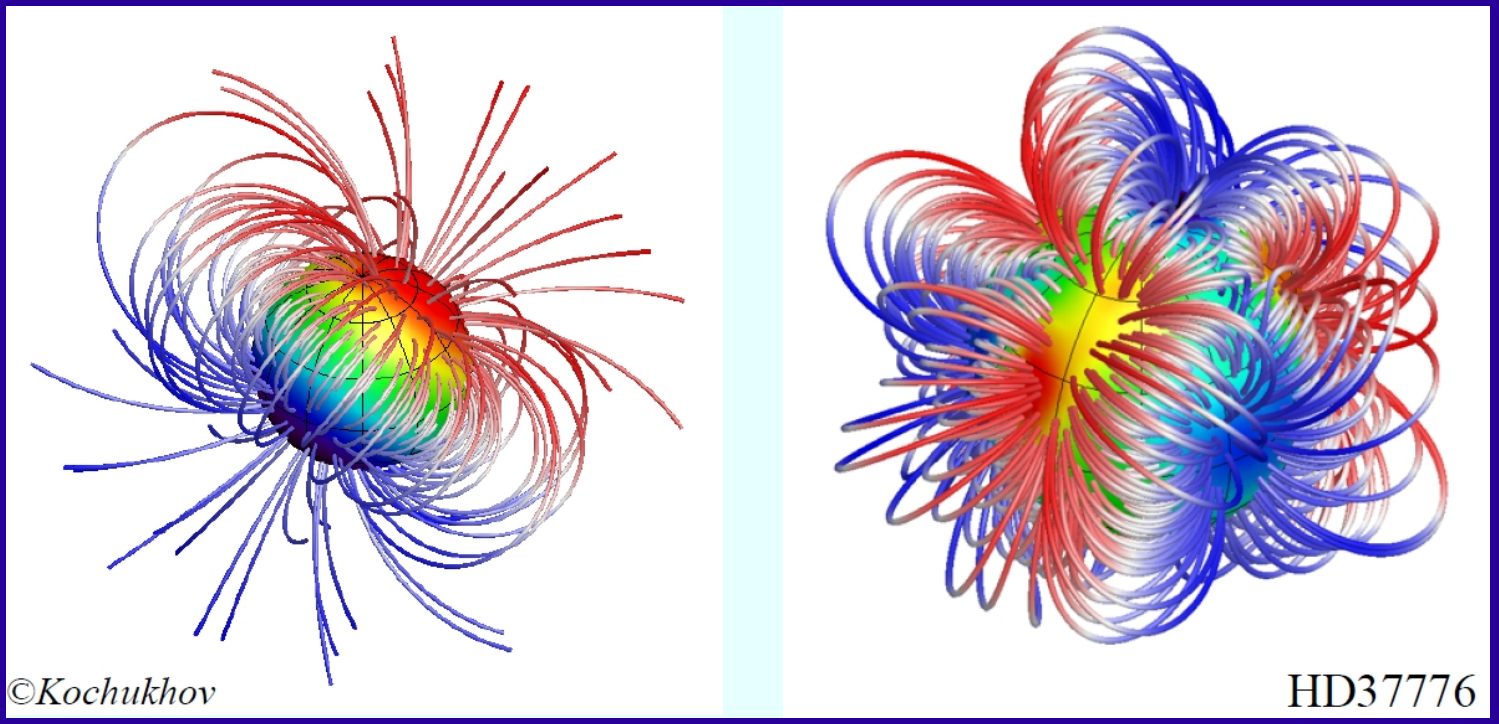
Sub-gauss field in Vega



Massive stars
Incidence / topologies / properties

	MiMeS Wade et al. (2013)	**BOB** ESO LP PI Morel T.
Detection rate	**~7%**	**~5%**

Magnetic field detected in 100 stars (14 O + 86 B)



Also τ Sco and τ Sco clones

Massive stars
Incidence / topologies / properties

	MiMeS Wade et al. (2013)	**BOB** ESO LP PI Morel T.
Detection rate	**~7%**	**~5%**

Magnetic field detected in 100 stars (14 O + 86 B)

