

# Stéphane Blondin

Full-time researcher in astrophysics

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## Research interests

- main thermonuclear (Type Ia) supernovae progenitor properties and explosion mechanisms, combining observations and numerical radiative-transfer simulations
- other supernovae and transients in general; cosmology with supernovae; spectral analysis algorithms

## Education

- 2016 **Habilitation Thesis (Habilitation à Diriger des Recherches, HDR)**, Aix-Marseille Université, France
- 2002–2005 **PhD in Astronomy (Dr. rer. nat.)**, Ludwig-Maximilians Universität München (LMU), European Southern Observatory (ESO), International Max Planck Research School on Astrophysics (IMPRS), Germany (*magna cum laude*)
- 1998–2002 **Master of Physics**, University of Southampton, UK (*first class honours*)
- 1997 **French Scientific Baccalauréat with International Option**, Lycée International de Saint Germain en Laye, France (*Speciality in Mathematics, British section*)

## Academic appointments

- 2018– **CNRS Researcher**, Laboratoire Franco-Chilien d'Astronomie, Santiago, Chili
- 2014–2018 **CNRS Researcher**, Laboratoire d'Astrophysique de Marseille, France
- 2012–2014 **CNRS Researcher**, Laboratoire d'Astrophysique de Marseille, France
- 2010–2012 **CNRS Researcher**, Centre de Physique des Particules de Marseille, France
- 2008–2010 **Fellow**, European Southern Observatory, Garching bei München, Germany
- 2005–2008 **Postdoctoral Fellow**, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA

## Research highlights

- I am the co-author of the **SuperNova IDentification (SNID) code** (Blondin & Tonry 2007), the most widely used tool for classifying new supernovae, with over 1300 citations
- I founded the **supernova data archive** of the Harvard-Smithsonian Center for Astrophysics (CfA SN Archive) in 2006 during my first postdoctoral appointment
- I have published and analyzed the **largest spectroscopic data set of Type Ia supernovae**, comprising 2603 spectra of 462 supernovae (Blondin et al. 2012)
- I am the author of **50 refereed publications** (12 as first author). Total citations: 5769
- **7 invited oral presentations** at conferences/workshops; **21 invited institute seminars**

## Awards

- 2008 European Southern Observatory (ESO) Fellowship
- 2007 "Initiative Postdoc" Grant from the French Ministry of Research
- 2003 NATO Advanced Study Institute Grant
- 2002 International Max Planck Research School on Astrophysics (IMPRS) Studentship
- 2001, 2002 University of Southampton Physics and Astronomy Departmental Prize

## Grants

- 2014–2017 PI of several grants from the “Programme National de Physique Stellaire” (PNPS)  
2011–2016 Co-I on an “Agence Nationale de la Recherche” (ANR) grant, *Radiative Transfer modelling of Core-Collapse Supernovae* (211 700 EUR)  
2012–2013 Co-I on a Marie-Curie International Reintegration Grant (IRG), *Stellar explosions* (100 000 EUR)

## Student supervision

- PhD Randa Asad (University of Cincinnati), 2009-2012 (co-supervisor)  
Malcolm Hicken (Harvard University), 2006-2008 (co-supervisor)  
Master Lucie Khlát (Ecole Normale Supérieure de Lyon), May-July 2018  
Jordan Noël (Université de Montpellier), March-June 2017  
Sarah Laghribi (Université de Montpellier), March-June 2013 (co-supervisor)  
Bachelor Joshua Esteves (Aix-Marseille Université), November-December 2016  
Vadim Becquet and Sébastien Aynaud (Aix-Marseille Université), June 2015  
Bailes Brown (Harvard University), 2006 (co-supervisor)

