The University of Georgia
Department of Physics and Astronomy
Athens, Georgia 30602

[S0002-7537(90)02901-8]

The following report covers the Department activities from October 1998 through October 1999.

1. PERSONNEL

Department members participating in astrophysics or astronomy research or instruction were Professors J. Scott Shaw and Jean-Pierre Caillault, Associate Professor Loris Magnani, Assistant Professor Peter Hauschildt, postdoctoral fellows Ian Short and Andreas Schweitzer, and graduate students Sangeeta Mysore, Fred Buls, Inseok Song, Travis Barman, Mariam Dittmann, and Ray Chastain. Undergraduate student Erin Smith from the University of Texas spent the summer as an NSF REU intern working with Shaw. Mysore received the PhD degree for her dissertation titled: ''The Study of the Variability Characteristics of the Late Type Stellar Population of M35'' and Buls was awarded the Master's degree for his thesis titled: ''Diffuse X-Ray Emission from the Open Clusters NGC 3572 and Hogg 10.'' Both theses were directed by Caillault.

Caillault was a member of the Scientific Organizing Committee of the 11th Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun.

2. FACILITIES

The University of Georgia is a member of the Southeastern Association for Research in Astronomy (SARA), a consortium of five south-eastern universities (East Tennesse State, Valdosta State, Florida Tech, Florida International University and the University of Georgia). The consortium operates a 0.9-m telescope on Kitt Peak. This telescope is now completely functional with a CCD camera. Some remote observing programs have commenced and robotic operation is currently underway. In addition, the consortium also operates a summer NSF REU program.

The astronomy group at the University of Georgia has four SUN Sparcstations, two HP workstations, one IBM workstation, and numerous smaller machines available for data processing and computation. In addition, a 0.6-m Cassegrain telescope is available on the roof of the Physics Building for teaching and public nights. This telescope has been equipped with UBVRI filters, and an Axiom CCD for student research.

3. RESEARCH

Mysore, Caillault, and J. Stauffer (CfA) analyzed photometric data of M35 (an open cluster with an age thought to be similar to that of the Pleiades) in order to select variables having large amplitudes whose light curves might yield rotation periods. Probable M35 members exhibiting light curve dispersions greater than a threshold value were selected as variables or potential fast rotators. However, the observational data were insufficient for a reliable period determination. Nevertheless, an important conclusion was drawn by comparing the dispersion values of K-type members with that of simulated data. This comparison revealed a fraction of fast rotators less than that found in the Pleiades, indicating that M35 is slightly older than the Pleiades. This conclusion was further supported by the fact that the earliest spectral type of the fast rotators in the Pleiades is $\sim$ K2, but fast rotators in M35, as determined from the largest dispersion values, begin to appear only at spectral type $\sim$ K6. Future rotational velocity measurements of M35, as well as the determination of more complete rotational velocity distributions of clusters of various ages, can better constrain the models of angular momentum evolution.

Buls and Caillault analyzed a ROSAT HRI observation of two open star clusters, NGC 3572 and Hogg 10, that reveals what appears to be extended X-ray emission. Two possibilities for the emission were considered: unresolved point sources and truly diffuse emission. After taking into account the known cluster membership and studying the distribution of fainter stars in the region, no evidence for fainter cluster members was found, leading to the conclusion that the extended X-ray emission is unlikely to be attributable to unresolved point sources. It is possible that the Of-type star, HD 97253, is powering, via its stellar wind, the diffuse emission in the region surrounding Hogg 10.

T. Hearty (MPE), Magnani, Caillault, R. Neuhäuser (MPE), J. Schmitt (MPE), and Stauffer investigated the star formation capability of two molecular clouds at high galactic latitude. Possible PMS stars in and around the translucent clouds MBM7 and MBM55 were identified via their X-ray emission by inspecting ROSAT All-Sky Survey observations of the clouds and environs and ROSAT pointed observations of the high density cores within the clouds. Follow-up optical spectroscopy of the stellar X-ray sources with $V < 15.5$ mag was conducted with the 1.5-m Fred Lawrence Whipple Observatory telescope to identify standard signatures of PMS stars (Li absorption and Hα emission). They found 11 stars that have W(Li) above their detection threshold. Three of the stars with lithium also have weak Hα emission. Relative ages for the stars with lithium are estimated by their position on a W(Li) vs. $T_{\rm eff}$ diagram. A calibration derived from data for several clusters with known ages indicates the stars are older than the translucent high-latitude clouds. This conclusion is supported by a comparison with theoretical evolutionary tracks of the stars from their sample for which they have distance measurements from Hipparcos. They find it is unlikely that any of the X-ray active, lithium-rich stars they identified have formed in the clouds in question. Theoretical and observational arguments support this conclusion and render unlikely the possibility that low extinction clouds are the sites of star formation.

