

Dr. Judith Irwin | Curriculum Vitae

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Employment

- **Queen's University** **Kingston**
Full Professor, Tenure 1997
1991–
Full range of duties, including research, teaching, and administration. For demonstration of leadership and initiatives, see below
- **Herzberg Institute of Astrophysics, NRC** **Ottawa**
Research Associate
1988–1991
Three-year post-doctoral position with the James Clerk Maxwell Telescope (JCMT) group. I was also responsible for the invited speakers in the colloquium series.
- **U. Toronto** **Toronto**
Teaching Assistant
1983–1988
Lab supervision, running tutorials and marking. I also ran public multi-media tours of the David Dunlap Observatory and demonstrated the use of the 74-inch telescope for the general public.
- **Provincial Museum of Alberta** **Edmonton**
Planetarium instructor
1980–1983
With one partner, I ran Alberta's Mobile Planetarium (see *Alberta's Roving Planetarium, Sky & Telescope*, 1978, Dec. issue). I developed planetarium shows for school groups of all ages and the public, presented live shows, conducted public observing sessions with an 8-inch telescope, and maintained planetarium equipment. I initiated and coordinated a program for teachers in which inflatable planetaria were loaned to schools and I ran workshops for the teachers. I wrote a 'compendium of astronomy' as a teacher resource and also built a 6-inch reflecting telescope.
- **U. Victoria, and Okanagan College** **Victoria and Kelowna**
Physics Lab Instructor
1978–1980
Coordinating and teaching all physics labs at a first and second year university level, buying and maintaining equipment, revising and developing laboratory exercises. Both were 1-term appointments. Note that the previous entry and this one (5 years of full-time employment) occurred between finishing my MSc degree and starting a PhD.

Education and Qualifications

Academic Qualifications.....

- **University of Toronto** **Toronto, Ont.**
1983–1988
PhD, Astronomy
- **University of Victoria** **Victoria, B. C.**
1975–1978
MSc, Astrophysics
- **University of Winnipeg** **Winnipeg, Man.**
1972–1975
BSc, Mathematics

Scholarships, Fellowships, Awards and Honours.....

- **Ruhr Universitaet Bochum** **Bochum, Ger.**
2016
Visiting International Professor (VIP) Award,
- **SKA** **Canada**
2005–06
Elected, Canadian Square Kilometre Array Committee Board,
- **CGPS** **Canada**
2000–02
Elected to Board of Directors of the Canadian Galactic Plane Survey project,
- **CASCA** **Canada**
1996–99
Elected, Canadian Astronomical Society Board of Directors,
- **CGPS** **Canada**
1997–98
Elected to Board of Directors of the Canadian Galactic Plane Survey project,
- **RASC Kingston Center** **Kingston, Ont.**
1997
Alice Vibert Douglas Astronomy Outreach Award,
- **Queen's U.** **Kingston, Ont.**
1991–1996
NSERC Women's Faculty Award,
- **NRC** **Ottawa, Ont.**
1988–1991
NRC Research Associateship,
- **NSERC** **(Declined)**
1988
NSERC Postdoctoral Fellowship,
- **U. Toronto** **Toronto, Ont.**
1988
Chant Fellowship,
- **U. Toronto** **Toronto, Ont.**
1987–1988
Ontario Government Scholarship,
- **U. Toronto** **Toronto, Ont.**
1986–1987
ZONTA International Amelia Earhart Award,
- **U. Toronto** **Toronto, Ont.**
1986
Carl Reinhardt Fellowship,
- **U. Toronto** **Toronto, Ont.**
1985–1986
Ontario Government Scholarship,
- **U. Toronto** **Toronto, Ont.**
1984–1985
Ontario Government Scholarship,
- **U. Toronto** **Toronto, Ont.**
1984–1985
Chant Fellowship,

- **U. Toronto**
University of Toronto Open Fellowship,
- **U. Victoria**
R. M. Petrie Memorial Fellowship,
- **U. Winnipeg**
University Gold Medal in Mathematics,
- **U. Winnipeg**
H. C. Ashdown Scholarship,
- **U. Winnipeg**
James T. Watson Memorial Scholarship,
- **U. Winnipeg**
R. H. Institute Scholarship,
- **U. Winnipeg**
James T. Watson Memorial Scholarship,

- Toronto, Ont.**
1983–1984
- Victoria, B. C.**
1975–1977
- Winnipeg, Man.**
1975
- Winnipeg, Man.**
1974–1975
- Winnipeg, Man.**
1974–1975
- Winnipeg, Man.**
1973–1974
- Winnipeg, Man.**
1972–1973

Technical and Observing Proposal/Data Reduction Skills.....