Very diverse magnetic objects

Slowly and rapidly rotating

Strong (~ kG) (extension of Ap-like magnetism)
and weaker (~0.1 kG) **fields**

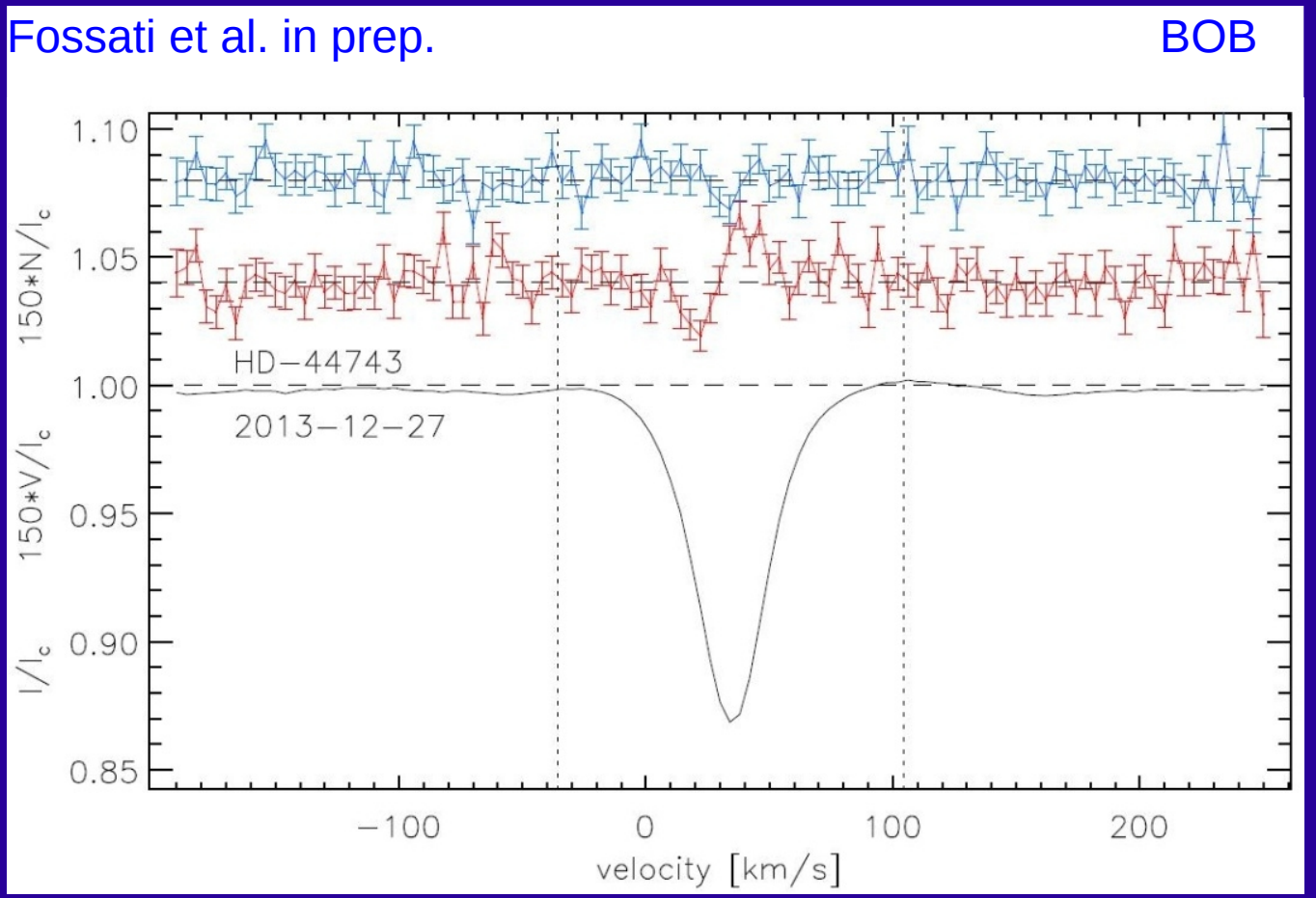
Peculiar spectra and not peculiar

Non-pulsator and pulsator

No correlation

Detection of weak fields in early B-type stars

β CMa

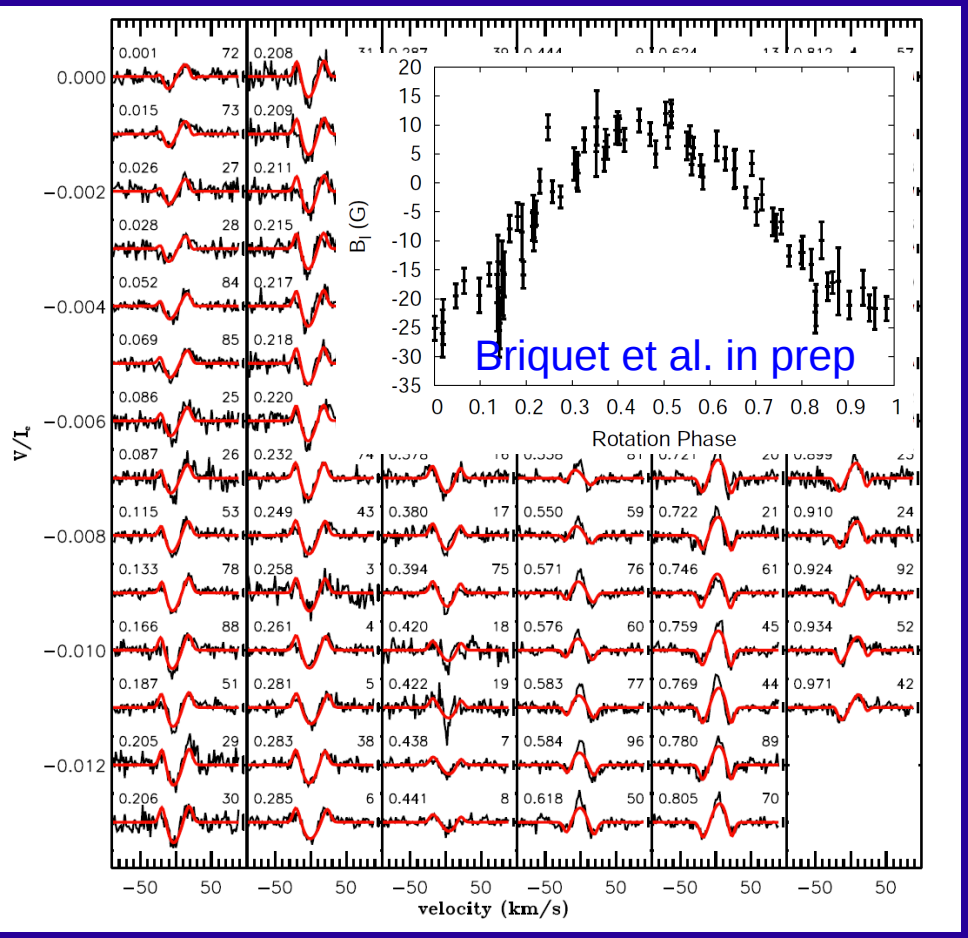