G. Micela (Palermo), S. Sciortino (Palermo), R. Harnden (CfA), V. Kashyap (CfA), R. Rosner (Chicago), C. Prosser (NOAO), F. Damiani (Palermo), Stauffer, and Caillault used the ROSAT HRI to explore a region of the Pleiades cluster formerly surveyed only with the ROSAT PSPC. The new observations substantially improved upon both the sensitivity and the spatial resolution for that region of the Pleiades, allowing them to detect 18 cluster members not detected before and 16 members not included in the catalogs used in previous surveys. The high sensitivity of the observations permitted them to obtain more stringent upper limits for 72 additional members and also provided sufficient numbers of stars to enable them to exlore the dependence of L_x on stellar rotation for the slow rotators of the Pleiades.

D. Barrado y Navascués (MPA), Stauffer, Song, and Caillault have determined the age of β Pictoris by using two M dwarfs (GL799 and GL803) whose space motions are coincident with those of β Pictoris within 1 km s^{-1} with small error bars. Based on a color-magnitude diagram derived from accurate photometry and Hipparcos parallaxes, these two possible proper-motion companions to β Pic are very young ($\sim$ 20 Myr). The chromospheric and coronal activities of these two stars also confirm that they are quite young. The estimated age for β Pic is 20 $\pm$ 10 Myr and this young age supports the contention that the IR excess for the Vega-like stars is age dependent.

Song, Caillault, Barrado y Navascués, and Stauffer have determined ages of eight late spectral type Vega-like stars through standard age dating techniques for late-type field stars (location on the color-magnitude diagram with theoretical isochrones, Li 6708Å absorption strength, CaII H&K, X-ray, $v\sin i$, kinematic population, etc.). With the exception of the very unusual pre-main sequence star system HD 98800, all seven Vega-like stars are the same age as the Hyades cluster or older. For the early-type stars, the correlation of age and IR excess plus the generally young ages for these prototypical objects suggest that many A stars form with disks and the observed disk-excess decrease with age is due to some evolutionary process. For the late-type Vega-like stars, the much older derived ages at least suggest that the time-scale for disk evolution is longer.

Song, Caillault, Barrado y Navascués, and Stauffer used Strömgren photometry data of nearby A stars ($<$ 50 pc) to estimate their ages. About 10% of these stars are Vega-like stars and the preliminary result shows that there exists clear age differences between Vega-like stars and other stars such that Vega-like stars are systematically younger. Unfortunately, the uncertainties in the ages are too big to extract more useful information such as an age-IR excess relation. However, the fact that all Vega-like stars are young supports the notion that the Vega-stage is common, at least for A-type stars, in the early stage of stellar evolution.

Hauschildt, Schwarz (Arizona State), Starrfield (Arizona State), Baron (Oklahoma), Allard (Lyon), Shore (Indiana, South Bend), and Whitelock (SAAO) studied LMC 1988 #1, a slow, CO type, dust forming classical nova. It was the first extragalactic nova to be observed with the IUE satellite. They successfully fitted observed ultraviolet and optical spectra of LMC 1988 #1 taken within the first two months of its outburst (when the atmosphere was still optically thick) with synthetic spectra computed using PHOENIX nova model atmospheres. The synthetic spectra reproduce most of the features seen in the spectra and provide V band magnitudes consistent with the observed light curve. The fits are improved by increasing the CNO abundances to 10 times the solar values. The bolometric luminosity of LMC 1988 #1 was approximately constant at 2×10^{38} ergs s^{-1} at a distance of 47.3 kpc for the first 2 months of the outburst until the formation of the dust shell.

