Before the Compact Stage: Magnetic Fields in Stars of All (St)Ages

Gregg A. Wade

Queen's University, Kingston, Canada Royal Military College of Canada, Kingston, Canada

contact e-mail: *gw33@queensu.ca*

From their births to their final phases, stars advect, amplify, and sculpt magnetic fields through interactions of those fields with the dynamic, ionized stellar plasma. Cooler stars with convective envelopes near their surfaces exhibit ubiquitous magnetic activity resulting from dynamos powered by the conversion of convective and/or rotational mechanical energy into magnetic energy, generating and sustaining highly structured and variable magnetic fields in their outer envelopes whose surface properties generally correlate strongly with stellar mass, age, and rotation rate. Strong magnetic fields are also frequently detected at the surfaces of stars with radiative envelopes. The characteristics of these fossil fields differ fundamentally from those of cool stars: they are intense, long-lived, and organized on global scales, and show no clear correlations with stellar rotational properties. Understanding the characteristics and relationships of these fundamental modes of stellar magnetism has important implications for our basic knowledge of every star in the Galaxy (and beyond). While hot stars, white dwarfs, and neutron stars exhibit radiative zones near their surfaces, many cool stars exhibit analogous regions in their deep interiors. On the other hand, the strong convection characterizing the exteriors of cool stars also occurs in the cores of hot stars. As a consequence, understanding envelope dynamos of cool stars informs our understanding of interior dynamos of hotter stars. Similarly, the study of surface fossil magnetism of hot stars (and degenerate remnants) informs us about analogous fundamental physics occurring deep below the observable surfaces of cool stars, including the Sun. This talk will review our current understanding of the magnetic fields of non-degenerate stars across the HR diagram, with a focus on connections between the structure of stars and their magnetic fields, and the coupled evolution of magnetic fields and their stellar hosts.