

## JOHN BALLY

Department of Astrophysical and Planetary Sciences  
Center for Astrophysics and Space Astronomy  
Campus Box 389, University of Colorado, Boulder CO 80309  
Phone: (303) 492-5786; FAX: (303) 492-7178; e-mail: john.bally@colorado.edu  
Internet: <http://casa.colorado.edu/~bally>

### Educational Background:

1972 B.S. (Astronomy) University of California, Berkeley  
1977 M.S. (Physics) University of Massachusetts, Amherst  
1980 Ph.D. (Astrophysics) University of Massachusetts, Amherst

### Professional Employment:

2000 - present	Professor	Department of Astrophysical and Planetary Sciences, University of Colorado, Boulder, CO
1991 - 1999	Associate Professor	Department of Astrophysical and Planetary Sciences, University of Colorado, Boulder, CO
1996 - 1999	Director	Center for Astrophysics and Space Astronomy, University of Colorado, Boulder, CO
1982 - 1991	Member of Technical Staff	AT&T Bell Laboratories, Holmdel, NJ
1980 - 1982	Post-Doctoral MTS	AT&T Bell Laboratories, Holmdel, NJ
1978 - 1980	Research Assistant	Five College Radio Astronomy Observatory (FCRAO) University of Massachusetts, Amherst, MA
1974 - 1974	Instructor (Physics)	California State University, Hayward, CA

### Areas of Research:

The astrophysics of star formation, disks and outflows associated with young stars, the formation of planetary systems, and investigations of the interstellar medium. Line and continuum observations at millimeter, sub-mm, infrared, and visual wavelengths. The hydrodynamics of shocks and ionization fronts. *Other interests:* Galaxy formation and evolution, and the search for extra-Solar planets. *Hardware/engineering experience:* Cryogenic mm-wave mixers, IF systems, and superconducting (SIS) receivers, near-infrared arrays and cameras, optics, and astronomical site characterization.

My current research has primarily focused on the formation of stars and planetary systems using observational tools throughout the spectrum from radio to X-rays, numerical computation, and theoretical analysis. I use of facilities in space such as the Hubble Space Telescope and the Chandra X-ray observatory and major observatories such as Keck, Gemini, and the National Astronomy Observatories in Arizona and Chile and the Apache Point Observatory in which CU is a partner.

My research has shown that most stars form in clusters in close proximity to massive stars whose intense radiation, winds, and supernova explosions profoundly impact the formation and architectures of planetary systems. Forming stars inject high-velocity winds, collimated jets, intense UV radiation, and explosive debris that drive the life cycles of gas, dust, and clouds that inhabit the Galaxy. Thus, star formation is a self-limiting process that controls the “ecology” of

the matter between the stars. Ultimately, star formation determines the cosmic fate of ordinary matter in the Universe through the mixture of long-lived low- and high-mass stars.

In addition to observations, I have worked on a variety of instrumentation projects including radio-astronomy receivers, new-methods of “site-testing” the astro-climate of potential observatory sites, and infrared cameras.

Recently, I conducted an ambitious surveys of Milky Way Galactic plane in the 1.1 mm wavelength emission produced by dense cloud cores. Observations of over 220 square degrees of sky have revealed about 10,000 cores intimately associated with the birth of stars and star clusters; the most massive objects may evolve into micro-quasars and black holes. I’m also a member of the Herschel Space Observatory Hi-GAL survey of the Galactic plane which is obtaining the first high-resolution survey at 5 wavelengths from 70 to 500  $\mu\text{m}$  from space. I’m investigating the ecology of the interstellar medium and the star-formation / stellar-evolution / stellar death life-cycle.

In 2014, I joined a large Spitzer Space Telescope “warm mission” project, SPIRITS, which has been granted ~1200 hours of observing time to monitor ~200 nearby galaxies. SPIRITS is seeking to identify new classes of luminous transients with luminosities between novae and supernovae that are primarily visible in the infrared portion of the spectrum.

#### **Committees:**

I serve on the Hi-GAL (Herschel Space Observatory Galactic Plane Survey) Steering Committee which is responsible for organizing data acquisition and analysis of the ~900 hour observing program to survey the Galactic Plane with the Herschel Space Observatory. I serve on the NASA’s SOFIA Users Group (SUG). In 2014, I completed a three year stint on the Atacama Large Millimeter Array (ALMA) proposal review panel and acting as the chair of one of the star formation sub-panels.