Hauschildt, Aufdenberg (Arizona State), Shore, and Baron successfully reproduce the full multi-wavelength spectrum, including the extreme ultraviolet (EUV) continuum observed by the *Extreme Ultraviolet Explorer*, of the B2 II star ϵ CMa with a non-LTE fully line-blanketed spherical model atmosphere. The available spectrophotometry of the star from 350 Å to 25 μm is best fit with model parameters $T_{eff} = 21750$ K, $\log(g) = 3.2$, and an angular diameter of 0.77 mas. Their model predicts a hydrogen ionizing flux, q_0, of 1.59×10^{21} photons cm^{-2} s^{-1} at the star's surface and 5540 photons cm^{-2} s^{-1} at the surface of the Local Cloud. The agreement between the model and the measured EUV flux is a result of the higher temperatures at the formation depths of the H I and He I Lyman continua compared to other models. These higher temperatures increase the level of the EUV continuum and reduce the strength of the 912 Å and 504 Å edges. An important difference between these calculations and previous ones is the computation of the model atmosphere out to very small optical depths which results in higher temperatures in the EUV continuum forming region.

Hauschildt, Pistinner (Bar Sheba), Eichler (Bar Sheba), and Baron calculated a grid of spherically symmetric OB stellar atmospheres at low metallicities, including both non-local thermodynamic equilibrium (NLTE) and metal line blanketing effects. This is done to assess the uncertainties in helium abundance determination by nebular codes due to input stellar atmosphere models. The more sophisticated stellar atmosphere models they use can differ from LTE models by as much as 40 percent in the ratio of He- to H-ionizing photons.

Hauschildt, Leggett (Hawaii), and Allard present new infrared JHK photometry for 61 halo and disk stars around the stellar/substellar boundary. In addition, new L′ photometry for 21 of these stars and for 40 low-mass stars taken from the Leggett 1992 photometry compilation was obtained. These data are combined with available optical photometry and astrometric data to produce color-color and absolute magnitude-color diagrams — the current sample extends the similar work presented in the 1992 paper into more metal-poor and lower mass regimes. The disk and halo sequences are compared to the predictions of the latest model atmospheres and structural models. Good agreement between observation and theory is found except for known problems in the V and H passbands probably due to incomplete molecular data for TiO, metal hydrides and H_2O. The metal-poor M subdwarfs are well matched by the models as oxide opacity sources are less important in this case. The known extreme M subdwarfs have metallicities about one-hundredth solar, and the coolest subdwarfs have $T_{eff} \sim 3000$ K with masses ~ 0.09 $M_{\odot}$. The grainless models are not able to reproduce the flux distributions of disk objects with $T_{eff} < 2500$ K.

However, a preliminary version of the NextGen–Dusty models which includes homogeneous formation and extinction by dust grains *is* able to match the colors of these very cool objects. The least luminous objects in this sample are GD165B, three DENIS objects — DBD0205, DBD1058 and DBD1228 — and Kelu-1. These have $T_{eff} \sim$ 2000 K and are at or below the stellar limit with masses $\leqslant$ 0.075 $M_\odot$. Photometry alone cannot constrain these parameters further as the age is unknown, but published lithium detections for two of these objects (Kelu-1 and DBD1228) imply that they are young (aged about 1 Gyr) and substellar (mass $\leqslant$ 0.06 $M_\odot$).

Hauschildt, Shahbaz (Oxford), and Naylor (Oxford) obtained high resolution echelle spectroscopy of the recurrent nova T CrB. They compared the surface abundance of Li in T CrB with field M-stars and find it to be somewhat below solar, whereas in the M3*III* field stars it is non-existent. Possible explanations for this include a delay in the onset of convection in the giant star, enhanced coronal activity due to star-spots or the enhancement of Li resulting from the nova explosion.

Hauschildt and Baron examined numerical methods and algorithms for the solution of NLTE stellar atmosphere problems involving expanding atmospheres, e.g., in novae, supernovae and stellar winds. A scheme of nested iterations can be used to reduce the high dimension of the problem to a number of problems with smaller dimensions. As examples of these sub-problems, they examined the numerical solution of the radiative transfer equation for relativistically expanding media with spherical symmetry, the solution of the multi-level non-LTE statistical equilibrium problem for extremely large model atoms, and the temperature correction procedure. Although modern iteration schemes are very efficient, parallel algorithms are essential in making large scale calculations feasible, necessitating the development of some new parallelization schemes.