HARPSpol

B_{pol} ~ 150 G

Detection of weak fields in early B-type stars

ζ Cas and other objects



Narval B_{pol} **< 100 G**

“strong” fields

B_{pol} ~kG (-> ~3kG)

+

“weak” fields

~50 G < B_{pol} < 1000 G

more ubiquitous?

~7% of stars

“ultra-weak” fields?

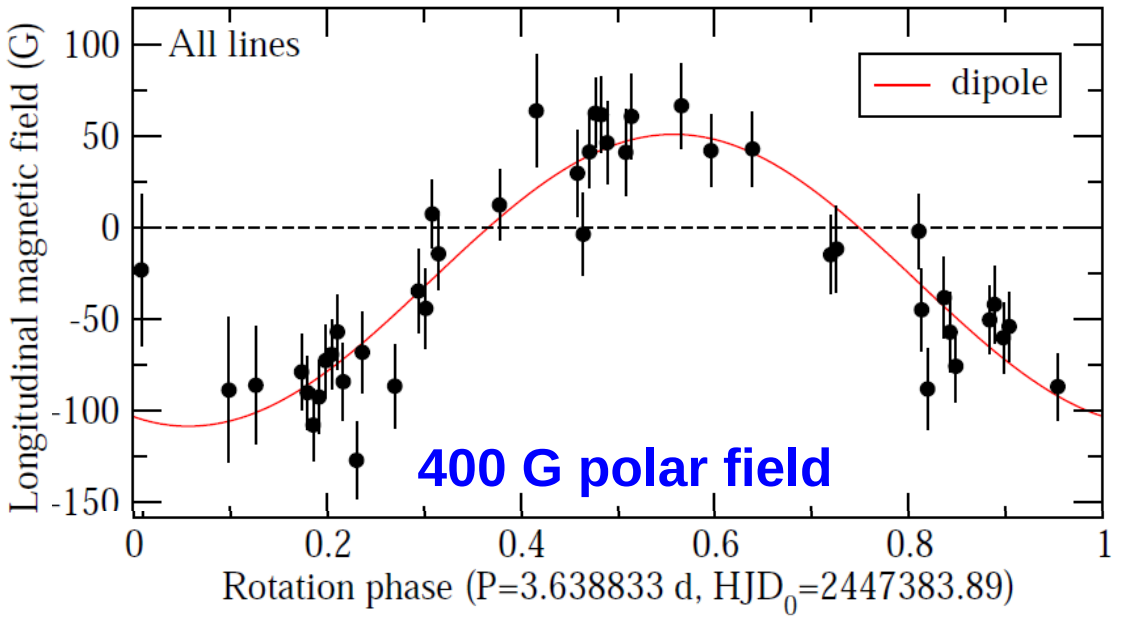
Not detected so far

Neiner et al. (2014)