## Professional activities

- Group Leader Founder of the *Transients discussion group* at LAM (14 members)  
Reviewer U.S.-Israel Binational Science Foundation (BSF); FONDECYT Initiation into Research; prix Jeunes Chercheurs de la Société Française de Physique; Veni grant of the Netherlands Organisation for Scientific Research; DiRAC HPC Resource Allocation Committee (×2); Opticon TAC (×2); ESO OPC panel secretary (×3)  
Committees Postdoc selection committee for the Labex OCEVU (2016)  
Conference *Supernovae in the Local Universe*, Australia (2014)  
organization *Radiation Transfer and Explosive Thermonuclear Burning in Supernovae*, Weizmann Inst. (2018)  
Societies IAU Individual Member  
Referee Regular referee for peer-reviewed journals (A&A, ApJ, MNRAS, Nature)

## Computer knowledge

- Programming Fortran 90/95, Python, C/C++, IDL; parallelization with OpenMP/MPI  
Supercomputer Regular user of high-performance computing clusters (e.g. Harvard University Odyssey cluster)

## Languages

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|---------|----------------|--|
| French  | Native speaker | <i>French citizen</i>  |
| English | Bilingual      | <i>Attended school in England (4 years); bilingual secondary education (7 years)</i> |
| Spanish | Excellent      | <i>Studied throughout secondary (5 years); spoken at home</i>                        |
| German  | Good           | <i>Studied throughout secondary (7 years); lived 4½ years in Munich</i>              |

## References

### Dr. Bruno Leibundgut

European Southern Observatory  
*VLT Programme Scientist*

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### Prof. Robert Kirshner

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*Clowes Professor of Science*

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### Prof. Brian Schmidt

Australian National University  
*Nobel Prize in Physics 2011*

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## Refereed publications

50 refereed publications (12 as first author). Total citations: 5769; indices:  $h = 36$ ,  $g = 50$  (as of September 3, 2018)