Hauschildt, Allard, and Baron present their NextGen Model Atmosphere grid for low mass stars to effective temperatures larger than 3000 K. These LTE models are calculated with the same basic model assumptions and input physics as the VLMS part of the NextGen grid so that the complete grid can be used, e.g., for consistent stellar evolution calculations and for internally consistent analysis of cool star spectra. This grid is also the starting point for a large grid of detailed NLTE model atmospheres for dwarfs and giants. The models were calculated from 3000 to 10000 K (in steps of 200 K) for $3.5 \leqslant \log(g) \leqslant 5.5$ (in steps of 0.5) and metallicities of $-4.0 \leqslant M/H \leqslant 0.0$. Furthermore, the results of the model calculations are compared to the Kurucz 1994 grid. Some comparisons to standard stars like Vega and the Sun are compared with detailed NLTE calculations.

Based on consistent evolutionary and pulsation calculations, Hauschildt, Alibert (Lyon), Baraffe (Lyon), and Allard analyze the effect of metallicity and different convection treatment in stellar models on P-L, P-C and P-R relationships. In order to perform accurate comparison with observations, they computed grids of atmosphere models and synthetic spectra for different metallicities, covering the range of effective temperatures and gravities relevant for this study. The models are compared to recent observations of galactic and Magellanic Cloud Cepheids. In general, good agreement is found between models and observations. In addition, for the range of metallicities of the Galaxy and the Magellanic Clouds a change of slope in the P-L relationship is predicted at low periods due to the reduction of the size of the blue loop during core He burning. The minimum mass undergoing a blue loop and consequently the critical period at which this change of slope occurs depends on the metallicity Z and the convection treatment in the stellar models. The variation of this minimum mass with metallicity yields a dependence of Z on the P-L relationship which is a consequence of evolutionary effects.

LHS 1070 (other common name: GJ 2005) is a nearby multiple system consisting of very low mass red dwarfs. Hauschildt, Leinert (MPKH), Allard, and Richichi (Arcetri) present the results of WFPC2 photometry and FOS spectroscopy for the three optically resolved components of this system acquired during HST cycle 5. These show (1) absolute brightnesses corresponding to theoretical masses of 0.078-0.083 $M_\odot$ and 0.076-0.081 $M_\odot$ for the faint pair, depending mainly on their age and metallicity; (2) a saturation of the optical TiO and VO absorption bands typical of the onset of photospheric dust formation, and (3) emission lines typical of moderate chromospheric activity in only the two most massive components. Li I lines are not seen. But also all other lines of the alkali elements are remarkably weak or even absent in the two faint companions B and C. This appears to be an effect of dust formation. Comparison of the observations with model spectra, which account for dust formation and for the resulting opacities, yields good agreement for solar metallicity and effective temperatures and gravities (in log cm/s^2) of 2950 K;5.3, 2400 K;5.5 and 2300 K;5.5 for the three components A,B and C, respectively. The existence of a fourth component, recently discovered in this system by HST Fine Guidance Sensor observations, has already been taken into account in the evaluation of the data for the main component. An effective temperature and gravity (in log cm/s^2) for the fourth component of 2500 K;5.3 would best be compatible with their data. Based on their analysis the three components C, B and D of LHS 1070, in this order, are the faintest stars within 20 pc of the Sun for which dynamical determinations of mass appear possible within a decade. The system LHS 1070 thus has the potential to be the most important source of information for probing the low mass end of the main sequence.

Hauschildt, Allard, Ferguson (Wichita), Baron, and Alexander (Wichita) have extended the NextGen model atmosphere grid to the regime of giant stars. The input physics of their models is nearly identical to the NextGen dwarf atmosphere models. However, spherical geometry is used self-consistently in the latter model calculations (including the radiative transfer). They also explore the effects of spherical geometry on the structure of the atmospheres and the emitted spectra.