- **Platforms:** Linux (Fedora, Ubuntu), MacOS, Microsoft Windows (only when I have to)
- **Software:** Unix, Python, Fortran, TeX/LaTeX, Spreadsheets (OpenOffice, Excel), Powerpoint, Maple, Veusz, Emacs
- **Astronomical and Data Reduction Packages:** TopCat, AIPS, CASA, IRAF, IDL, Siril
- **Telescopes on which I have been awarded competitive Observing Time:** Very Large Array (New Mexico, USA), Dominion Radio Astrophysical Observatory (Penticton, B. C.), Giant Metre-Wave Radio Telescope (Pune, India), Nobeyama Radio Observatory (Nobeyama, Japan), Australian Telescope Compact Array (Narrabri, Australia), James Clerk Maxwell Telescope (Mauna Kea, Hawaii, USA), Observatoire Mont Megantic (Mont Megantic, Quebec), Arecibo Radio Telescope (Arecibo, Puerto Rico), Greenbank Telescope (Greenback, Virginia, USA), Infrared Telescope Facility (Mauna Kea, Hawaii, USA)

Research

Research Focus.....

My research focusses on observations and analysis of spiral galaxies that are edge-on to the line of sight. Observing galaxies so oriented provides a unique view of the regions above and below the disks of these galaxies. Such galaxies would appear to be thin 'lines' in the sky if observed in the optical part of the spectrum because in the optical we see starlight, and the stars are relegated to a thin disk in comparison to the galaxy's diameter. However, when observing at radio, infrared, or X-rays wavelengths, we see gas and dust rather than stars. The components consist of hot gas (X-rays), cool dust (infrared) or relativistic cosmic ray electrons (radio). Every component that is seen between the stars in a galaxy disk can also be seen at large distances above and below the disk, although they are faint. In fact, the galaxy looks quite 'round' when these other wavebands are targetted. We refer to the emission represented by these high latitude components as the galaxy 'halo'.

What is the reason for such a difference? Some galaxies show quite large bright halos while others show very little. For many years, only sketchy data have been available because of the challenging nature of the required

observations. Several years ago, I realized that a larger survey of nearby edge-on systems was needed. Moreover, a key component had been missing: knowledge of the strength and orientation of the magnetic fields. I called on my colleagues around the world who had knowledge of the disk-halo interaction over a wide range of wavelengths as well as theoretical knowledge, and wrote a large observing proposal for the Expanded Very Large Array (EVLA) radio telescope. The observations were to include information on galaxy magnetic fields.

The result was CHANG-ES (Continuum Halos in Nearby Galaxies – an EVLA Survey). We obtained over 400 hours on the VLA and more than 200 hours of complementary time on the Greenbank Telescope (GBT). These are large awards of telescope time. As can be seen from my publication list, this survey has been very fruitful (11 papers so far with half a dozen in draft stage) with some surprises. For example, see <http://public.nrao.edu/news/pressreleases/galaxy-halos> and <https://public.nrao.edu/news/pressreleases/surprising-image-provides-new-tool>. I am the principal investigator (PI) of CHANG-ES and am still currently leading a wonderful international team. See queensu.ca/changes for our first data release and information about the members. I anticipate that the major part of this project will be completed by 2019 although follow-up opportunities will still be available and there are still many opportunities for involvement, student and faculty alike.

Research Grants.....

Aside from the Natural Sciences and Engineering Research Council (NSERC) Individual or Discovery Grants listed below, I have received a number of smaller grants over the years. For example, Queen's University has several smaller grants (of order \$5K) which I have also received (e.g. the Principal's Development Fund, the Cave Fund for hosting D. J. Saikia from India). Please note that NSERC grants for astronomers are generally modest.

- **NSERC** **\$22,000/yr**
Galaxy Evolution and Environments – Disk-Halo Outflows, Feedback and Magnetic Fields, *2016–2021*
- **NSERC** **\$48,000/yr**
Outflows from Spiral Galaxies – Feedback and the Deep Magnetic Field, *2011–2016*
- **NSERC** **\$38,900/yr**
Galaxy Origins – Environment, Evolution & Outflows, *2005–2010*
- **NSERC** **\$28,000/yr**
Fountains and Winds in Galaxies, *2000–2005*
- **NSERC** **\$26,565/yr**
Winds, Jets, Bubbles and Fountains – A Study of Gas Flows within and around Galaxies, *1996–2000*
- **NSERC** **\$23,000/yr**
Outflows from Galaxies, *1991–1996*

Invited Talks.....

