Curriculum Vitae

Personal

Name:	Darrin Alan Casebeer
Current Address:	The University of Oklahoma
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Education

May, 2006 (Expected)	Ph.D.	The University of Oklahoma, Norman, OK
	Advisor:	Karen M. Leighly
	Thesis Title:	A Quantitative Study of Emission and Absorption Lines in AGN and AGN winds.
December, 2002	M.S.	The University of Oklahoma, Norman, OK
May, 1999	B.S. Astrophysics	The University of Oklahoma, Norman, OK
December, 1989	B.S. I.S.	Kansas State University, Manhattan, KS

Professional Experience

2001 – present	Graduate Research Assistant, University of Oklahoma
1999 – 2001	Graduate Teaching Assistant, University of Oklahoma
1996 – 1999	Summer REU program, University of Oklahoma
1993 – 1994	Software Engineer, The Software Group, Plano Tx
1990 – 1992	Software Engineer, Brite Voice Systems, Wichita Ks

Public Talks

"An Overview of Super-Massive Black Holes and AGN", Friday Night at the Observatory, Homer L. Dodge Dept of Physics and Astronomy, Neilson Hall, University of Oklahoma, November 2003

"Special and General Relativity for the Layman", Southern Oaks Library, Oklahoma City, Ok, May 2004

Contributed Talks

"Spectral Synthesis Models for AGN winds and the Warm Absorber Using PHOENIX",The Physics of the Warm Absorber, Warsaw Poland 5-7 Oct, 2005

"The Radiative Transfer Code PHOENIX:Application to AGN",AGN Winds in Caribbean, St. Johns Virgin Islands 29 Nov-2 Dec, 2005

"Spectral Synthesis Models for AGN winds Using PHOENIX",207th Meeting of the American Astronomical Society, Washington, DC, 2006

Meetings and Workshops Attended

193st Meeting of the American Astronomical Society, Austin , Tx, 1999

198st Meeting of the American Astronomical Society, Pasadena, Ca, 2001

199st Meeting of the American Astronomical Society, Washington, DC, 2002

FUSE meeting at John Hopkins, Baltimore MD, 27-30 March, 2002

201st Meeting of the American Astronomical Society, Seattle, WA, 2003

AGN Physics with the SDSS, Princeton NJ, 27-30 July, 2003

205th Meeting of the American Astronomical Society, San Diego, Ca, 2005

The Physics of the Warm Absorber, Warsaw Poland 5-7 Oct, 2005

AGN Winds in Caribbean, St. Johns Virgin Islands 29 Nov-2 Dec, 2005

207th Meeting of the American Astronomical Society, Washington, DC, 2006

Publications

Casebeer, D., Branch, D., Blaylock, M., Millard, J., Baron, E., Richardson, D., & Ancheta, C. ,"Lick Observatory Photographic Supernova Spectra",2000, PASP, 112, 1433

Blaylock, M., Branch, D., **Casebeer, D.**, Millard, J., Baron, E., Richardson, D., & Ancheta, C. ,"Palomar Observatory Photograph Supernova Spectra",2000, PASP, 112, 1439

Casebeer, D., & Leighly, K.,"FUSE Observations of the Narrow-line Seyfert 1 Galaxy RE 1034+39", 2001, Bulletin of the American Astronomical Society, 33, 1374

Richardson, D., Thomas, R. C., **Casebeer**, D., Blankenship, Z., Ratowt, S., Baron, E., & Branch, D.,"SUSPECT - The Online Supernova Spectrum Database", 2001, Bulletin of the American Astronomical Society, 33, 1428

Richardson, D., Branch, D., **Casebeer, D.**, Millard, J., Thomas, R. C., & Baron, E."Blaylock, M., Branch, "A Comparative Study of the Absolute Magnitude Distributions of Supernovae",2000, PASP, 112, 1439 2002, AJ, 123, 745

Casebeer, D., & Leighly,K,"Dependence of emission line ratios and strengths on the spectral energy distribution.", 2002, Bulletin of the American Astronomical Society, 34, 1183

