Jorge Cuadra

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Academic Appointments

- **2010–present**: Profesor Asistente at the Departamento de Astronomía y Astrofísica, **Pontificia Universidad Católica de Chile**, Santiago.
- **2008–2010**: Joint postdoctoral research position between the **Max-Planck Institute for Astrophysics**, Garching, Germany, and the **Shanghai Astronomical Observatory**, China.
- **2006–2008**: Postdoctoral researcher at **JILA, University of Colorado**, Boulder, USA.

Education

- **PhD in Astronomy, 2006**
  Max-Planck Institute for Astrophysics (MPA), Garching, Germany.
  Thesis: *Stars in the Galactic Centre: Sources and Probes of the Accretion Flow.*
  Advisers: Dr. S. Nayakshin and Prof. R. Sunyaev.
- **Licenciatura en Astronomía, 2001**
  P. Universidad Católica (PUC), Santiago, Chile.
  Dissertation: *The Luminosity Function of Galaxies up to* $z \sim 1.5$.
  Adviser: Prof. F. Barrientos.
- **Graduate Courses on Physics and Astronomy, 2001–2002**
  Courses on Engineering and Computer Science, 1996–2000
  P. Universidad Católica (PUC), Santiago, Chile.
- **Astrophysics Schools**
  - *Numerical N-body Dynamics*; Strasbourg, France, Mar. 2004
  - *Joint Evolution of Black Holes and Galaxies*; Como, Italy, May 2003
  - *Stellar Remnants*; Vatican Observatory, Italy, June–July 2001
  - Cerro Tololo Inter-American Observatory *Research Experience for Undergraduates* Programme; La Serena, Chile, Jan.–Mar. 2001

Research Experience

- **Massive black hole binaries mergers (since 2007)** Modelled numerically the coalescence of a massive black hole binary within a sub-pc gas disc. Scaled the results analytically, finding that disc-driven mergers are possible for binaries with $M \lesssim 10^7\,\mathrm{M}_\odot$.
- **Star formation in AGN accretion discs (since 2004)** Modelled the formation of young stars in the Galactic centre as the fragmentation of a massive accretion disc. Developed numerical simulations to quantify the effects of the disc thermodynamics and stellar feedback.
- **Stellar dynamics in the Galactic centre (since 2003)** Worked on analytical estimates and N-body simulations of the dynamics of stellar discs orbiting a massive black hole. Found that the evolution of a single flat disc cannot reproduce the observed Galactic centre dynamics.
- **Accretion of stellar winds in the Galactic centre (2004–07)** Constructed numerical models of stellar wind dynamics in the Galactic centre. Characterised the expected infrared and X-ray gas emission as a function of the stellar wind properties. Found that the accretion flow is variable and may form a 2-phase medium.
- **Eclipses and flares: signatures of an inactive disc (2002–03)** Constrained the existence of a cold accretion disc in the Galactic centre from the lack of variability of the observed stars. Also modelled X-ray flares in Sgr A* as star–disc collisions.
- **Observational Astronomy (1999–2002)** Used IRAF to measure the optical light curve of the unusual type Ia supernova 2000cx. Calculated the luminosity function at redshift ~ 1 from the Canada–France Deep Fields survey. Performed observations at various major telescopes in Chile.

Computational Skills

- Using and developing extensions for the smoothed particle hydrodynamics (SPH) parallel code GADGET.
- Using N-body codes such as MERCURY, NEMO, and GYRFALCON.
- Programming in C and IDL.

Research Resources Awarded

- NSF Teragrid Projects: *Gas dynamics of binary–disc interactions*, *Self-gravity and fragmentation in eccentric accretion discs*, and *Gas dynamics of binary–disc interactions including star formation.*
  Total of 1,054,480 CPU hours awarded as PI (2007–09)
- ESO Large Programme *The Galactic Centre: a unique laboratory for studying fundamental physical processes near black holes* (PI: R. Genzel). 22.5 nights + 91 hours awarded on ESO telescopes (2007–09)