#### **Teaching:**

I teach at all levels, including introductory and advanced undergraduate, graduate courses, and I supervise students at all levels. I contributed to the development of our Observational Astronomy I and II (ASTR 3520/3520 sequence for majors, and the Extraterrestrial Life (ASTR 3300 and now listed as ASTR2040) which is our introduction to astrobiology. I have given many popular lectures to astronomy groups and the public including the Denver Museum of Nature and Science and at the Fiske Planetarium. I typically supervise between 1 and 3 graduate students at any one time who are working on PhD dissertations. Most of my ex-students have move onto successful careers in the sciences. I supervised several post-docs including Jon Morse, Nathan Smith, and Sean Raymond.

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## Publications:

- Bally, J. 2015. *Astrophysics: Mystery survivor of a supermassive black hole.*  
Nature 524, 301-302
- Ochsendorf, B.B., Brown, A.G.A., Bally, J., Tielens, A.G.G.M. 2015.  
*Nested Shells Reveal the Rejuvenation of the Orion-Eridanus Superbubble.*  
The Astrophysical Journal 808, 111.
- Bally, J., Mann, R.K., Eisner, J., Andrews, S.M., Di Francesco, J., Hughes, M., Johnstone, D.,  
Matthews, B., Ricci, L., Williams, J.P. 2015. ALMA  
*Observations of the Largest Proto-Planetary Disk in the Orion Nebula, 114-426: A CO  
Silhouette.* The Astrophysical Journal 808, 69.
- Reiter, M., Smith, N., Kiminki, M.M., Bally, J. 2015.  
*HH 666: different kinematics from H-alpha and [Fe II] emission provide a missing link  
between jets and outflows.*  
Monthly Notices of the Royal Astronomical Society 450, 564-574.
- Ellsworth-Bowers, T.P., Glenn, J., Riley, A., Rosolowsky, E., Ginsburg, A., Evans, N.J., II,  
Bally, J., Battersby, C., Shirley, Y.L., Merello, M. 2015.  
*The Bolocam Galactic Plane Survey. XIII. Physical Properties and Mass Functions of Dense  
Molecular Cloud Structures.*  
The Astrophysical Journal 805, 157.
- Hartigan, P., Reiter, M., Smith, N., Bally, J. 2015. *A Survey of Irradiated Pillars, Globules, and  
Jets in the Carina Nebula.* The Astronomical Journal 149, 101.
- Bally, J., Ginsburg, A., Silvia, D., Youngblood, A. 2015. *The Orion Fingers: Near-IR Adaptive  
Optics Imaging of an Explosive Protostellar Outflow.* Astron.&Astrophys. 579, 130.
- Rathborne, J. M., and 11 colleagues 2015. *A cluster in the making: ALMA reveals the initial  
conditions for high-mass cluster formation.* Astrophysical Journal, 802, 125.
- Reiter, M., Smith, N., Kiminki, M.M., Bally, J., Anderson, J. 2015. *Disentangling the outflow  
and protostars in HH 900 in the Carina Nebula.* ApJ, MNRAS, 448, 3429.
- Merello, M., Evans, N. J., II, Shirley, Y. L., Rosolowsky, E., Ginsburg, A., Bally, J.,  
Battersby, C., Dunham, M.~M. 2015. *The Bolocam Galactic Plane Survey. XI.  
Temperatures and Substructure of Galactic Clumps Based on 350 micron Observations.*  
Astrophysical Journal Supplements, 218, 1.
- Raga, A.C., Reipurth, B., Castellanos-Ramirez, A., Chiang, H.-F., Bally, J. 2015.  
*Collisionally Excited Filaments in Hubble Space Telescope H $\alpha$  and H $\beta$  Images of HH 1/2.*  
The Astrophysical Journal 798, LL1.