Richardson, D., Thomas, R., **Casebeer, D.**, Branch, D., & Baron, E.,"SUSPECT, The Online Supernova Spectrum Archive: Year Two", 2002, Bulletin of the

American Astronomical Society, 34, 1205

Casebeer, D., & Leighly, K. M.,"FUSE Observation of the Narrow-line Seyfert 1 Galaxy RE 1034+39", 2003, ASP Conf. Ser. 290: Active Galactic Nuclei: From Central Engine to Host Galaxy, 290, 81

Moore, J. R., Leighly, K. M., & **Casebeer, D.**,"Near-UV Spectra of Narrow-Line Quasars from the SDSS", 2003, American Astronomical Society Meeting Abstracts, 203,

Casebeer, D., Baron , E., Branch, D., & Leighly, K.,"Modeling AGN Spectra with PHOENIX: A Self-consistent Approach", 2004, ASP Conf. Ser. 311: AGN Physics with the Sloan Digital Sky Survey, 311, 231

Casebeer, D., Leighly K., Baron, E., ,"FUSE Observation of the Narrow-line Seyfert 1 Galaxy RE 1034+39",2006, To appear in ApJ

Nava A.,**Casebeer, D.**, Henry, R.,Jevremovic,D., "A Re-Determination of N and O in Low Metallicity Systems", submitted to ApJ

Casebeer, D., Baron, E.,Jevremovic,D.,Leighly K.,"Modeling FeLoBAL AGN with PHOENIX", in prep

Casebeer, D., Baron, E.,Jevremovic,D.,Leighly K.,"Adding Forbidden Transitions to PHOENIX", in prep

Courses Taught

Introductory Astronomy (Discussion Sections) 3 semesters

General Physics Laboratory 1 semester

Research Statement

I am interested in quantitative spectroscopic modeling of active galactic nuclei (AGN), supernovae (SNe), and stellar spectra to better understand the physics of these objects and the galaxies in which they reside.

Using the generalized radiative transfer code PHOENIX I have been modeling a subset of AGN known as Iron Low Ionization Broad Absorption line AGN (FeLoBALs). This work was done in collaboration with University of Oklahoma professors Karen Leighly, Eddie Baron, and post-doc Darko Jevremovic. The motivation for this analysis was first presented in Branch et al. (2002), They noted that these objects appeared to have P-Cygni like spectral features. Using the spectral synthesis code SYNOW they were able to replicate the features of these objects well. However SYNOW is a highly parameterized code mainly used for line identification. I continued this work with the more physical atmospheres code PHOENIX. PHOENIX solves the radiative transfer equation exactly in a scattering atmosphere. In addition the atomic ion level populations are determined self-consistently with the radiation field. Therefore the intricate connection between the radiating gas and the radiation field are self-consistent. The emergent spectrum emitted by PHOENIX, if it compares favorably with the observed spectrum of an object, can tell us something about the physics of the observed object. With PHOENIX we could fit the observed spectra of some FeLoBALs quite well. The paper on this work is in preparation and will be submitted to the Astrophysical Journal. .

My work with AGN began with a study of coordinated *FUSE*, *ASCA*, *EUVE*, and archived *HST* data for the narrow-line Seyfert 1 RE1034+39. This work was done in collaboration with Karen Leighly and Eddie Baron. The SED is extremely hard with the big blue bump in the EUV to soft X-ray. I measured integrated emission line fluxes, then compared the observed integrated emission line fluxes to modeled line fluxes using the photo-ionization code CLOUDY. We did three types of computer modeling. The first involved demonstrating that the emission lines come from an emitting gas which was illuminated by the same SED as we observe. The second type of modeling was to see if the RE1034+39 SED was required to produce the observed emission lines. In addition we tried locally optimally emitting (LOC) cloud models for which the incident spectrum was the RE1034+39 SED. We found that the computed emission line strengths are consistent with the RE1034+39 SED. We found that a SED with similar properties to the RE1034+39 SED, was required to produce the computed emission line strengths of RE1034+39. We found that the LOC model could not reproduce the emission line strengths for the measured emission lines in RE1034+39. These results will be published in the January issue of the Astrophysical Journal (Casebeer Leighly, and Baron 2006).