+ eps CMa, HD 25558, τ Sco, HD 37742

Hubrig et al. 2009, MiMeS, BOB

Asteroseismology of magnetic stars
Constraints on effects of fields on interior mixing



Multisite photometry + spectroscopy
+ Narval spectropolarimetry

β Cep star
V2052 Oph

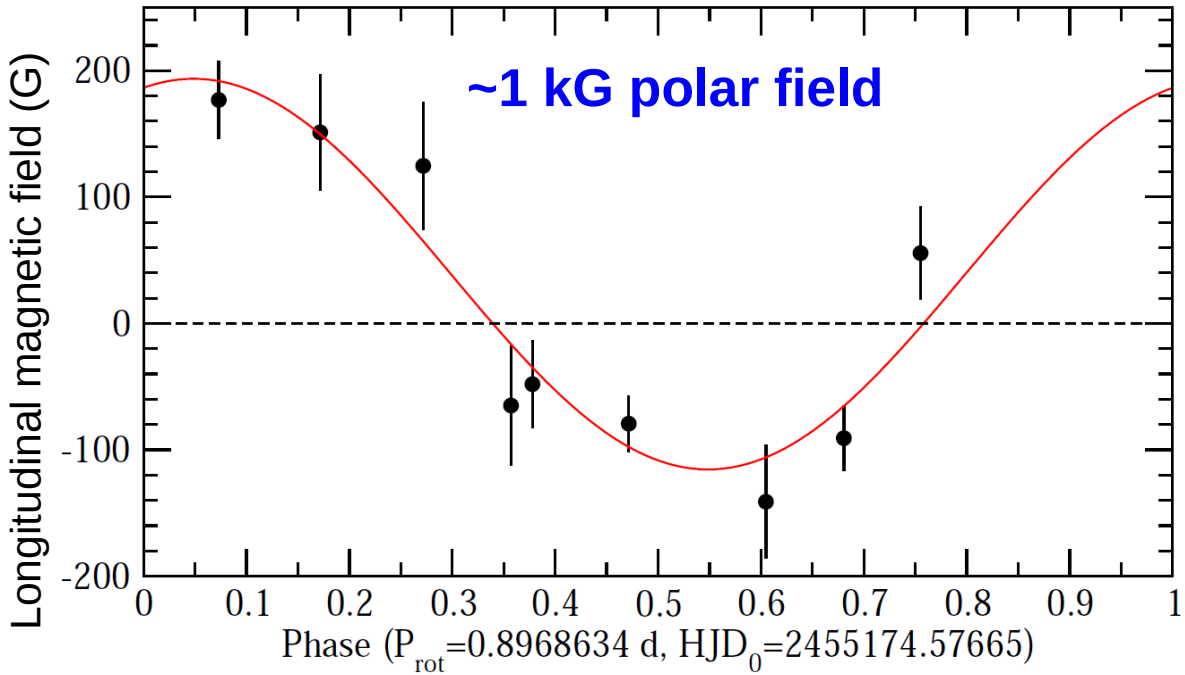
Handler et al. 2012, Briquet et al. 2012,
Neiner et al. 2012

just observed by MOST

CoRoT photometry
+ Narval spectropolarimetry

Hybrid B-type star
HD 43317

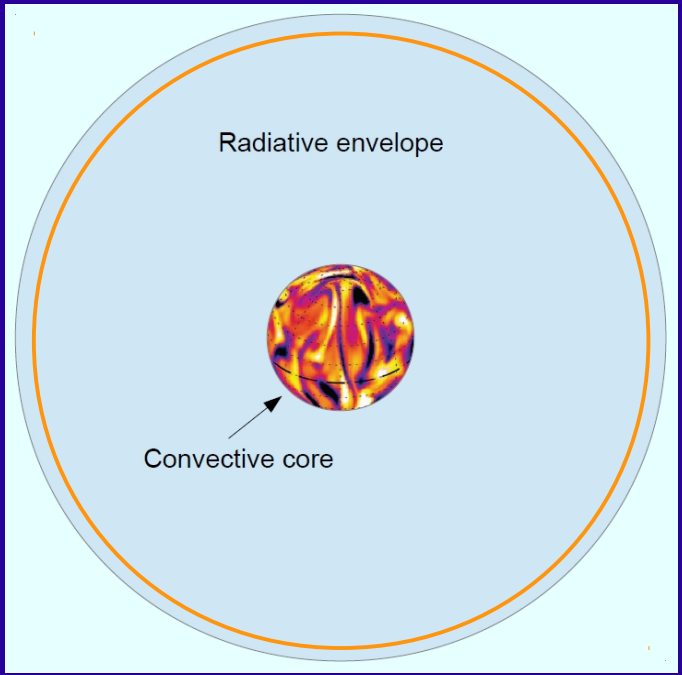
Pápics et al. 2012, Briquet et al. 2013



Stars with radiative envelopes
Origin of observed magnetic fields

Core dynamo fields?