Hauschildt, Leggett, Allard, Dahn (NO-Flagstaff), Kerr (NO-Flagstaff), and Rayner obtained infrared (1–2.5 μm) spectroscopy for 42 halo and disk dwarfs with spectral type M1 to M6.5. These data are compared to synthetic spectra generated by the latest model atmospheres of Allard and Hauschildt. Photospheric parameters like metallicity, effective temperature and radius are determined for the sample. Good agreement is found between observation and theory except for known problems due to incomplete molecular data for metal hydrides and H_2O. The metal-poor M subdwarfs are well matched by the models as oxide opacity sources are less important in this case. The derived effective temperatures for the sample range from 3600 K to 2600 K; at these temperatures grain formation and extinction are not significant in the photosphere. The derived metallicities range from solar to one-tenth solar. The radii and effective temperatures derived agree well with recent models of low mass stars.

Hauschildt, Aufdenberg, and Baron presented non-LTE metal line-blanketed expanding atmosphere models and synthetic spectra for comparison with the spectral energy distribution of A-supergiant α Cyg from the UV to the radio. Their model treats the hydrostatic inner atmosphere and the extended expanding outer atmosphere as a unified structure and the radiative transfer is computed in the co-moving frame. By simultaneously fitting the UV, optical, IR and radio spectrophotometry they can constrain $\dot{M}$. Stability of the deep hydrostatic layers against outward acceleration demands that the gravitational potential at the photosphere be log(g) $\approx$ 1.5. The best fitting model angular diameter is in very good agreement with the most recent interferometric measurement. A good fit to the photospheric Balmer and Pfund lines is found along with the Mg II resonance lines which lead to a best fit terminal velocity of $v_\infty =$ 225 km s^{-1}. In addition, synthetic radio spectra from the partially ionized winds of A-supergiants over a range of mass-loss rates are computed and the standard assumptions regarding the radio spectra of warm supergiants break down for A-supergiants.

Schweitzer, Scholz (AIP), Irwin (IA-Cambridge), Ibata (ESO), Stauffer, McCaughrean (AIP) and Zinnecker (AIP) have analyzed several nearby late type dwarfs and subdwarfs discovered in a new high proper motion survey of the southern sky. They measured spectral types and estimated the parallaxes, finding from a subsample of all M dwarfs observed at SAAO about 40 percent to be within 25 pc. They also found a very late type (esdM7) extreme subdwarf and 4 very late type ($>$ dM6.5) M dwarfs. Some of the objects have also been observed spectroscopically in the near infrared, with preliminary results available.

Scholz, Irwin, Schweitzer and Ibata detected a new bright (R = 13.4) high proper motion star within their survey of the Southern sky using APM measurements of UK Schmidt plates. This star, APMPM J0237-5928 showing the largest proper motion (μ = 0.77 arcsec/yr) among the newly discovered relatively bright ($11 < R < 15$) proper motion stars in 40 UKST fields, was identified with an X-ray source, 1RXS J023630.5-592827. The optical spectrum is typical of an M5 dwarf and shows strong emission lines. An effective temperature $T_{\rm eff}$=3100 K and solar metallicity were determined using ''NextGen'' model atmospheres for M dwarfs. A distance between 11 and 14.5 pc is estimated based on the spectral type and on the comparison of the observed spectrum with the models. With this distance they determine the relatively high X-ray luminosity $\log L_X = 27.8$ for a late-type M dwarf. The heliocentric space motion was obtained as $(U,V,W) = (-39, -28, -27) \pm (8,5,6)$ km s^{-1}.

Schweitzer, Scholz, Stauffer, Irwin and McCaughrean present the discovery of the coolest extreme subdwarf known to date. APMPM J0559 − 2903 was measured to be esdM7. Unlike solar metallicity dwarfs, there are no very late type objects known among the extreme subdwarfs. APMPM J0559 − 2903 was discovered in a new southern high proper motion survey. Follow up spectroscopy at Keck was used to identify the spectral type with the help of spectral indices. Using the NextGen grid of model atmospheres by Hauschildt *et al.* they measured the effective temperature to be 3100 K and the metallicity to be $z = -1.5$. The theoretical parameters place this object at a distance of 100 pc with a space velocity of 260 km s^{-1} relative to the LSR.