OU professor Dick Henry and graduate student Aida Nava have developed a program to study primary nitrogen abundance. Aida Nava and I collaborated on a project to calculate ionization correction factors and electron gas temper-

atures, which will be used to constrain the primary nitrogen abundance from emission line observations of HII regions in low metallicity emission galaxies. We used PHOENIX to calculate the SED for the O-stars and the CLOUDY photo-ionization code to calculate the HII region emission line strengths. With PHOENIX we controlled the metallicity of the SED and the HII region, we could go to very low metallicities (1/50 Solar), and we used a state of the art stellar model for the SED. OII and NII cannot be observed in these objects and therefore we must model the relationship between them and the observed ion OIII. We found, using the models discussed above, that OII and NII emission shifted to different ionization zones of the cloud for lower metallicities. Therefore we cannot use the same electron gas temperature for OII and NII in this conversion. We were able to calculate an ionization correction factor which will be used to convert from observed NII/ OII fluxes to actual elemental ratios. The paper has been submitted to the Astrophysical Journal.

The study of late time SNe and AGN emission requires forbidden and semi-forbidden line transitions. I have added forbidden transitions to PHOENIX and verified that they are present in the model spectra. This paper is in preparation to be submitted to Astrophysical Journal Supplements.

I have also updated and enhanced the semi-empirical spectral energy distribution and am working on three related projects:

1. Karen Leighly is using the original spectral energy distributions created for RE1034+39 paper in order to test their effects in radiation driven winds using the methods of Castor, Abbott and Klein (1974).
2. OU undergraduate Jason King is extending the LOC work to include the new spectral energy distributions.
3. I am also including the new spectral energy distributions in the code PHOENIX. This will allow me to constrain radiative accelerations in radiatively driven winds without using the approximations of Castor, Abbott, and Klein (1974).

Projects 1 and 2 require millions of CLOUDY runs. In order to speed up calculation time I have adapted CLOUDY to run in parallel. This allows me to generate millions of CLOUDY runs over various parameters in a matter of hours. Project 3 will require Compton heating to be added to PHOENIX due to the hard X-ray emission in AGN SED. I plan to add this in the future,

I modified the spectral synthesis code SYNOW (used for spectral line identification) to use the Kurucz unbinned line list. This allows for line identification of objects with lower expansion velocities such as late time supernovae (SNe) and the FeLoBAL AGN. Work relating to the use of this code is in preparation and will result in two publications.

I have been involved with the research projects of literally dozens of undergraduates. For example I was the leader of a team which digitized and cataloged

historical SNe spectra from the Lick and Palomar optical observatories. The historical spectra were originally plotted from photographic plates at the Lick and Palomar observatories. These paper plots included a non linear spectrum and a laboratory spectrum. We digitized and linearized the spectra using a scanner and software which I developed. This work was published in PASP (Casebeer et al. 2000 and Blaylock et al. 2000)

I contributed to a statistical study in which we studied the luminosity distributions of different types of supernovae. This work was published in the Astronomical Journal (Richardson et al. 2002).

As an early graduate student, I was a co-developer on the SUSPECT supernovae database. The database interface was written in PERL with the CGI and DBI packages. Since then I have been involved in the maintenance of this software. SUSPECT can be found at http://suspect.nhn.ou.edu/.

I was computer programmer for several years before I developed an interest in astronomy. This work allowed me to become proficient in several computer languages including C and fortran and to learn how to design software in a group environment. These skills have been quite useful during my tenure as a graduate student and make me highly qualified for computational astrophysics research. In addition as a graduate student I have learned to use the following packages: SPECFIT in IRAF, IDL, OpenMP, MPI, and PERL.