Charbonneau & MacGregor 2001
Browning et al. 2004
Brun et al. 2005

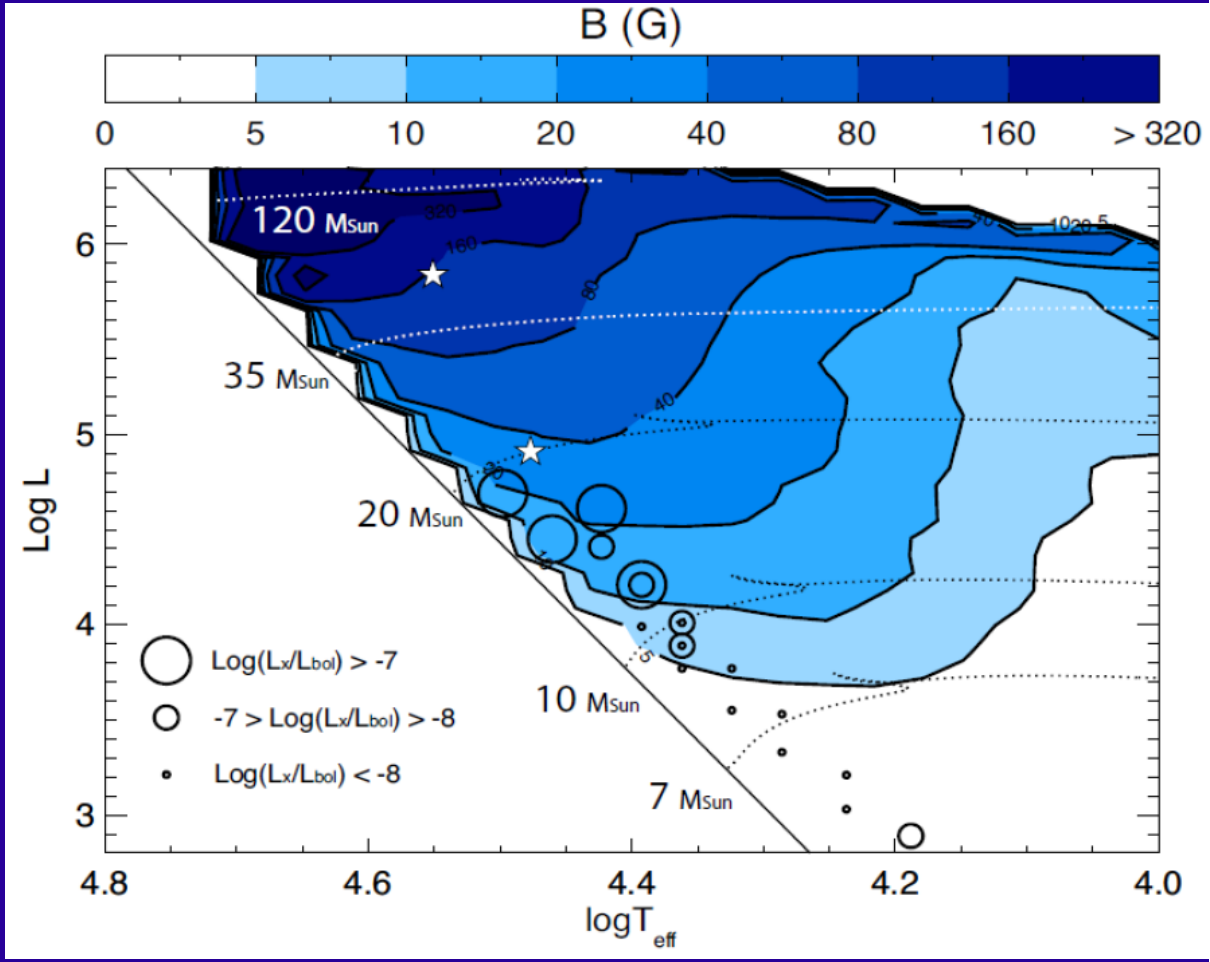


Dynamo fields in radiative envelope?

Braithwaite 2006
Zahn, Brun & Mathis 2007

Dynamo in sub-surface convective zone?