I have given a variety of invited talks over the years. Recently (March 16, 2018), I gave the colloquium at NRAO (National Radio Astronomy Observatory), in Socorro, New Mexico. I was also a CAP (Canadian Association of Physicists) speaker for 2018 (see https://www.cap.ca/programs/cap-lecture-tour/2018-lecture-tour/httpsservices-cap-calecture_touradmin-php2018-cap-lecture-tour-speaker-list/).

Memberships in Professional Organizations.....

International Astronomical Union, the Canadian Astronomical Society (CASCA), the Royal Astronomical Society of Canada (RASC), the Canadian Association of Physicists (CAP), and (though not currently) the American Astronomical Society.

Teaching

Teaching Philosophy.....

There is currently a huge push to turn the classroom into a region of technical wizardry. To a degree, this is desirable, it can be exciting for the students to be introduced to modern techniques of pedagogical measurement, and there can be an added energy to the learning environment. For example, I have used clickers (now superseded by cell phone apps) which provide instant feedback to students and which works well for very large 1st year classes. Technology can also allow a university or college to reach out much farther than their physical borders. On-line courses are another example and, if chosen carefully, can be true value-added to a university.

What is extremely important, however, is that content is not lost and not given a back-seat to 'smoke and mirrors'. The professor is the most important connection between the student and what is often hard-won knowledge. With a limited amount of time in the classroom, technological aids are sometimes not aids at all, but rather impediments to learning. The result is that the professor can spend more time on preparing the slides, clickers, apps, etc. than on course content and development. It also tends to lead the professor to adopt canned courses for sale. Such courses are developed elsewhere (often outside of Canada) and are set up so that every year there is a new version of an on-line textbook that forces students to keep buying. Students then believe that true knowledge is 'somewhere else' and the experience of attending a university in their own country or province/territory is diminished. Students need to trust that their professor knows what he or she is talking about and they need to see that they can learn, right here, just as well as anyone else.

As an example, I have used standard texts as well as on-line material for first year physics. For a course like Phys 435/815 (Stellar Structure and Evolution), however, I have provided a variety of scientific references (including, for an upcoming course, the text by Francis LeBlanc at the University of Moncton) and I also wrote my own notes for them, synthesizing what I had learned into a coherent course structure. For Phys 315 (Physical Processes in Astrophysics), I wrote my own textbook (*Astrophysics – Decoding the Cosmos*, by Judith Irwin, Wiley Interscience, ISBN: 978-0-470-01306-9) to fully cover the content that I thought was necessary. Although published in 2007, it is still being adopted in a variety of places (e.g. University of Manitoba). These points are only being brought up to illustrate that the professor is not meant to be a conveyor of someone else's knowledge, but rather a synthesizer of accumulated understanding and, better yet, a creator of knowledge through his or her own personal research.

Teaching Dossier.....

I have taught the following courses at Queen's University. Unless otherwise indicated, I had sole responsibility as professor for the course. As various programs were revised, some of the courses were replaced with others. Those that are no longer offered are marked with an asterisk. Courses starting with 1 - 4 are undergraduate courses (1st year, 2nd, etc.), those starting with 8 or 9 are graduate courses. Those that are double-numbered (e.g. 435/813) are offered jointly to 4th year undergraduates plus graduate students. H means a half-course (Fall term or winter term only) and 'Modules' are half of a half-course designed for graduate students only. 'Co-taught' means taught with one other professor. A bold-faced **M** means that I have taught the course multiple times.