- 2018 **Blondin, S.**, L. Dessart, and D. J. Hillier. “The detonation of a sub-Chandrasekhar-mass white dwarf at the origin of the low-luminosity Type Ia supernova 1999by”. In: *MNRAS* 474, pp. 3931–3953. arXiv: 1711.09107.
- 2017 **Blondin, S.**, L. Dessart, D. J. Hillier, and A. M. Khokhlov. “Evidence for sub-Chandrasekhar-mass progenitors of Type Ia supernovae at the faint end of the width-luminosity relation”. In: *MNRAS* 470, pp. 157–165. arXiv: 1706.01901.
- Blondin, S.**, J. L. Prieto, F. Patat, P. Challis, M. Hicken, R. P. Kirshner, T. Matheson, and M. Modjaz. “Erratum: A Second Case of Variable Na I D Lines in a Highly-reddened Type Ia Supernova (2009, ApJ, 693, 207)”. In: *ApJ* 844, 88, p. 88.
- Dhawan, S., B. Leibundgut, J. Spyromilio, and **Blondin, S.** “Two classes of fast-declining Type Ia supernovae”. In: *A&A* 602, A118, A118. arXiv: 1702.06585.
- Hicken, M. et al. “Type II Supernova Light Curves and Spectra from the CfA”. In: *ApJS* 233, 6, p. 6. arXiv: 1706.01030.
- 2016 Dhawan, S., B. Leibundgut, J. Spyromilio, and **Blondin, S.** “A reddening-free method to estimate the  $^{56}\text{Ni}$  mass of Type Ia supernovae”. In: *A&A* 588, A84, A84. arXiv: 1601.04874.
- Narayan, G. et al. “Light Curves of 213 Type Ia Supernovae from the ESSENCE Survey”. In: *ApJS* 224, 3, p. 3. arXiv: 1603.03823.
- 2015 **Blondin, S.**, L. Dessart, and D. J. Hillier. “A one-dimensional Chandrasekhar-mass delayed-detonation model for the broad-lined Type Ia supernova 2002bo”. In: *MNRAS* 448, pp. 2766–2797. arXiv: 1501.06583.
- 2014 Dessart, L., **Blondin, S.**, D. J. Hillier, and A. Khokhlov. “Constraints on the explosion mechanism and progenitors of Type Ia supernovae”. In: *MNRAS* 441, pp. 532–550. arXiv: 1310.7747.
- Dessart, L., D. J. Hillier, **Blondin, S.**, and A. Khokhlov. “[Co III] versus Na I D in Type Ia supernova spectra”. In: *MNRAS* 439, pp. 3114–3120. arXiv: 1310.7750.
- Dessart, L., D. J. Hillier, **Blondin, S.**, and A. Khokhlov. “Critical ingredients of Type Ia supernova radiative-transfer modelling”. In: *MNRAS* 441, pp. 3249–3270. arXiv: 1308.6352.
- Modjaz, M. et al. “Optical Spectra of 73 Stripped-envelope Core-collapse Supernovae”. In: *AJ* 147, 99, p. 99. arXiv: 1405.1910.
- 2013 **Blondin, S.**, L. Dessart, D. J. Hillier, and A. M. Khokhlov. “One-dimensional delayed-detonation models of Type Ia supernovae: confrontation to observations at bolometric maximum”. In: *MNRAS* 429, pp. 2127–2142. arXiv: 1211.5892.
- Dessart, L., R. Waldman, E. Livne, D. J. Hillier, and **Blondin, S.** “Radiative properties of pair-instability supernova explosions”. In: *MNRAS* 428, pp. 3227–3251. arXiv: 1210.6163.
- 2012 **Blondin, S.** et al. “The Spectroscopic Diversity of Type Ia Supernovae”. In: *AJ* 143, 126, p. 126. arXiv: 1203.4832.
- Dessart, L., D. J. Hillier, R. Waldman, E. Livne, and **Blondin, S.** “Superluminous supernovae:  $^{56}\text{Ni}$  power versus magnetar radiation”. In: *MNRAS* 426, pp. L76–L80. arXiv: 1208.1214.
- 2011 **Blondin, S.**, D. Kasen, F. K. Röpké, R. P. Kirshner, and K. S. Mandel. “Confronting 2D delayed-detonation models with light curves and spectra of Type Ia supernovae”. In: *MNRAS* 417, pp. 1280–1302. arXiv: 1107.0009.
- Blondin, S.**, K. S. Mandel, and R. P. Kirshner. “Do spectra improve distance measurements of Type Ia supernovae?” In: *A&A* 526, A81, A81. arXiv: 1012.0005.
- Rest, A., B. Sinnott, D. L. Welch, R. J. Foley, G. Narayan, K. Mandel, M. E. Huber, and **Blondin, S.** “On the Interpretation of Supernova Light Echo Profiles and Spectra”. In: *ApJ* 732, 2, p. 2. arXiv: 1004.3783.