Articles in Refereed Journals

- **Cuadra**, Armitage, Alexander, Begelman: *Massive black hole binary mergers within sub-pc scale gas discs.* MNRAS 393, 1423 (2009)
- Alexander, Armitage, **Cuadra**: *Binary formation and mass function variations in fragmenting discs with short cooling times.* MNRAS 389, 1655 (2008)
- **Cuadra**, Armitage, Alexander: *Stellar dynamical evidence against a cold disc origin for stars in the Galactic Centre.* MNRAS 388, L64 (2008)
- Alexander, Armitage, **Cuadra**, Begelman: *Self-gravitating fragmentation of eccentric accretion disks.* ApJ 674, 927 (2008)
- **Cuadra**, Nayakshin, Martins: *Variable accretion and emission from the stellar winds in the Galactic centre.* MNRAS 383, 458 (2008)
- Nayakshin, **Cuadra**, Springel: *Simulations of star formation in a gaseous disc around Sgr A* – a failed AGN.* MNRAS 379, 21 (2007)
- Nayakshin & **Cuadra**: *Clumpy stellar winds and the obscuration of active galactic nuclei.* A&A 465, 119 (2007)
- Paumard et al. (including **Cuadra**): *The Two Young Star Disks in the Central Parsec of the Galaxy: Properties, Dynamics and Formation.* ApJ 643, 1011 (2006)
- Nayakshin, Dehnen, **Cuadra**, Genzel: *Weighing the young stellar discs around Sgr A*.* MNRAS 366, 1410 (2006)
- **Cuadra**, Nayakshin, Springel, Di Matteo: *Galactic Centre stellar winds and Sgr A* accretion.* MNRAS 366, 358 (2006)

- Nayakshin & **Cuadra**: *A self-gravitating accretion disk in Sgr A* a few million years ago: Is Sgr A* a failed quasar?* A&A 437, 437 (2005)
- **Cuadra**, Nayakshin, Springel, Di Matteo: *Accretion of cool stellar winds on to Sgr A*: another puzzle of the Galactic Centre?* MNRAS 360, L55 (2005)
- Nayakshin, **Cuadra**, Sunyaev: *X-ray flares from Sgr A*: Star–disk interactions?* A&A 413, 173 (2004)
- **Cuadra**, Nayakshin, Sunyaev: *Bright stars and an optically thick inactive disk in Sgr A* and other dormant galaxy centers.* A&A 411, 405 (2003)
- Candia et al. (including **Cuadra**): *Optical and Infrared Photometry of the Unusual Type Ia Supernova 2000cx.* PASP 115, 277 (2003)
- Day et al. (including **Cuadra**): *Light and Color Curves of Six Field RR Lyrae Variable Stars.* PASP 114, 645 (2002)

Articles in Conference Proceedings

(Only first author contributions of at least two pages are listed.)

- *Black Hole Binary Mergers Within Gas Discs.* Hunting for the Dark: The Hidden Side of Galaxy Formation. AIP Conf. Ser., in press.
- *Accretion of Stellar Winds in the Galactic Centre.* The Energetic Cosmos: from Suzaku to ASTRO-H. pp. 130–133. Available online at `http://www-utheal.phys.s.u-tokyo.ac.jp/SuzakuConference2009`
- *Formation and Dynamics of Stellar Discs in the Galactic Center.* The Starburst–AGN Connection. ASP Conference Series, vol. 408, pp. 358–362 (2009)
- (invited) *Star formation and stellar winds around the Galactic supermassive black hole.* Astrophysics of Compact Objects. AIP Conference Proceedings, vol. 968, pp. 348–354 (2008)
- *Accretion of Stellar Winds in the Galactic Centre.* Relativistic Astrophysics and Cosmology – Einstein's Legacy. ESO Astrophysics Symposia. pp. 115–119 (2008)

- *Accretion of stellar winds onto Sgr A*.* Black Holes from Stars to Galaxies – Across the Range of Masses. IAU Symposium 238, pp. 191–194 (2007)

- *Variable accretion of stellar winds onto Sgr A*.* Galactic Center Workshop 2006 – From the Center of the Milky Way to Nearby Low-Luminosity Galactic Nuclei. J. Phys. Conf. Ser., vol. 54, pp. 436–442 (2006)

- *Accretion of Stellar Winds in the Galactic Centre.* XI IAU Regional Latin American Meeting of Astronomy. RevMexAA (SC), vol. 26, pp. 139–140 (2006)

- *Growing Stars in AGN Disks.* Growing black holes: accretion in a cosmological context. ESO Astrophysics Symposia. pp. 248–249 (2005)

Colloquia

Institute Seminar; MPA Garching, Germany, Mar. 2010
Astrophysics Seminar; Racah Inst. of Physics, Jerusalem, Israel, Dec. 2009
High Energy Astrophysics Seminar; MPA Garching, Germany, Feb. 2009
Physics Dept. Seminar; Univ. Andrés Bello, Santiago, Chile, Jan. 2009
Astronomy Dept. Seminar; Univ. de Chile, Santiago, Chile, Jan. 2009
Astronomy Dept. Colloquium; P. Univ. Católica, Santiago, Chile, Jan. 2009
Max-Planck Partner Group Seminar; Shanghai Obs., China, Nov. 2008
Lunch Talk; Leiden Observatory, Netherlands, June 2008
Astronomy Dept. Colloquium; P. Univ. Católica, Santiago, Chile, Dec. 2007
Astronomy Group Seminar; Univ. of Southampton, UK, Sep. 2007
Astronomy Seminar; Shanghai Observatory, China, July 2007
JILA Astrophysics Lunch Seminar; Boulder, USA, Jan. 2007
Lunch Talk; Leiden Observatory, Netherlands, June 2006
Star Formation Seminar; Astroph. Institute Potsdam, Germany, Feb. 2006
Institute Seminar; MPA Garching, Germany, Mar. 2005