- **Phys 106**, *General Physics (one term)*, (for students of chemistry and physics, calculus-based)
- **Phys 107**, *Introductory Physics*, (for students in the Life Sciences, algebra-based)* **M**
- **Phys 115 (H)**, *Introduction to Astrophysics*, (1st calculus-based course in Astrophysics)*
- **Phys 117 (H)**, *Introductory Physics*, (Revised from Phys 107, for students in the Life Sciences) **M**

- **Phys 215 (H)**, *Basic Physical Processes in Astrophysics, (2nd calculus-based course in Astrophysics)** **M**
- **Phys 225 (H)**, *Mechanics, (for Engineering Physics students)* **M**
- **Phys 315 (H)**, *Physical Processes in Astrophysics, (2nd calculus-based course in Astrophysics)* **M**
- **Phys 372 (H)**, *Thermodynamics, (for both Arts&Science and Engineering Physics students)* **M**
- **Phys 415 (H)**, *Modern Observational Astronomy, (observational techniques, co-taught)** **M**
- **Phys 433/813 (H)**, *Galactic Astronomy, (the Milky Way)** **M**
- **Phys 435/815 (H)**, *Stellar Structure and Evolution, (the Sun and other stars)*
- **Phys 455**, *Engineering Physics Thesis, (as supervisor)* **M**
- **Phys 590**, *Arts&Science Thesis, (as supervisor)* **M**
- **Phys 811 (H)**, *Radio Astrophysics, (technical, observational and physical interpretation)** **M**
- **Phys 813 (H)**, *Galactic Astrophysics, (Milky Way, stellar, gaseous, & dark matter)* **M**
- **Phys 814 (H)**, *Extragalactic Astrophysics, (Galaxies, co-taught)* **M**
- **Phys 845**, *Astrophysics of the Interstellar Medium, (Module)*
- **Phys 899**, *Master's Thesis Research, (as supervisor)* **M**
- **Phys 901**, *Graduate Student Seminar Series, (Coordinator)*
- **Phys 999**, *PhD Thesis Research, (as supervisor)* **M**

Undergraduate Student Supervision.....

Queen's University has 4th year thesis projects for both engineers (Phy 455) and Arts&Science students (Phy 590). I have supervised many students over the years for both of these courses. A typical number is one to two per year. I have also supervised a number of summer students in a variety of projects.

Graduate Student Supervision.....

Students who have been co-supervised with one other professor are denoted with an asterisk. In one case (Beland) the co-supervision was for a mature student at Trent University who was working on his MSc at the same time as holding down a full-time job.

- Alex Woodfinden, *MSc, Rotation Measure Reversals in Galactic Halos** 2017–
- Alison Merritt, *MSc, Spectral Index Variations in Spiral Galaxies* 2016–
- Amanda Desouza, *MSc, Radio Continuum Imaging of the Massive Edge-on Galaxy NGC 2613* 2014–2017
- Jacques Beland, *MSc, Self-Organizing Maps and Galaxy Evolution** 2010–2014
- Jeremy MacHattie, *MSc, A Study of the Neutral Hydrogen Content of BCD Galaxies* 2011–2013
- Jeremy Durelle, *MSc, Gas Ejection from Spiral Galaxy Disks** 2009–2011
- Heather Kennedy, *MSc, Investigation of Neutral Hydrogen in Three Edge-on Spiral Galaxies* 2007–2009
- Tara Parkin, *MSc, Investigating the Spectral Energy Distribution of the Dwarf Galaxy, IC 10* 2006–2008
- Guillaume Rivest, *MSc, Dust Dynamics in the Galactic Disk-Halo Vicinity** 2005–2007
- Cyndi Whaley, *MSc, Infrared Observations of the Spiral Galaxy NGC 891* 2005–2007

- *Dr. Sabine McConnell, PhD, Data Mining for Galaxy Classification** 2003–2006
- *Dr. Rupinder Brar, PhD, The Sub-mm/Radio Correlation in Spiral Galaxies* 1999–2005
- *Tara Mowery (née Chaves), MSc, Neutral Hydrogen in NGC 2613* 2001–2003
- *Dr. Siow-Wang Lee, PhD, The ISM in the Edge-on Galaxies NGC 3044 and NGC 5775* 1993–1998
- *Brian Frei, MSc, Magnetic Fields and Superbubbles** 1995–1997
- *Denise King (née Giguere), MSc, Atomic Hydrogen in the Spiral Galaxy M 108* 1994–1996
- *Barkat Sorathia, MSc, A Radio Continuum Survey of Edge-on Spiral Galaxies* 1992–1994

Post-Doctoral Fellow Supervision.....

- *Dr. Theresa Wiegert, Data Reduction Pipelines for the CHANG-ES Survey* 2011–2014
- *Dr. Jeroen Stil, Canadian Galactic Plane Survey Analysis* 1999–2001
- *Dr. Jayanne English, Radio Continuum Analysis of Edge-on Galaxies* 1996–1998

Leadership, Initiatives, and Public Outreach

As indicated above, I initiated and am leading the CHANG-ES research project.

