Modeling Intrinsic Luminosity Variations Induced by Internal Magnetic Field in the Sun and in Solar-like Stars

Federico Spada *[spada@mps.mpg.de], Max-Planck-Institut für Sonnensystemforschung, Göttingen, Germany*

During their main sequence evolution, solar-like stars (M < 1.2 Msun) possess outer convective layers where magnetic fields are generated by dynamo action. As a consequence, these stars are magnetically active and can undergo brightness variations because of two distinct mechanisms. The first is the appearance and disappearance of surface features (starspots, faculae, magnetic network) that enter and leave the visible stellar disk because of stellar rotation and of their own evolution. Secondly, magnetic fields in the interior can induce intrinsic readjustments of the stellar structure and thus affect the stellar luminosity directly.

In this talk, I will present intrinsic magnetic variability models for the Sun and solar-like stars. The models are constructed using an opportunely modified 1D stellar evolution code that takes into account the mechanical, thermal, and energy budget effects of time-dependent magnetic fields, such as, e.g., the inhibition of convective energy transport through magnetized layers. For the Sun, the internal magnetic field profiles are constrained using helioseismic measurements, and prescribed on the basis of the output of state-of-the-art mean-field solar dynamo models. For young, fast-rotating, and therefore strongly magnetically active stars, the magnetic field at the surface is assumed to be in equipartition with the plasma pressure.

The observable predictions of these models, both in the solar and the stellar context (e.g., as a viable explanation for the so-called "radius inflation problem" of low-mass stars) will be discussed.