Magnetic flux generation and transport in cool stars

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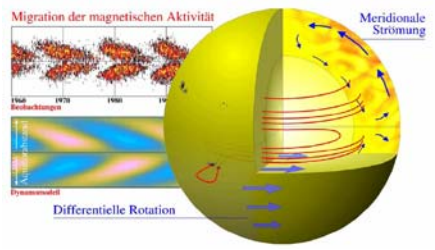
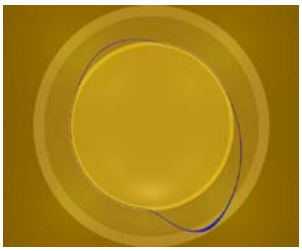
We construct a combined model for magnetic field generation and transport in stars with outer convection zones, including the Sun. The magnetic field is generated in the rotational shear layer at the bottom of the convection zone. The field is stored in a stably stratified layer of overshooting convection until magnetic instability leads to the buoyant rise of magnetic flux bundles to the stellar surface. The evolution of the emerged surface flux is then followed through a numerical flux transport model describing the effects of differential rotation, meridional flow, and large-scale convection. The results will be confronted with the observations of the Sun and magnetically active cool stars.



Dynamo

[tachocline/overshoot layer]

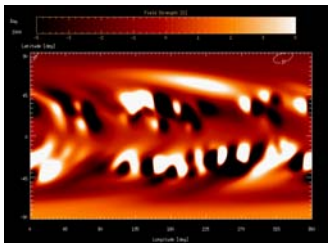
- $\alpha\Omega$ dynamo
- Flux tube dynamo
- Effects of stellar properties



Flux tube dynamics

[from overshoot to subsurface]

- Instabilities of **thin** flux tubes
- Effects of localised flows
- Evolution of dynamo-generated flux tubes (cycle properties)
- Effects of stellar properties



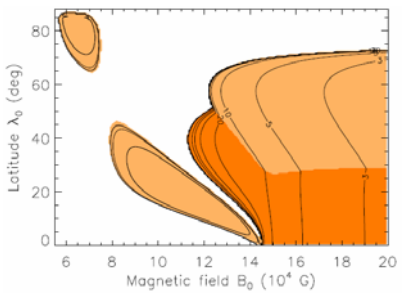
Surface flux transport

[photosphere]

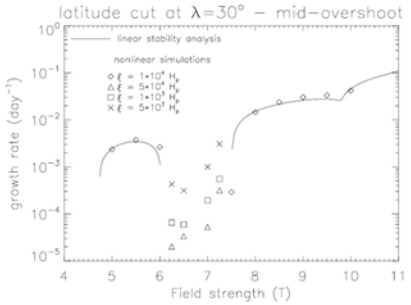
- Flux/size evolution of magnetic regions
- Redistribution of magnetic flux of rising flux tubes
- Implications on the dynamo
- Effects of stellar properties

<< Work in progress >>

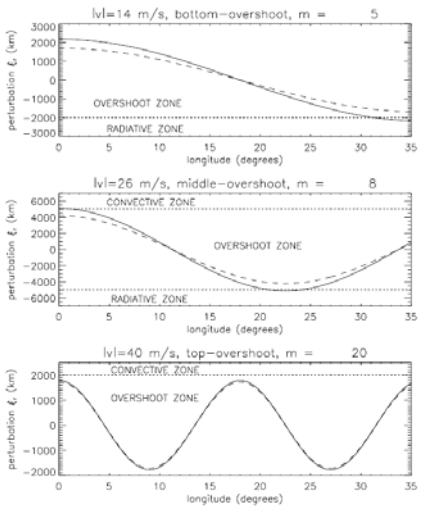
- Linear stability of flux tubes within the differentially rotating overshoot region



- Perturbation amplitude vs. drag instability



- Effects of convective drag on a thin flux tube



- Trajectories of unstable flux tubes with respect to initial field strength, flux, and latitude

- Flux dispersal for large magnetic regions on rapidly rotating stars