Conference Talks

LISA Astro–GR meeting; Paris, France, Oct. 2010 (*invited review*)
460th Heraeus Workshop on Black Holes; Bad Honnef, Germany, June 2010
LISA Massive Black Hole Binaries; Zürich, Switzerland, Feb. 2010
Stars and Singularities; Rehovot, Israel, Dec. 2009 (*invited*)
The Hidden Side of Galaxy Formation. Qawra, Malta, Oct. 2009

Massive Black Hole Binaries; Beijing, China, July 2009 (*invited*)
The Energetic Cosmos: from Suzaku to ASTRO-H; Otaru, Japan, June 2009
8th Sino–German Workshop on Astrophysics; Kunming, China, Feb. 2009
7th Meeting of the Chilean Astronomical Society; Santiago, Chile, Jan. 2009
Kavli Workshop on Accretion Discs; Beijing, China, Nov. 2008
East-Asia Numerical Astrophysics Meeting; Nanjing, China, Nov. 2008
The Starburst–AGN Connection; Shanghai, China, Oct. 2008
Meeting of the Division on Dynamical Astronomy; Boulder, USA, Apr. 2008
Astrophysics of Compact Objects; Huangshan, China, July 2007 (*invited*)
Black Holes (IAU General Assembly); Prague, Czech Rep., Aug. 2006
Galactic Centre Workshop; Bad Honnef, Germany, Apr. 2006
11th Latin-American Regional IAU Meeting; Pucón, Chile, Dec. 2005
Relativistic Astrophysics and Cosmology; Munich, Germany, Nov. 2005
Workshop on Simulations with Gadget; Garching, Germany, Oct. 2005
High Energy Phenomena in the Galactic Centre; Paris, France, June 2005
Modelling Dense Stellar Systems (Modest-5a); Edinburgh, UK, Dec. 2004

Conference Posters

Circumstellar Disks to Planetary Systems; Garching, Germany, Nov. 2009
The Paradoxes of Massive Black Holes; Santa Barbara, USA, Apr. 2005
Growing Black Holes; Garching, Germany, June 2004
3rd Meeting of the Chilean Astronomical Society; Santiago, Chile, Jan. 2004
Joint Evolution of Black Holes and Galaxies; Como, Italy, May 2003
199th AAS Meeting; Washington, DC, USA, Jan. 2002
10th Latin-American IAU Meeting; Córdoba, Argentina, Sep. 2001

Other Professional Activities

- Webmaster of the Accretion Group at SHAO (2008–09).
- Organiser of the JILA Astrophysics Lunch Seminar (2007–08).
- Student Representative in the Executive Committee of the International Max-Planck Research School on Astrophysics (Garching, 2005).
- Member of the Local Organising Committee for the conference *Growing Black Holes: Accretion in a Cosmological Context* (Garching, 2004).
- Refereed papers for *ApJ*, *MNRAS*, *A&A*, and *PASJ*.

Fellowships

- Fellowship for International Young Researchers from the Chinese Academy of Sciences (2008–09).
- PhD Fellowship from the International Max-Planck Research School on Astrophysics at the University of Munich (2002–06).
- PhD Fellowship from CONICYT (2002).

Teaching Experience

- *Star Formation and Dynamics in the Galactic Centre*, 2-hour invited lecture, part of the graduate programme of the Joint Institute for Galaxy and Cosmology of SHAO and USTC, Shanghai (Oct. 2008).
- *Accretion Discs*, informal lecture at the Accretion Group Graduate Seminar, Shanghai Astronomical Observatory (Sep. 2008).
- *Star Formation and Stellar Wind Accretion in the Galactic Center*, invited lecture at the 'Galactic Center' Graduate Seminar, University of Colorado (Apr. 2008).
- Teaching Assistant for several courses at P. Univ. Católica de Chile:
  2001B: Experimental Astronomy (PC lab supervision)
  2001A: Extragalactic Astrophysics (preparing PC homework)
  2000B: General Astrophysics (problem classes)
  1999B: Space, Time and Universe (grading)
  1999A: Logic for Computer Science (problem classes)
  1998A: Introduction to Programming (grading)
  1997A: Introduction to Programming (writing code examples)

References

- Phil Armitage, JILA, University of Colorado, USA
  `pja@jilau1.colorado.edu`
- Sergei Nayakshin, University of Leicester, UK
  `Sergei.Nayakshin@astro.le.ac.uk`
- Volker Springel, Max-Planck Institute for Astrophysics, Germany
  `volker@mpa-garching.mpg.de`

Last updated on March 17, 2010.