- Rest, A. et al. "Direct Confirmation of the Asymmetry of the Cas A Supernova with Light Echoes". In: *ApJ* 732, 3, p. 3. arXiv: 1003.5660.
- 2010 Burke, D. L. et al. "Precision Determination of Atmospheric Extinction at Optical and Near-infrared Wavelengths". In: *ApJ* 720, pp. 811–823.
- 2009 **Blondin, S.**, J. L. Prieto, F. Patat, P. Challis, M. Hicken, R. P. Kirshner, T. Matheson, and M. Modjaz. "A Second Case of Variable Na I D Lines in a Highly Reddened Type Ia Supernova". In: *ApJ* 693, pp. 207–215. arXiv: 0811.0002.
- Foley, R. J. et al. "Spectroscopy of High-Redshift Supernovae from the ESSENCE Project: The First Four Years". In: *AJ* 137, pp. 3731–3742. arXiv: 0811.4424.
- Hicken, M., W. M. Wood-Vasey, **Blondin, S.**, P. Challis, S. Jha, P. L. Kelly, A. Rest, and R. P. Kirshner. "Improved Dark Energy Constraints from ~100 New CfA Supernova Type Ia Light Curves". In: *ApJ* 700, pp. 1097–1140. arXiv: 0901.4804.
- Hicken, M. et al. "CfA3: 185 Type Ia Supernova Light Curves from the CfA". In: *ApJ* 700, pp. 331–357. arXiv: 0901.4787.
- Modjaz, M. et al. "From Shock Breakout to Peak and Beyond: Extensive Panchromatic Observations of the Type Ib Supernova 2008D Associated with Swift X-ray Transient 080109". In: *ApJ* 702, pp. 226–248. arXiv: 0805.2201.
- Simon, J. D. et al. "Variable Sodium Absorption in a Low-extinction Type Ia Supernova". In: *ApJ* 702, pp. 1157–1170. arXiv: 0907.1083.
- 2008 Becker, A. C. et al. "Exploring the Outer Solar System with the ESSENCE Supernova Survey". In: *ApJL* 682, pp. L53–L56. arXiv: 0805.4608.
- Blondin, S.** et al. "Time Dilation in Type Ia Supernova Spectra at High Redshift". In: *ApJ* 682, pp. 724–736. arXiv: 0804.3595.
- Dessart, L. et al. "Using Quantitative Spectroscopic Analysis to Determine the Properties and Distances of Type II Plateau Supernovae: SN 2005cs and SN 2006bp". In: *ApJ* 675, pp. 644–669. arXiv: 0711.1815.
- Foley, R. J. et al. "Constraining Cosmic Evolution of Type Ia Supernovae". In: *ApJ* 684, pp. 68–87. arXiv: 0710.2338.
- Matheson, T. et al. "Optical Spectroscopy of Type Ia Supernovae". In: *AJ* 135, pp. 1598–1615. arXiv: 0803.1705.
- Modjaz, M., R. P. Kirshner, **Blondin, S.**, P. Challis, and T. Matheson. "Double-Peaked Oxygen Lines Are Not Rare in Nebular Spectra of Core-Collapse Supernovae". In: *ApJL* 687, pp. L9–L12. arXiv: 0801.0221.
- Rest, A. et al. "Spectral Identification of an Ancient Supernova Using Light Echoes in the Large Magellanic Cloud". In: *ApJ* 680, pp. 1137–1148. arXiv: 0801.4762.
- Sauer, D. N. et al. "Properties of the ultraviolet flux of Type Ia supernovae: an analysis with synthetic spectra of SN 2001ep and SN 2001eh". In: *MNRAS* 391, pp. 1605–1618. arXiv: 0803.0871.
- Wood-Vasey, W. M. et al. "Type Ia Supernovae Are Good Standard Candles in the Near Infrared: Evidence from PAIRITEL". In: *ApJ* 689, pp. 377–390. arXiv: 0711.2068.
- 2007 **Blondin, S.** and J. L. Tonry. "Determining the Type, Redshift, and Age of a Supernova Spectrum". In: *ApJ* 666, pp. 1024–1047. arXiv: 0709.4488.
- Brown, P. J. et al. "Early Ultraviolet, Optical, and X-Ray Observations of the Type IIP SN 2005cs in M51 with Swift". In: *ApJ* 659, pp. 1488–1495. eprint: astro-ph/0612541.
- Davis, T. M. et al. "Scrutinizing Exotic Cosmological Models Using ESSENCE Supernova Data Combined with Other Cosmological Probes". In: *ApJ* 666, pp. 716–725. eprint: astro-ph/0701510.
- Garg, A. et al. "Light Curves of Type Ia Supernovae from Near the Time of Explosion". In: *AJ* 133, pp. 403–419. eprint: astro-ph/0608639.