In addition, however, when I arrived at Queen's, I noticed that the on-campus observatory had fallen into disuse and the telescope was an 'old clunker'. I began using it as best as possible for projects for our 2nd year students and also opened it up for public viewing on a semi-regular basis (e.g. when Comet Shoemaker-Levy impacted Jupiter and other events). However, it became clear that the observatory needed refurbishment and a more modern telescope was desirable.

For this, I initiated an 'adopt-a-star' program to raise funds for a new telescope. With assistance from our graduate students, we raised \$200,000 towards a new computerized telescope, instrumentation, a new dome and preparation of an outdoor observing deck. After this success, Queen's Advancement raised additional funds to complete the project (McGirr family donation). I also initiated a long-running collaboration with the Kingston Centre of the Royal Astronomical Society of Canada (RASC), called KAON. I successfully applied for an additional \$5,000 from Ontario's Trillium Foundation and a lesser amount from the Community foundation of Kingston to help with this public outreach component.

Since that time, the public open houses at the Queen's Observatory have steadily grown and reached many thousands. The telescope (now superseded by yet a newer model) has been regularly used for monthly open houses with the support of the RASC. I am no longer the faculty member in charge of the observatory but it is gratifying to know that this initiative, started in the 1990s is still going strong. Our monthly open houses typically have an attendance of approximately one hundred people and feature a professor or graduate student who makes a presentation on a variety of topics (I have done a number of these as well) along with public observing if the weather is clear.

Astronomy lends itself well to public outreach and piquing the imagination of both young people and adults alike. My involvement in public astronomy over the years has included: local contact for the Meteorites and Impacts Advisory Committee of the Canadian Space Agency, sponsor of the Queen's Astronomy Club, classroom presentations at a local elementary school, many guest speaker presentations for Queen's open houses the Astronomy

Club and the RASC (Kingston and Ottawa Center), guest on the national radio show *Quirks and Quarks*, occasional columnist for the local paper *Kingston This Week*, CAP speaker at the University of Manitoba, and others.

International Experience

I have taken sabbatical leaves in India (1998 - 1999, 15 months), in France (2004, 6 months), and in Germany (2016, 3 months). Each sojourn provided me with exceptional opportunities to see how universities and institutes operate in other countries. In addition, as part of the CHANG-ES project, I spent 3 months in Socorro, New Mexico, at the National Radio Astronomy Observatory (invited) to work with experts at the Very Large Array. Leading the international CHANG-ES consortium has also been an interesting exercise in melding the knowledge and expertise of scientists from Germany, the USA, China, Canada and Australia; it is necessary to ensure that all contributions are valued, while steering through a maze of international idiosyncracies and scientific leanings. This team consists of exceptional scientists and it is a privilege to be their PI. So far, it seems to have worked well!

Administration

Committees.....

I have been on a variety of Scientific Organizing committees for conferences.

At Queen's University, I have been on many committees, some as chair. Examples are the Undergraduate Curriculum Committee, the PhD Qualifying Committee, the Computing Committee, the Colloquium Committee, the Graduate Student Steering Committee, the Workload Committee, the Planning Committee, and many PhD and MSc defense examinations. I have been an evaluator for Queen's Chancellor's Scholarships, and on the Headship Search Committee for Department Head.

I have been elected regularly to the PRT (Promotion, Renewal and Tenure) Committee at Queen's which I am currently on. I am the Equity Representative on this committee. We also have responsibility for hiring. I have been on the Killam Committee (2009-10) which is a national committee to choose the best Canadian scientists for awards.

Reviews and Refereeing.....

I have been a referee for a number of scientific journals, e.g. *Astronomy & Astrophysics*, *Monthly Notices of the Royal Astronomical Society*, the *Astrophysical Journal*, and others.

I have been an external reviewer for the USA National Radio Astronomy Observatory (2011 -12). I have been on Time Allocation Committees for telescope time (e.g. the James Clerk Maxwell Telescope, the Very Large Array, the Greenbank Telescope, and the NRAO 12-m telescope). I have also been on the Advisory Panel for the James Clerk Maxwell Telescope.

I have been on the review committee for the Chemistry Dept. at Queen's and for the Physics Dept. at McMaster University.

