

**The Properties of Super Star Clusters in A Sample of
Starburst Galaxies**

by

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B.A., Carleton College, 1995

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A thesis submitted to the
Faculty of the Graduate School of the
University of Colorado in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
Department of Astrophysical and Planetary Sciences

2001

This thesis entitled:
The Properties of Super Star Clusters in A Sample of Starburst Galaxies
written by Kelsey Johnson
has been approved for the Department of Astrophysical and Planetary Sciences

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The final copy of this thesis has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.

Johnson, Kelsey (Ph.D., Astrophysics)

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Thesis directed by Prof. Peter Conti

ABSTRACT

“Super star clusters” are the most massive extreme in the continuum of young star clusters. In this thesis, I examine the properties of such super star clusters in a sample of starburst galaxies with space and ground-based observations and in the optical, mid-infrared, and radio regimes. Using optical photometry, I estimate the ages and masses, as well as construct luminosity functions for the super star cluster systems. Additional $H\alpha$ observations allow me to place tighter constraints on the burst ages and trace very recent star formation. The super star clusters detected in these galaxies typically have estimated ages $\lesssim 10$ Myr, masses of $\sim 10^{3-6} M_{\odot}$, and luminosity functions consistent with other super star cluster systems with a slope of $\alpha \approx -2$ ($\phi(L) \propto L^{\alpha}$).

Next I discuss an even earlier stage of massive star cluster evolution, when super star clusters are still embedded in their birth material. I overview the discovery of “ultra dense H II regions” (UDH IIs) with radio and mid-infrared observations. From the radio observations, I calculate the electron densities, radii, and number of ionizing photons (and therefore number of embedded massive stars). The mid-infrared observations confirm the presence of hot dust cocoons surrounding these objects. These embedded clusters account for at least $\sim 60\%$ of the mid- to far-infrared flux of He 2-10. I also discuss the impact of UDH IIs on the radio to far-infrared flux ratio.

Finally, I present a sample of 35 embedded star formation regions (ranging from the size of small OB-associations to super star clusters) serendipitously detected in nearby galaxies. This sample of objects begins to fill in the continuum of cluster masses between individual UCH II regions and the embedded massive clusters.

Acknowledgements

Perhaps the greatest irony of a thesis text is that the pages most likely to be read are those of the acknowledgments. The weight of these pages is all the heavier because it is precisely the people most likely to read them who most deserve to be acknowledged, and I will undoubtedly realize as soon as this thesis has been printed that several important people have been inadvertently left out. My sincere apologies in advance — to everyone who has provided me with kind words, a welcome ear, new ideas, useful criticism, or their invaluable time, I am truly indebted.

A long, and sometimes complicated, path of people and events winds back through the years which have brought me to this academic rite of passage. Most of these events were out of my control, and most of these people I met by chance. The importance of serendipity has not been lost on me, and I must acknowledge that I have been fantastically lucky. Here I will roughly outline, in forward chronological order, the people who come to mind as having a large impact on my academic career.

As an undergraduate at Carleton College, I was surrounded by caring faculty who didn't let me fall through the cracks — most importantly Dr. Cindy Blaha and Dr. Bruce Thomas. My summer job working with Cindy was my springboard into the coming years. This summer job in turn enabled me to work with Dr. Phil Massey in Arizona the following summer — again, a lucky chance which has had a profound impact on my life since that time. Indeed, I have looked to Phil for his infallible advice on both academic issues and those related to real life since that summer. I believe that this work with Phil played a significant role in Dr. Peter Conti recruiting me as a graduate student for the University of Colorado (although I don't think either of them

would admit to this).

Peter has provided me with unwavering support during my time as a graduate student, and perhaps most importantly has allowed me room to grow and explore new ideas (many of which never came to fruition). I only hope that someday I have a fraction of his intuition and patience. Along with Peter, Dr. Katy Garmany also had a large role in my academic advising and went significantly beyond the “job description” many times. The unofficial title she held at the University of Colorado of “Graduate Student Godmother” was certainly well deserved.

Upon arriving in graduate school, I briefly overlapped with Peter’s previous graduate student, Dr. Margaret Hanson. Margaret is one of the most dynamic women I have had the pleasure to know in astrophysics, and she has served as my primary role model through the years. My officemate, Tanya Ramond, has also been an important part of my graduate life. We have commiserated on many occasions, but have also shared many happy times. My office sometimes seems like a second home, which hasn’t been so bad because I’ve had such a great officemate.

Throughout my graduate student years I have also received a great deal of guidance from afar — Dr. Bill Vacca has generously offered his time as a scientific advisor. He has been exceedingly patient and I count him as one of the few people I am comfortable asking “stupid” questions. As a measure of his conscientious replies to my queries, my email folder entitled “Bill” has more entries than any other.

My work with Peter also led me to meet another valued collaborator and friend, Dr. Chip Kobulnicky. With another nod to serendipity, it was my first interaction with Chip (I needed to use one of his published images in a talk) which led us to discover “ultradense HII regions”. These objects form a major part of this thesis and have led to numerous other opportunities for which I am grateful.

Throughout graduate school I have been fortunate to have wonderful support structure among the graduate students. I often question whether I would have survived my first two years in the program without my classmates Sebastian Heinz, Aaron Lewis, and Kevin McLin.

In particular, Kevin's generosity stands out as I recall those years — on several occasions he would do things like spontaneously bring me dinner when I didn't have time to go home myself. He also kept me from completely burying myself in work by coaxing me out for hikes in the mountains. Along with my classmates, Marc DeRosa (DeRosa) and Marc Swisdak (Swisdak) were a fundamental part of my support network. Because DeRosa had his office only a few yards away from my own, he was often the recipient of random questions (both technical and scientific). Swisdak was always willing to think through particularly vexing questions which I wasn't sure how to approach on my own. I greatly admire Swisdak's character for his patience, work ethic, fairness, and compassion, and hold his character up as a standard to which I aspire.

On a non-academic note, the Womprats and Nerfherders (the department's intramural ultimate teams), have provided an invaluable outlet for stress and a wonderful occasion to socialize and get at least a little physical activity in my schedule. These teams even put up with me as captain for several seasons, and it was a great pleasure to be a part of these teams as we evolved from barely fielding a team of beginners to having over thirty players on two teams and winning championships.

Finally, and most importantly, I come to my husband, Rémy Indebetouw. Somehow he stands by me when I am at my worst as well as celebrating with me when I am at my best. He has kept me going on many occasions when I was ready to give up and has diligently protested my complaints of not being smart enough, strong enough, or good enough. Throughout the years we have been together, his influence on my life has helped me grow into a better person, and his presence in my life gives me a sense of peace.

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