- Hicken, M., P. M. Garnavich, J. L. Prieto, **Blondin, S.**, D. L. DePoy, R. P. Kirshner, and J. Parrent. “The Luminous and Carbon-rich Supernova 2006gz: A Double Degenerate Merger?” In: *ApJL* 669, pp. L17–L20. arXiv: 0709.1501.
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- Stubbs, C. W. et al. “Toward More Precise Survey Photometry for PanSTARRS and LSST: Measuring Directly the Optical Transmission Spectrum of the Atmosphere”. In: *PASP* 119, pp. 1163–1178. arXiv: 0708.1364.
- Wood-Vasey, W. M. et al. “Observational Constraints on the Nature of Dark Energy: First Cosmological Results from the ESSENCE Supernova Survey”. In: *ApJ* 666, pp. 694–715. eprint: astro-ph/0701041.
- 2006 **Blondin, S.** et al. “Using Line Profiles to Test the Fraternity of Type Ia Supernovae at High and Low Redshifts”. In: *AJ* 131, pp. 1648–1666. eprint: astro-ph/0510089.
- Modjaz, M. et al. “Early-Time Photometry and Spectroscopy of the Fast Evolving SN 2006aj Associated with GRB 060218”. In: *ApJL* 645, pp. L21–L24. eprint: astro-ph/0603377.
- 2005 **Blondin, S.**, J. R. Walsh, B. Leibundgut, and G. Sainton. “Extracting clean supernova spectra. Towards a quantitative analysis of high-redshift Type Ia supernova spectra”. In: *A&A* 431, pp. 757–771. eprint: astro-ph/0410406.
- Krisciunas, K. et al. “Hubble Space Telescope Observations of Nine High-Redshift ESSENCE Supernovae1,” in: *AJ* 130, pp. 2453–2472. eprint: astro-ph/0508681.
- Matheson, T. et al. “Spectroscopy of High-Redshift Supernovae from the ESSENCE Project: The First 2 Years”. In: *AJ* 129, pp. 2352–2375. eprint: astro-ph/0411357.
- 2004 Barris, B. J. et al. “Twenty-Three High-Redshift Supernovae from the Institute for Astronomy Deep Survey: Doubling the Supernova Sample at  $z > 0.7$ ”. In: *ApJ* 602, pp. 571–594. eprint: astro-ph/0310843.
- Strolger, L.-G. et al. “The Hubble Higher  $z$  Supernova Search: Supernovae to  $z \sim 1.6$  and Constraints on Type Ia Progenitor Models”. In: *ApJ* 613, pp. 200–223. eprint: astro-ph/0406546.

## Non-refereed publications

including 187 IAU circulars (161 as first author)

- 2015 **Blondin, S.** “Constraints on the explosion mechanism and progenitors of Type Ia supernovae”. In: *SF2A-2015: Proceedings of the Annual meeting of the French Society of Astronomy and Astrophysics*. Pp. 319–323.
- Blondin, S.**, L. Dessart, and D. J. Hillier. “A Spherical Chandrasekhar-Mass Delayed-Detonation Model for a Normal Type Ia Supernova”. In: *19th European Workshop on White Dwarfs*. Vol. 493. Astronomical Society of the Pacific Conference Series, p. 559.
- 2010 Burke, D. L. et al. “Calibration of the LSST instrumental and atmospheric photometric passbands”. In: *Observatory Operations: Strategies, Processes, and Systems III*. Vol. 7737. Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, p. 77371D.
- 2009 Howell, D. A. et al. “Type Ia supernova science 2010-2020”. In: *astro2010: The Astronomy and Astrophysics Decadal Survey*. arXiv: 0903.1086.
- Poznanski, D. et al. “Type II Supernovae as Probes of Cosmology”. In: *astro2010: The Astronomy and Astrophysics Decadal Survey*. arXiv: 0902.3142.
- 2007 **Blondin, S.** and J. L. Tonry. “Determining the Type, Redshift, and Phase of a Supernova Spectrum”. In: *The Multicolored Landscape of Compact Objects and Their Explosive Origins*. Vol. 924. AIP Conference Series, pp. 312–321. eprint: astro-ph/0612512.
- 2006 Sollerman, J. et al. “Supernova Cosmology and the ESSENCE Project”. In: *Beyond Einstein - Physics for the 21st Century*. Vol. 637. ESA-SP, p. 14.1. eprint: astro-ph/0510026.
- 2005 Leibundgut, B. and **Blondin, S.** “Evidence for dark energy from Type Ia supernovae”. In: *Nuclear Physics B Proceedings Supplements*. Vol. 138, pp. 10–15.