I have been a reviewer for a book for *Physics Today*, and for a grade 12 textbook.

I regularly am a reviewer of NSERC grant applications and also grant applications from other countries (e.g. the Netherlands, Iceland).

References

- References are available on request

Publications

Note: my name has been underlined and names of my students or others that I have supervised have been italicized. KEY as follows:

AJ: *Astronomical Journal*

A&A: *Astronomy & Astrophysics*

ApJ: *Astrophysical Journal*

JRASC: *Journal of the Royal Astronomical Society of Canada*

MRNAS: *Monthly Notices of the Royal Astronomical Society*

NewA: *New Astronomy*

PASJ: *Publications of the Astronomical Society of Japan*

PASP: *Publications of the Astronomical Society of the Pacific*

Books.....

Irwin, J. A. 2007, *Astrophysics – Decoding the Cosmos*, Wiley Interscience Textbook, 446 pages, ISBN 978-0-470-01305-2

Full Journal Papers.....

1. Miskolczi, A., Heesen, V., Dettmar, R.-J., and 8 coauthors, including Irwin 2018, “CHANG-ES XIV: A LOFAR and JVLA view of the edge-on star-forming galaxy NGC 3556”, *A&A*, in press
2. Irwin, J. A., Henriksen, R. N., Wezgowiec, M., Damas-Segovia, A., Wang, Q. D., Krause, M., Heald, G., Dettmar, R.-J., Li, J.-T., *Wiegert*, T., and 11 coauthors 2018, “CHANG-ES XI: Circular Polarization in the Cores of Nearby Galaxies”, *MNRAS*, 476, 5057
3. Heesen, V., Krause, M., Beck, R., Adebahr, B., Bomans, D. J., Carretti, E., Dumke, M., Heald, G., Irwin, J., and 4 coauthors 2018, “Radio haloes in nearby galaxies modelled with 1D cosmic-ray transport using SPINNAKER”, *MNRAS*.tmp..109H, arXiv:1801.05211 (39 pp.)
4. Henriksen, R. N., *Woodfinden*, A., and Irwin, J. A. 2018, “Exact axially symmetric galactic dynamos”, *MNRAS* tmp..254H, arXiv:1801.08637 (23 pp.)
5. Vargas, C. J., Mora-Partiarroyo, S. C., Schmidt, P., Rand, R. J., Stein, Y., Walterbos, R. A. M., Wang, Q. D., Basu, A., Patterson, M., Kepley, A., Beck, R., Irwin, J. A., Heald, G., Li, J., and *Wiegert*, T. 2018, “CHANG-ES X: Spatially Resolved Separation of Thermal Contribution from Radio Continuum Emission in Edge-on Galaxies”, *ApJ*, 853, 128 (23 pp.)
6. Krause, M., Irwin, J. A., and 15 coauthors 2017, “CHANG-ES IX: Radio scale heights and scale lengths of a consistent sample of 13 spiral galaxies seen edge-on and their correlations”, accepted to *A&A*, arXiv:171203780 (15 pp.)
7. Perlman, E. S., Meyer, E. T., Wang, Q. D., Yuan, Q., Henriksen, R., Irwin, J. A., Krause, M., *Wiegert*, T., Murphy, E. J., Heald, G., Dettmar, R.-J. 2017, “Compact Resolved Ejecta in the Nearest Tidal Disruption Event”, *ApJ*, 842, 126 (9 pp.)
8. Irwin, J. A., and 13 coauthors 2017, “CHANG-ES - VIII. Uncovering hidden AGN activity in radio polarization”, *MNRAS*, 464, 1333 - 1346
9. Damas-Segovia, A., Beck, R., Vollmer, B., *Wiegert*, T., Krause, M., Irwin, J. A., and 5 coauthors, 2016, “CHANG-ES. VII. Magnetic Outflows from the Virgo Cluster Galaxy NGC 4388”, *ApJ*, 824, 30
10. Li, Jiang-Tao, Beck, R., Dettmar, R.-J., Heald, G., Irwin, J. A., and 11 coauthors, 2016 “CHANG-ES - VI.