Cantiello & Braithwaite 2011



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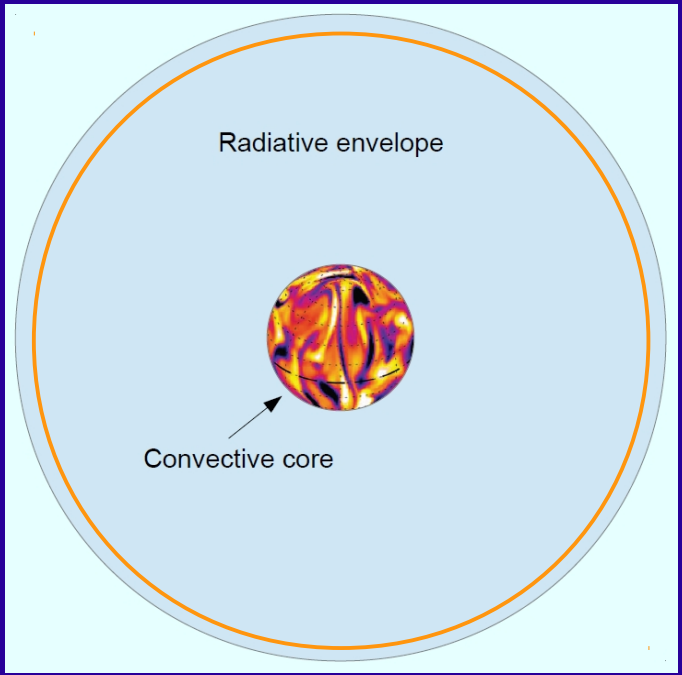

