SOLar - STellar - ICE (SOLSTICE) connection: understanding stellar magnetic activity and its variability

Rosaria Simoniello*[1], Christoffer Karoff[2], Fadil Inceouglu[2], Travis Metcalfe[3], Sylvaine Turck-Chieze[1], Fardschou Mads[2], and Jesper Olsen[2]

[1]Service d'Astrophysique (SAp) – CEA – Service d'Astrophysique, CEA-Saclay, DSM/DAPNIA/SAp, Bât. 709, L'Orme des Merisiers, F-91 191 Gif-sur-Yvette Cedex, France, France
[2]Aarhus University [Aarhus] – Nordre Ringgade 1 DK-8000 Aarhus C, Denmark
[3]Space Science Institute (SSI) – SPACE SCIENCE INSTITUTE 4750 Walnut Street — Suite 205 Boulder, Colorado 80301, United States

Abstract

The Mount Wilson Observatory (MWO) monitored the CaII fluxes of 100 stars of spectral type G0-K5. The observations indicate a pattern of correlated changes in rotation and chromospheric activity on an evolutionary timescale: young stars exhibit chaotic high average levels of activity and rapid rotation rates; stars of intermediate age have moderate levels of activity and rotation rates, and occasional smooth multiple cycles; stars as old as the Sun and older have slower rotation rates, lower activity levels and smooth (single or multiple) cycles with occasional flat behavior (Grand Minimum state). The typical astrophysical dynamo excites eigenmodes of different symmetry types and it might explain stellar variability at different ages. Multi cyclic behavior naturally occurs in stellar dynamos as result of the cycle periods of the excited dynamo modes and this in turn induces the presence of multiple magnetic cycles in stellar magnetic activity. Within this scenario the dynamo efficiency can be seen as the capability to excite as many as possible eigenmodes, while the Grand Minimum phase, can be seen as the result of a less efficient dynamo. This is a fascinating possibility that needs to be investigated and to this aim we need to bring together complementary information coming from the Sun and solar - like stars. Cosmogenic isotopes, in fact, allows us to study the long term variability on centennial to millennial time scales, while other Sun-like stars allows to track the dynamo at different evolutionary states and investigate its effect on stellar magnetic activity through observtions of Ca emission lines or internal structures with asteroseismology.
This work will present results from the analysis of cosmogenic isotopes aiming to better understand the origin of Grand Minima in the Sun and of 50 stars provided by the MWO to check whether or not the cycle period of different magnetic dynamo configurations might be the possible mechanism behind multiple magnetic cycles in solar - like star, as in the Sun (Simoniello et al. 2013). We will also present the project that aims to merge the data from the MWO and the Lowell Observatory, providing the scientific community the unprecedented chance to work with 50 years of stellar data for 32 stars.

*Speaker