Schweitzer and Hauschildt developed a technique to treat huge systems like molecules in non-LTE. This technique is based on the superlevel formalism. Superlevels consist of many individual levels that are assumed to be in LTE. The usage of superlevels reduces the size of the rate equations and the number of rates dramatically and, thereby, makes the problem computationally feasible. Their superlevel formalism retains maximum accuracy by using direct opacity sampling (dOS) when calculating the radiative transitions. They implemented this method in their current model atmospheres for cool dwarfs. Cool dwarfs have low electron densities and a radiation field that is far from a black body. Both properties invalidate the conditions for the common LTE approximation. Therefore, the huge molecular systems are treated in non-LTE. As a case study they applied their method on carbon monoxide obtaining accurate results since the conditions for the superlevel method are very well met for molecules. The test molecule CO shows significant deviations from LTE in the outer regions of cool photospheres.

Short, Hauschildt, and Baron have used the multi-purpose model atmosphere code PHOENIX to calculate atmospheric models that represent novae in the optically thick wind phases of their outburst. They have improved the treatment of NLTE effects by expanding the number of elements that are included in the calculations from 15 to 19, and the number of ionization stages from 36 to 87. The code can now treat a total of 10713 levels and 102646 lines in NLTE. Aluminum, P, K, and Ni are included for the first time in the NLTE treatment and most elements now have at least the lowest six ionization stages included in the NLTE calculation. In addition, they investigated the effects of expanded NLTE treatment on the chemical concentration of astrophysically significant species in the atmosphere, the equilibrium structure of the atmosphere, and the emergent flux distribution. Although qualitative agreement with previous, more limited NLTE models has been found, the expanded NLTE treatment leads to significantly different values for the size of many of the NLTE deviations. In particular, for the hottest model presented here ($T_{\rm eff}$ = 35 000 K), for which NLTE effects are largest, the expanded NLTE treatment *reduces* the NLTE effects for these important variables: H I concentration, pressure structure, and emergent far *UV* flux. Moreover, the addition of new NLTE species may greatly affect the concentration of species that were already treated in NLTE, so that, generally, *all* species that contribute significantly to the e^- reservoir or to the total opacity, or whose line spectrum overlaps or interlocks with that of a species of interest, must be treated in NLTE to insure an accurate result for any particular species.

Short and Byrne (Armagh) presented the first simultaneous multi-line fitting of a semi-empirical atmospheric model with a chromosphere and transition region to the H I and Ca II spectra of an RS Can Ven star (II Peg). The static component of the Hα emission core, the line profile of Hβ, the apparent absence of Hγ and Hδ, and the emission core profiles of Ca II K and two of the Ca II IR triplet lines are all approximately fit by a static 1D model with the following properties: $\log m$ at the onset of the transition region is ≈ -2.85, and a 6000 K plateau in the upper chromosphere that spans about a decade in $\log m$. In particular, the model is able to reproduce the unusually steep Balmer decrement (compared to the dMe stars), in which Hα is strongly in emission and Hβ is in absorption, without recourse to extra-atmospheric material. This latter result holds when the metal abundance is varied in the background opacity calculation of the non-LTE H I calculation. The Ca II IR triplet lines are best fit by a model in which $T_{\rm min}$ is cooler by 300 K and shallower by over half a decade in $\log m$ than that which best fits the optical lines. The emergent flux in the IR triplet line cores arises from the $T_{\rm min}$ region, whereas the flux in the other diagnostics arises from layers well above $T_{\rm min}$, and it is postulated that this may be the cause of the discrepancy.

Magnani, Hartmann (Bonn), and Thaddeus (Harvard) have completed and analyzed a CO(J=1-0) survey for high-latitude molecular gas in the portions of the northern and southern Galactic hemispheres which are observable from Cambridge, MA, the site of the 1.2 m mm-wave telescope used to search for CO emission. A total of 170 detections were made from over 15,000 sampled lines of sight. Many new molecular clouds were discovered and await follow-up observations.

Magnani and Chastain have begun a project to study the gas-to-dust ratio at high Galactic latitudes. The column density of gas will be determined from the high-latitude CO survey described above and from the Leiden-Dwingeloo 21 cm survey by Hartmann and Burton. The dust content will be derived from IRAS 60 and 100 μm data.

Shaw and Dittmann continue their work on detection of close binary stars in open clusters.

The publication list includes all papers published or submitted between October 1998 and October 1999 by the staff.

