1-2001

Break Out Session: The Future of White Dwarf Observing

Ted von Hippel
Gemini Observatory, vonhippt@erau.edu

12TH *European Workshop on White Dwarf Stars*
ASP Conference Series, Vol. 226, 2001
J. L. Provencal, H. L. Shipman, J. MacDonald, & S. Goodchild, eds.

Break Out Session: The Future of White Dwarf Observing

Ted von Hippel

Gemini Observatory, 670 North A'ohoku Place, Hilo, HI 96720, USA

1. Introduction

On Thursday, June 15, 2000 the conference participants joined one of four afternoon break out sessions. Our break out session was charged with addressing the following questions: *Astronomy is changing. Eight to ten meter telescopes looking towards the edge of the Universe will dominate the astronomical landscape. Queue scheduling, large surveys, and the current emphasis towards the red end of the spectrum will also affect us. What consequences do these changes imply for our field? How can we convince telescope assignment committees to grant observing time to proposers from our community?*

I started by summarizing the new capabilities at the largest ground-based telescopes, which include improved temporal coverage of variable objects via queues, $\leq$ 100 milli-arcsecond near-IR imaging using adaptive optics, vastly improved mid-IR sensitivity due to very low emmissivity, efficient multi-plexing instruments, as well as the obviously improved signal-to-noise ratio with a larger aperture. Harry Shipman then guided participants in an examination of how our community might best take advantage of these capabilities. One overarching theme emerged: white dwarf luminosity function (WDLF) studies. The enthusiasm for this topic was so great that more than a dozen of us stayed after the conference ended to continue discussing how we could coordinate and collaborate a major improvement in our knowledge and understanding of the WDLF.

The study of the white dwarf luminosity function connects most practitioners in the WD community, whether they are atmospheric or interior theorists, or observers studying WD oscillations, compositions, masses, or ages. In addition, the WDLF has the distinct advantage that we can explain its importance to colleagues outside our field as it provides new insight into the age, star formation history, and initial mass function of the Galaxy. We charted a path forward along three distinct lines: (a) the disk WDLF, (b) the halo WDLF, and (c) open cluster studies. A short description of the concepts and goals for each of these three avenues of study follows.

2. The Proposed WDLF Collaboration

The Galactic Disk WDLF: The goal of this component of the collaboration is to improve our knowledge of the WDLF by an order of magnitude. This will require approximately ten times as many WDs over all luminosities as well as improvements in our theoretical understanding of WDs, particularly in their atmospheres. We discussed how current deep photometric studies, such as the NOAO deep-wide survey, or spectroscopic/photometric surveys such as the Sloan Digital Sky Survey (SDSS), might provide the spring-board for this work. Follow-up studies might first take the form of re-observing the NOAO deep-wide field with appropriate narrow-band filter(s) or encouraging a second epoch SDSS for astrometry. In either case, these surveys serve only as a starting point. We need follow-up spectroscopy in order to determine effective temperatures and surface gravities, as well as trigonometric parallaxes and near-IR photometry to determine bolometric luminosities. We believe that a broad-based community-wide effort over the next five to ten years could accomplish this ten-fold improvement in our knowledge and understanding of the local disk WDLF. The benefits would be important: a precise age for the Galactic disk at the solar radius, a greatly improved knowledge of the star formation history in the same region, and a good empirical constraint of the poorly understood crystallization phase diagram issues which affect WD cooling rates near 10 Gyr.

The Galactic Halo WDLF: The halo WDLF holds exciting insights into the age of the Galaxy independent of the observational and theoretical uncertainties in the stellar evolutionary ages for the globular clusters. The problem is much more challenging than the Galactic disk WDLF however, since the local halo stellar density is $\approx$ 500 to 800 times less than the disk stellar density. The WDLF disk collaboration would take up the halo WDLF challenge after completing the bulk of its work on the disk WDLF.

Open Cluster Studies: Open clusters hold the key to a detailed comparison of the ages derived from WD cooling with those derived via stellar evolution theory over a range of age and metallicity. As an important byproduct, these studies could also greatly improve the initial-final mass relation, which is both a basic component of stellar evolution and an ingredient in calculating WD ages. Clusters with ages between approximately 0.5 and 2.0 will provide tests of core convective overshoot theory, whereas older clusters will provide tests of whether systematic errors exist within stellar evolution or WD cooling theory. The goal is to obtain WD cooling ages for open clusters spanning the widest possible range of age and metallicity, and thereby lay a careful framework for understanding the WDLF age for the Galactic disk and eventually the Galactic halo. Eventually, we hope to find the limit of the WD cooling sequence in globular clusters, but this is likely beyond the limits of current ground-based instrumentation or the Hubble Space Telescope even with its new Advanced Camera for Surveys, since even for the closest globulars the WD terminus is expected to be at $V \geq 30$.

Forming the WDLF Collaboration: The next step for our community is to form the WDLF collaboration. This collaboration will be difficult to efficiently form and manage, since our wide range of nationalities presents us with a complicating funding environment and the usual difficulties of regular communication among a large and diverse group. On the other hand, the wide range of expertise, talent, and (hopefully) telescope access within our community is certainly up to the challenge of this important problem. Improving our understanding and knowledge of the WDLF may be the best means for our community to interact with the widest range of astronomers by contributing to the important topical problems of the age structure and star formation history of the Galaxy.