- Ginsburg, A., Bally, J., Battersby, C., Youngblood, A., Darling, J., Rosolowsky, E., Arce, H., Lebron Santos, M.E. 2015. *The dense gas mass fraction in the W51 cloud and its protoclusters*. Astronomy and Astrophysics 573, AA106.
- Williams, J.P., Mann, R.K., Di Francesco, J., Andrews, S.M., Hughes, A.M., Ricci, L., Bally, J., Johnstone, D., Matthews, B. 2014. *ALMA Observations of a Misaligned Binary Protoplanetary Disk System in Orion*. The Astrophysical Journal 796, 120.
- Bally, J., Ginsburg, A., Probst, R., Reipurth, B., Shirley, Y. L., Stringfellow, G.S. 2014. *Outflows, Dusty Cores, and a Burst of Star Formation in the North America and Pelican Nebulae*. The Astronomical Journal 148, 120.
- Pon, A., Johnstone, D., Bally, J., Heiles, C. 2014. *Kompaneets model fitting of the Orion-Eridanus superbubble*. Monthly Notices of the Royal Astronomical Society 444, 3657-3669.
- Rathborne, J.M., and 11 colleagues 2014. *Turbulence Sets the Initial Conditions for Star Formation in High-pressure Environments*. The Astrophysical Journal 795, LL25.
- Bally, J., and 13 colleagues 2014. *Absorption Filaments toward the Massive Clump G0.253+0.016*. The Astrophysical Journal 795, 28.
- Kasliwal, M.M., and 33 colleagues 2014. *SPIRITS Discoveries of Infrared Transients with Spitzer*. The Astronomer's Telegram 6644, 1.
- Bally, J. 2014. *Clumps and Cores in Massive Star-Forming Regions from Orion to the Central Molecular Zone*. Dense Cores: Origin, Evolution, and Collapse 305.
- Kendrew, S., Ginsburg, A., Johnston, K., Beuther, H., Bally, J., Cyganowski, C.J., Battersby, C. 2014. *All quiet on the Western front? New evidence for massive star formation in Sgr C*. IAU Symposium 303, 220-222.
- Bally, J., Hi-GAL Team 2014. *The Herschel view of the Galactic center*. IAU Symposium 303, 1-14.
- Wehres, N., Ochsendorf, B., Bally, J., Snow, T., Bierbaum, V., Cox, N.L.J., Kaper, L., Tielens, A.G.G~M. 2014. *Search for DIBs in Emission: MWC 922 - The Red Square Nebula*. IAU Symposium 297, 226-228.
- Frank, A., and 12 colleagues 2014. *Jets and Outflows from Star to Cloud: Observations Confront Theory*. Protostars and Planets VI 451-474.
- Longmore, S.N., Kruijssen, J.M.D., Bastian, N., Bally, J., Rathborne, J., Testi, L., Stolte, A., Dale, J., Bressert, E., Alves, J. 2014. *The Formation and Early Evolution of Young Massive Clusters*. Protostars and Planets VI 291-314.

- Molinari, S., and 10 colleagues 2014. *The Milky Way as a Star Formation Engine. Protostars and Planets VI* 125-148.
- Balog, Z., and 13 colleagues 2014. *The Extraordinary Far-infrared Variation of a Protostar: Herschel/PACS Observations of LRL54361*. *The Astrophysical Journal* 789, L38.
- Pon, A., Johnstone, D., Bally, J., Heiles, C. 2014. *The origin of ionized filaments within the Orion-Eridanus superbubble*. *MNRAS* 441, 1095-1104.
- Kruijssen, J.M.D., Longmore, S.N., Elmegreen, B. G., Murray, N., Bally, J., Testi, L., Kennicutt, R. C. 2014. *What controls star formation in the central 500 pc of the Galaxy?* *MNRAS*. 440, 3370-3391.
- Battersby, C., Ginsburg, A., Bally, J., Longmore, S., Dunham, M., Darling, J. 2014. *The Onset of Massive Star Formation: The Evolution of Temperature and Density Structure in an Infrared Dark Cloud*. *ApJ*, 787, 113.
- Bally, J., & the Hi-GAL Team. 2014. *The Herschel view of the Galactic center*. *IAU Symposium* 303, 1-14.
- Rathborne, J.M., and 11 colleagues. 2014. *G0.253+0.016: A Centrally Condensed, High-mass Protocluster*. *ApJ*, 786, 140.
- Battersby, C., Bally, J., Dunham, M., Ginsburg, A., Longmore, S., Darling, J. 2014. *The Comparison of Physical Properties Derived from Gas and Dust in a Massive Star-forming Region*. *ApJ*, 786, 116.
- Mann, R.K., Di Francesco, J., Johnstone, D., Andrews, S. M., Williams, J. P., Bally, J., Ricci, L., Hughes, A. M., Matthews, B. C. 2014. *ALMA Observations of the Orion Proplyds*. *ApJ*, 784, 82.
- Shuping, R.Y., Kassis, M., Bally, J., Morris, M.R. 2014. *The Curious Morphology and Orientation of Orion Proplyd HST-10*. *ApJ*, 781, L37.
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- Battersby, C., Bally, J. 2014. *An 80 pc Long Massive Molecular Filament in the Galactic Mid-Plane*. *Astrophysics and Space Science Proceedings* 36, 417.
- Pillitteri, I., and 14 colleagues 2014. *Mapping the Star Formation in Orion A/L1641*. *Astrophysics and Space Science Proceedings* 36, 291.
- Ginsburg, A., Bressert, E., Bally, J., Battersby, C. 2014. *Surveying Dense Gas with Bolocam: There Are No Pre-stellar Massive Clusters in the First Quadrant*.

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