PUBLICATIONS

Alibert, Y., Baraffe, I., **Hauschildt, P.**, & Allard, F. 1999, ‘‘Period – luminosity – color – radius relationships of Cepheids as a function of metallicity: evolutionary effects,’’ AAp, in press

Aufdenberg, J. P., **Hauschildt, P.**, Shore, S. N., & Baron, E. 1998, ‘‘A Spherial Non-LTE Line-Blanketed Stellar Atmosphere Model of the Early B Giant ϵ CMa,’’ ApJ, 498, 837

Aufdenberg, J. P., **Hauschildt, P.**, & Baron, E. 1999, ‘‘A Non-LTE Line-Blanketed Stellar Atmosphere Model for the Early B Giant β CMa,’’ MNRAS, 302, 599

Baraffe, I., Chabrier, G., Allard, F., & **Hauschildt, P.** 1998, ‘‘Evolutionary models for solar metallicity low-mass stars: mass-magnitude relationships and color-magnitude diagrams,’’ AAp, 337, 403

Baron, E. & **Hauschildt, P.** 1998, ‘‘Parallel Implementation of the PHOENIX Generalized Stellar Atmosphere Program. II: Wavelength Parallelization,’’ ApJ, 495, 370

Baron, E., Branch, D., **Hauschildt, P.**, Filippenko, A. V., & Kirshner, R. P. 1999, ‘‘Spectral Models of the Type Ic SN 1994I in M51,’’ ApJ, in press

Barrado y Navascués, D., Stauffer, J., **Song, I.**, & **Caillault, J.-P.** 1999, ‘‘The Age of β Pictoris,’’ ApJ, 520, L123

Beuermann, K, Baraffe, I., & **Hauschildt, P.** 1999, ‘‘Barnes-Evans relations for late-type giants and dwarfs,’’ AAp, 348, 524

Ciardi, D. R., Howell, S. B., Dhillon, V. S., Wagner, R. M., **Hauschildt, P.**, & Allard, F. 1998, ‘‘Observations of the Polar ST Leonis Minoris During an Extreme Low State: Indentificaion of the Secondary Star,’’ PASP, 110, 1007

Ciardi, D. R., Howell, S. B., **Hauschildt, P.**, & Allard, F. 1998, ‘‘The Relative Contributions to the Near-Infrared Emission in Short Period Cataclysmic Variables,’’ ApJ, 504, 450

Ferguson, J. W., Alexander, D. R., Johnson, H. R., Allard, F., & **Hauschildt, P.** 1999, ‘‘PAHs & Grains in Carbon-rich Stellar Atmospheres,’’ ApJ, submitted

Hartmann, D., **Magnani, L.**, & Thaddeus, P. 1998, ‘‘A Survey of High-Latitude Molecular Gas in the Northern Galactic Hemisphere,’’ ApJ, 492, 205

Hauschildt, P., Shore, S. N., Schwarz, G. J., Baron, E., Starrfield, S., & Allard, F. 1997, ‘‘Detailed NLTE Model Atmospheres for Novae during Outburst: I. New Theoretical Results,’’ ApJ, 490, 803

Hauschildt, P. & Baron, E. 1999, ‘‘Numerical Solution of the Expanding Stellar Atmosphere Problem,’’ Journal of Computational and Applied Mathematics, in press

Hauschildt, P., Allard, F., & Baron, E. 1999, ‘‘The NextGen Model Atmosphere grid for $3000 \leqslant T_{\rm eff} \leqslant 10000\,{\rm K}$,’’ ApJ, 512, 377

Hauschildt, P., Allard, F., Ferguson, J., Baron, E., & Alexander, D. R. 1999, ‘‘The NextGen Model Atmosphere grid: I. Spherically symmetric model atmospheres for giant stars with effective temperatures between 3000 and 6800 K,’’ ApJ, in press

Hearty, T., **Magnani, L.**, **Caillault, J.-P.**, Neuhäuser, R., Schmitt, J.H.M.M., & Stauffer, J. 1999, ‘‘A Search for Star Formation in the Translucent Clouds MBM7 & MBM55,’’ AAp, 341, 163

Howell, S. B., **Hauschildt, P.** , & Dhillon, V. S. 1998, ‘‘Time-Resolved Spectroscopy of AL Comae Berenices,’’ ApJ Letters, 494, 223