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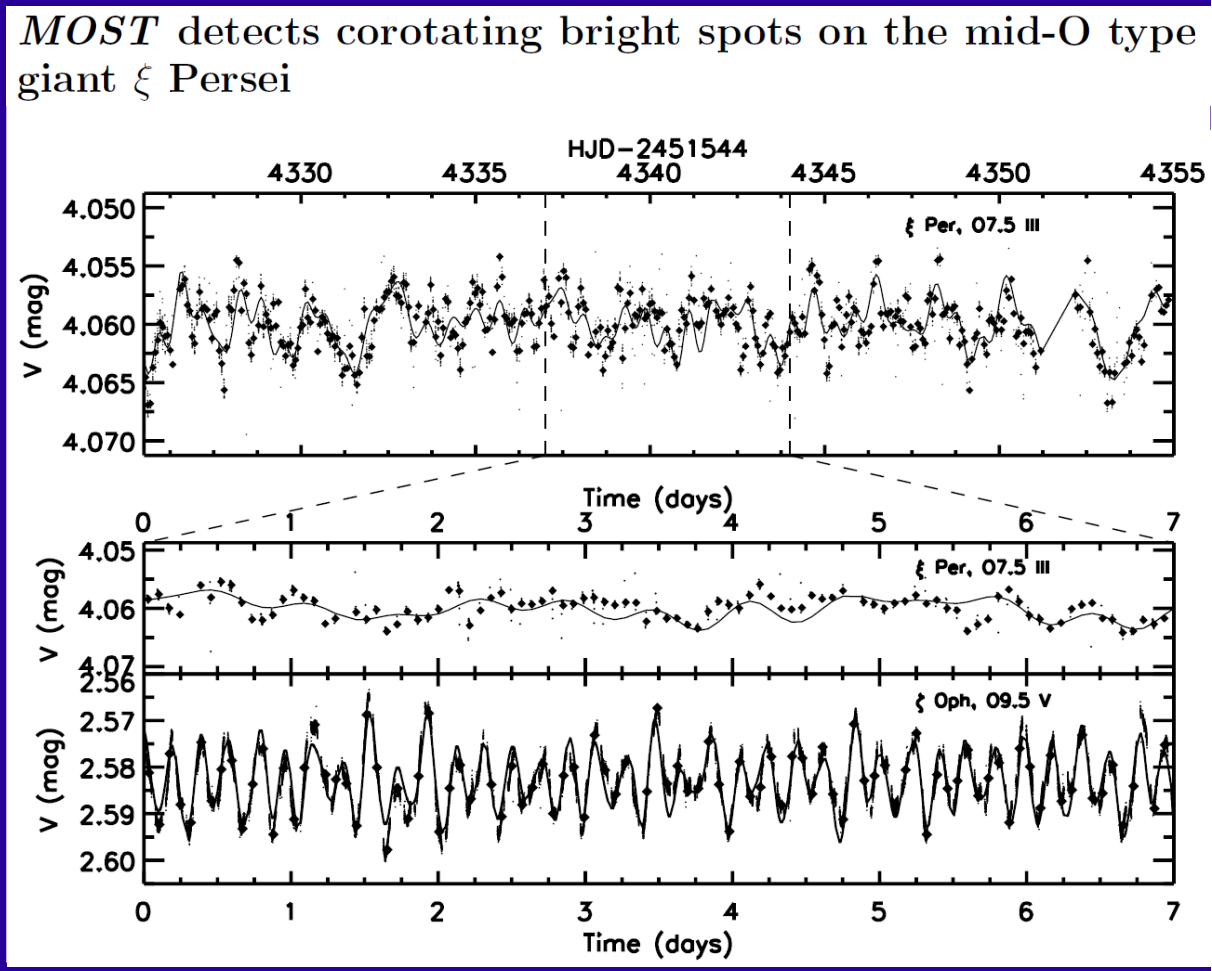
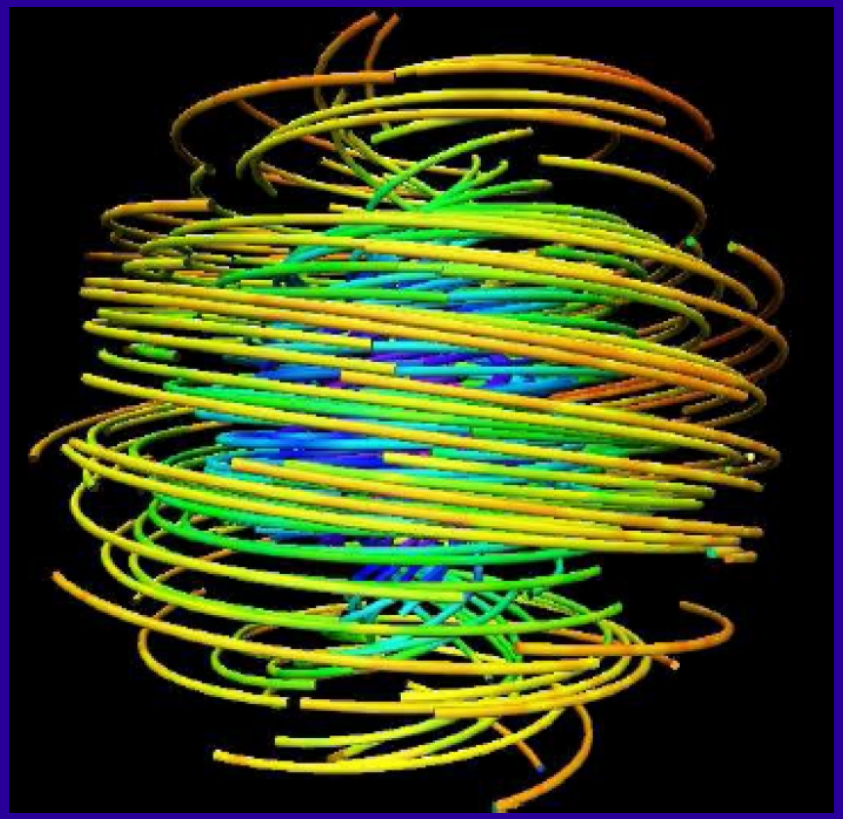
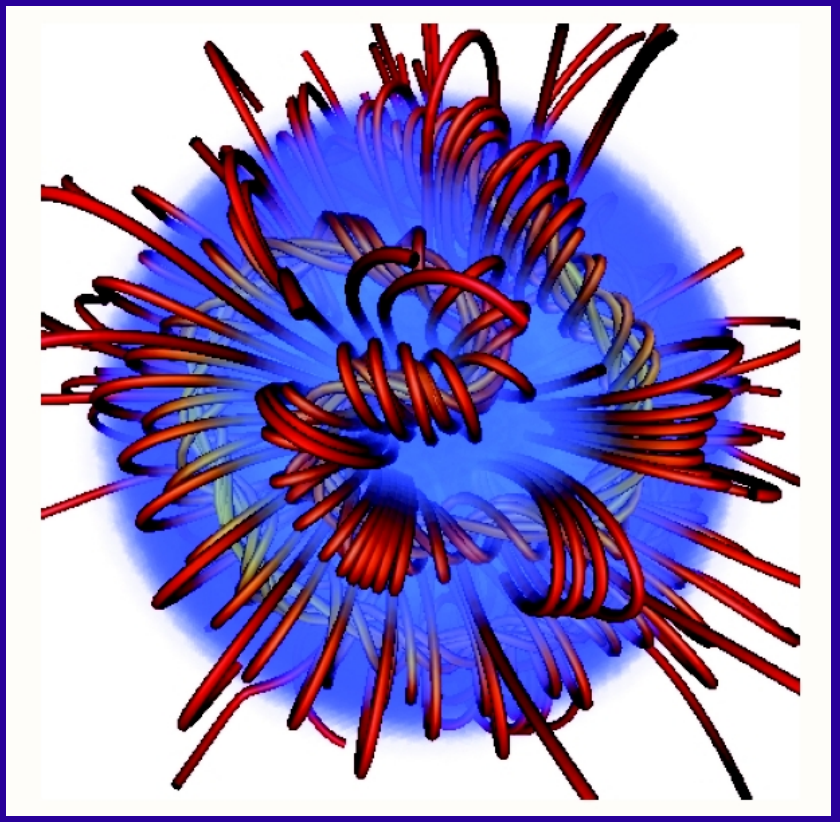
Ramiaramanantsoa et al. 2014