- Probing Supernova energy deposition in spiral galaxies through multiwavelength relationships”, *MNRAS*, 456, 1723 - 1738
11. Henriksen, R. N., and Irwin, J. A. 2016, “Magnetized Galactic Halos and Velocity Lags”, *MNRAS*, 458, 4210 - 4221
 12. Irwin, J. A., Henriksen, R. N., Krause, M., and 5 coauthors, 2015 “CHANG-ES V: Nuclear Radio Outflow in a Virgo Cluster Spiral after a Tidal Disruption Event”, *ApJ*, 809, 172 (26 pp.)
 13. Wiegert, T., Irwin, J. A., Miskolczi, A., and 20 coauthors, 2015, “CHANG-ES IV: Radio continuum emission of 35 edge-on galaxies observed with the Karl G. Jansky Very Large Array in D-configuration – Data Release 1”, *AJ*, 150, 81 (25 pp. plus appendices and on-line material)
 14. Irwin, J. A., Krause, M., English, J., and 7 coauthors, 2013, “CHANG-ES III. UGC 10288—An Edge-on Galaxy with a Background Double-lobed Radio Source”, *AJ*, 146, 164 (18 pp.)
 15. Irwin, J. A., Brar, R. S., Saikia, D. J., and Henriksen, R. N. 2013, “The 617 MHz- λ 850 μ m correlation (cosmic rays and cold dust) in NGC 3044 and NGC 4157”, *MNRAS*, 433, 2958 - 2974
 16. Madden, S. C. and 31 coauthors including Irwin, J. A. 2013, “An Overview of the Dwarf Galaxy Survey”, *PASP*, 125, 600 - 635
 17. Wilson, C. D., and 58 coauthors including Irwin, J. A. 2012, “The JCMT Nearby Galaxies Legacy Survey - VIII. CO data and the $L_{CO(3-2)}$ - L_{FIR} correlation in the SINGS sample”, *MNRAS*, 424, 3050 - 3080
 18. Irwin, J. A., Beck, R., Benjamin, R. A., and 19 coauthors, 2012, “Continuum Halos in Nearby Galaxies: An EVLA Survey (CHANG-ES). II. First Results on NGC 4631”, *AJ*, 144, 44 (13 pp.)
 19. Irwin, J. A., Beck, R., Benjamin, R. A., and 19 coauthors, 2012, “Continuum Halos in Nearby Galaxies: An EVLA Survey (CHANG-ES). I. Introduction to the Survey”, *AJ*, 144, 43 (9 pp.)
 20. Irwin, J. A., Wilson, C. D., Wiegert, T., and 8 coauthors 2011, “The JCMT Nearby Galaxies Legacy Survey V: The CO(J=3-2) Distribution and Molecular Outflow in NGC 4631”, *MNRAS*, 410, 1423 - 1440
 21. Wilson, C. D., Warren, B. E., Irwin, J. A., and 21 coauthors 2011, “The JCMT Nearby Galaxies Legacy Survey IV. Velocity Dispersions in the Molecular Interstellar Medium in Spiral Galaxies”, *MNRAS*, 410, 1409 - 1425
 22. Bendo, G. J., and 24 coauthors including Irwin, J. A. 2010, “The JCMT Nearby Galaxies Legacy Survey III: Comparisons of cold dust, polycyclic aromatic hydrocarbons, molecular gas, and atomic gas in NGC 2403”, *MNRAS*, 402, 1409
 23. Warren, B. E., and 22 coauthors including Irwin, J. A. 2010, “The JCMT Nearby Galaxies Legacy Survey II: Warm Molecular Gas and Star Formation in Three Field Spiral Galaxies”, *ApJ*, 714, 571 - 588
 24. Irwin, J. A., Hoffman, G. L., Spekkens, K., Haynes, M. P., Giovanelli, R., Linder, S. M., Catinella, B., Momjian, E., Koribalski, B. S., Davies, J., Brinks, E., de Blok, W. J. G., Putman, M. E., & van Driel, W. 2009, “ Λ CDM Satellites and HI Companions – The Arecibo ALFA Survey of NGC 2903”, *ApJ*, 692, 1447 - 1463
 25. Wilson, C. D., et al. and 22 coauthors including Irwin, J. A. 2009, “The James Clerk Maxwell Telescope Nearby Galaxies Legacy Survey. I. Star-Forming Molecular Gas in Virgo Cluster Spiral Galaxies”, *ApJ*, 693, 1736 - 1748
 26. Whaley, C. H., Irwin, J. A. Madden, S. C., Galliano, F., & Bendo, G. J. 2009, “A Multiwavelength Infrared Study of NGC 891”, *MNRAS*, 395, 97 - 113
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