Leggett, S. K., Allard, F., & **Hauschildt, P.** 1998, ‘‘Infrared Colors at the Stellar/Substellar Boundary,’’ ApJ, 509, 836

Lenz, E. J., Baron, E., Branch, D., & **Hauschildt, P**, Nugent, P. E. 1999, ‘‘Metallicity Effects in NLTE Model Atmospheres of Type Ia Supernovae,’’ ApJ, in press

Magnani, L., Hartmann, D., & Thaddeus, P. 1999, ‘‘A Survey of High-Latitude Molecular Gas in the Southern Galactic Hemisphere,'' ApJ, in press

Martini, P., Wagner, R. M., Tomaney, A., Rich, R. M., Della Valle, M., & **Hauschildt, P.** 1999, ''Nova Sagittarii 1994 #1 (V4332 Sagittarii): The Discovery and Evolution of an Unusual Luminous Red Variable Star,'' AJ, 118, 1034

Micela, G., Sciortino, S., Harnden, F.R., Jr., Kashyap, V., Prosser, C.F., Damiani, F., Stauffer, J., & **Caillault, J.-P.** 1999, ''Deep ROSAT HRI Observations of the Pleiades,'' AAp, 341, 751

Pistinner, S. L., **Hauschildt, P.**, Eichler, D., & Baron, E. 1999, ''Spectroscopy Of Low Metallicity Giant H II Regions: A grid of low Metallicity Stellar atmospheres,'' MNRAS, 302, 684

Pistinner, S. L., **Hauschildt, P.**, Eichler, D., & Baron, E. 1999, ''On The Primordial Helium Abundance And Spectroscopic Uncertainties,'' Israel Rev. Phys., in press

Schweitzer, A., Scholz, R.-D., Stauffer, J., Irwin, M. & McCaughrean, M.J. 1999, '' APMPM J0559-2903: The coolest extreme subdwarf known,'' AAp, 350, L60

Scholz, R.-D., Irwin, M., **Schweitzer, A.**, & Ibata, R. 1999, ''APMPM J0237-5928: a new nearby active M5 dwarf detected in a high proper motion survey of the Southern sky,'' AAp, 345, L55

Schwarz, G. J., **Hauschildt**, Starrfield, S., Whitelock, P. A., Baron, E., & Sonneborn, G. 1999, ''A multiwavelength study of the early evolution of the classical nova LMC 1988 #1,'' MNRAS, in press

Schweitzer, A. Scholz, R.-D., Irwin, I., Ibata, R., Stauffer, J., McCaughrean, M.J. & Zinnecker, H. 1999, ''Nearby late type dwarfs discovered by a new high proper motion survey,'' in *Proceedings of NASA Ames Nearby Stars Workshop*, Backmann, D. & Henry, T. (eds.), in press

Shabaz, T., **Hauschildt, P.**, Naylor, T., & Ringwald, F. 1999, ''On the abundance of Lithium in T CrB,'' MNRAS, 306, 675

Shaw, J.S., Ragona, T., & McCook, G. 1999, ''A Preliminary Solution for the Eclipsing Binary RZ Dra,'' IAPPP Communications, 73, 117

Short, C.I., & Byrne, P.B., 1999, in *Proceedings of Solar and Stellar Activity: Similarities and Differences*, ASP Conference Series 158, C.J. Butler and J.G. Doyle, eds. (San Fransisco: ASP), p. 311

Short, C.I. & Doyle, J.G. 1998, ''Paβ as a chromospheric diagnostic in M dwarfs,'' AAp, 331, L5

Short, C. I., **Hauschildt, P.**, & Baron, E. 1999, ''Massive Multi-species, Multi-level NLTE Model Atmospheres for Novae in Outburst,'' ApJ, in press

Song, I., **Caillault, J.-P.**, Barrado y Navascués, D., Stauffer, J., & Randich, S. 1999, ''Ages of Late Spectral Type Vega-Like Stars,'' ApJ, submitted

Wichmann, R., Covino, E., Alcala, J. M., Krautter, J., Allain, S., & **Hauschildt, P.** 1999, ''High-resolution spectroscopy of ROSAT-discovered WTTSs near Lupus,'' MNRAS, in press

L. Magnani

♦