Stars with radiative envelopes
Origin of observed magnetic fields

Analytical and numerical predictions

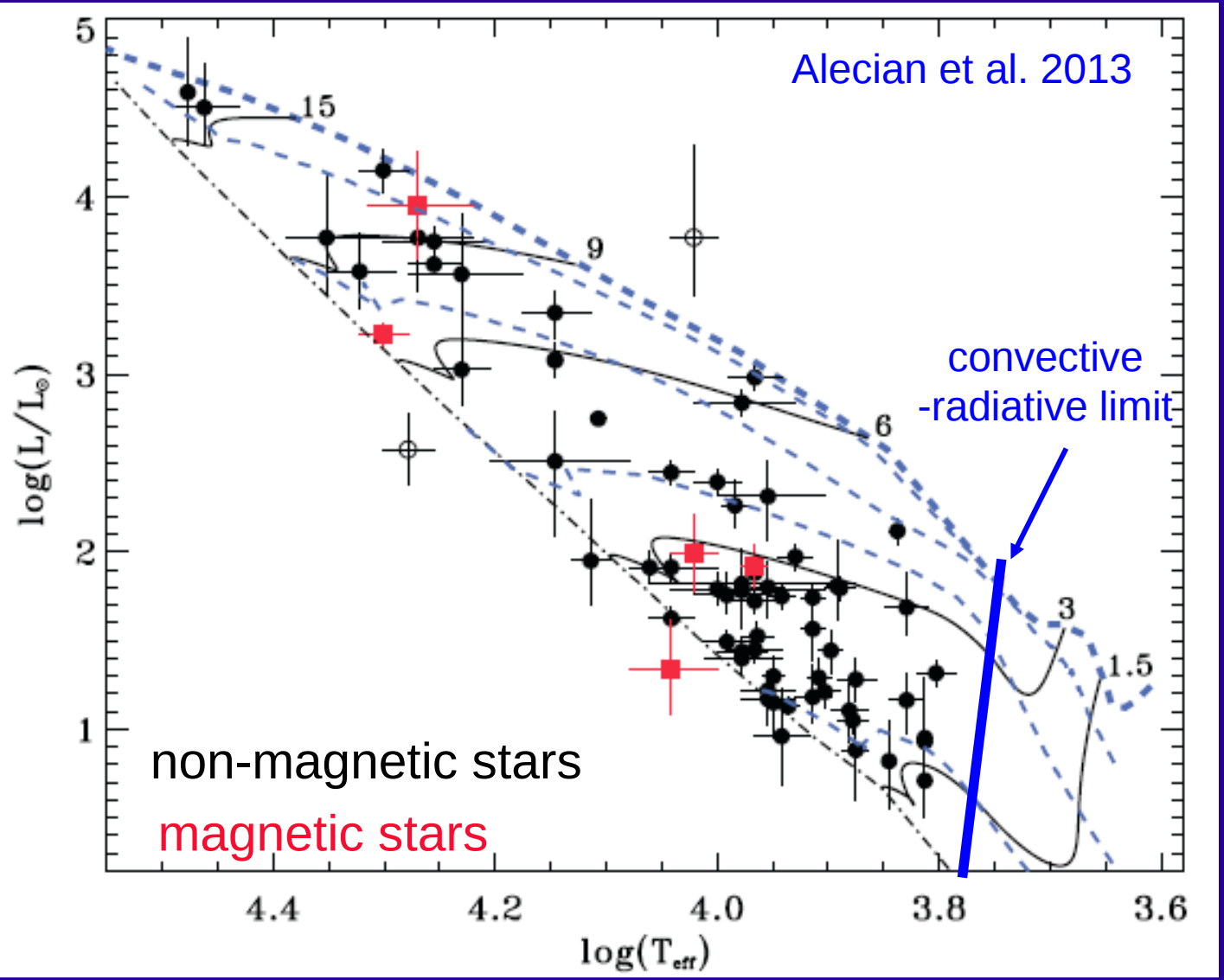




Observed fields are fossil fields

Braithwaite & Nordlund 2006, Duez & Mathis 2010

Testing the fossil field hypothesis
Herbig Ae/Be survey



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