Marco CIRELLI

Date of Birth: June 20th, 1975
Place of Birth: Milano, Italy
Citizenship: Italian (& French since 2015)

Curriculum Vitae

Present position and address:

from 10.2017 **CNRS Research Director** (DR2) in Theoretical Physics
currently at the **LPTHE, Jussieu**, Paris

LPTHE, CNRS & Sorbonne U., Boîte 126, T13-14 4ème étage
4 place Jussieu, F-75252 Paris, France
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Research Interests:

Astroparticle - Physics beyond the Standard Model - Cosmology
Dark Matter (models, direct and indirect searches, colliders)
Neutrinos (phenomenology, sterile neutrinos, neutrino cosmology, supernova)

Education and Past Employment:

07.2018 Italian Scientific Qualification to full professor

01.10.2017 Promotion to **Research Director** level of CNRS

10.2015 – 09.2017 **CNRS Researcher** (CR1), **LPTHE** at Jussieu, Paris, France

03.02.2015 **HDR** (french *Habilitation à Diriger des Recherches*) from **Orsay University**

10.2012 – 09.2015 **CNRS Researcher** (CR1) at **IPhT**, CEA-Saclay, France

10.2009 – 09.2012 **CERN Fellow** at CERN Theory Division
on leave from CNRS

10.2007 – 09.2009 **CNRS Researcher** (CR2) at **IPhT**, CEA-Saclay, France

10.2006 – 09.2007 **Post-Doc**, Institut de Physique Théorique at **CEA-Saclay**, France
awarded INFN postdoc fellowship, *first place - 97.5/100*

09.2003 – 09.2006 **Post-Doc**, Physics Dept., **Yale University**, New Haven, CT, USA
Particle Theory group (Prof. Thomas Appelquist)

17.04.2004 **Ph.D. in Physics** from **Scuola Normale Superiore**:
70/70 magna cum laude
Thesis: "Sterile neutrinos in 4D and 5D in supernovæ and the cosmo"
Advisors: R. Barbieri (Scuola Normale Superiore, Pisa),
A. Romanino (Scuola Normale Superiore, Pisa and CERN)
Board of external referees: A.Yu. Smirnov (ICTP, Trieste) and
A. Dolgov (INFN, Ferrara).

06 – 07.2003 Short Term Visitor at CERN Theory Division, Geneva, Switzerland
supported by Scuola Normale studentship

2001 – 2003 Ph.D. Student at Scuola Normale Superiore, Pisa, Italy
Research Interest: High Energy Physics, Extra dimensions, Neutrino Physics
Key courses: Elementary Particle Theory (R. Barbieri) - Cosmology (A. Riotto) -
Critical Phenomena (S. Caracciolo) - Monopoles (V. Zakharov) -
Non Perturbative aspects in Quantum Field Theory (F. Strocchi) -
String Theory (M. Porrati) - High Energy Astrophysics (M. Vietri)

11.07.2000 **Laurea in Physics** from **Milano University**:
110/110 magna cum laude
Thesis: "Soft Gluon Resummation in Drell-Yan processes in QCD"
Advisors: G. Marchesini (later at Milano-Bicocca University, Italy)
P. Nason (now at INFN, Milano-Bicocca, Italy)

1994 – 1999 Undergraduate studies in Physics, Milano University
Exams average: *29.8/30*

Languages:

Italian (native), English, French.

Miscellaneous awards:

- *PEDR* (Reward for Scientific Excellence) 2016-2020 – awarded by the CNRS
- **Thibaud prize** 2014 – awarded by the *Académie des sciences, belles-lettres et arts de Lyon*
- Laureate of European Research Council (**ERC**) **Starting Grant** 2011
- 'Nuclear Physics B Most Cited Article 2006-2010' Award – for paper [13] below

Professional Activities:

- Scientific Policy Steering and Administration:
  - member of the selection board,
    EDPIF, PhD School in physics in the Paris area
    2018 - 2020
  - member of the scientific council,
    UFR Physique (Physics Department) of UPMC - Sorbonne University, Paris
    2017 - 2020
  - member of the scientific council,
    LPNHE (Particle Physics Lab), UPMC - Sorbonne University, Paris
    2017 - 2020

▷ Grants and Grant Administration:
- national representative and working group deputy-coordinator, COST Action '*Connecting insights in fundamental physics*' (∼ 110 K€/yr in all), 2016–2020 (main coordinator A. Weiler)
- ERC Starting Grant, project '*NewDark*' (∼ 1.5 M€ over 5+1 yr), 2012–2018
- travel and collaboration grant funded by *PEPS CNRS* (5 K€/yr), 2010–2011 (main coordinator P. Serpico)
- one postdoctoral recruitment funded by *Physique des 2 Infinis* Consortium (100 K€), 2008–2010, with IAP
- 'scientist in charge' of the Saclay node of the European RTN Network *UniverseNet*, 2008-2011 (main coordinator S. Sarkar, Oxford)

▷ Advisor of PhD Students:
- PhD of Marta Maria Perego (jointly with SPP Saclay), 2014-2018
- PhD of Andrea Vittino (jointly with Torino University), 2012-2015
- PhD of Gaëlle Giesen, 2012-2015
- PhD of Paolo Panci (jointly with L'Aquila University), 2009-2011

▷ Supervision of Post-docs:
- Mathieu Boudaud, 2016-2019
- Kalliopi Petraki, 2015-2016
- Bradley Kavanagh, 2014-2017
- Filippo Sala, 2013-2017
- Marco Taoso, 2012-2015
- Gabrijela Zaharijas, 2009-2011
- Fabio Iocco (with IAP), 2008-2009

▷ Supervision of other Students and Post-docs:
- internship of Netra Gourlay (University of Edinburgh), 2018
- 'mentoring' of Amélie Chatelain, within the *STEP'UP* Doctoral School in Paris, 2016-2019
- internship of Kenza Zeghari (UPMC - Paris 6 University), 2017
- Erasmus internship of Elena Pinetti (University of Torino), 2016
- internship of Yifan Chen (École Polytechnique), 2015
- internship of Jatan Buch (Indian Institute of Technology, Kharagpur), 2014
- CERN summer student project of Caner Ünal, 2010
- 'mentoring' of Andrzej Hryczuk, within the *UniverseNet* network, 2009-2011
- master research internship of Carolin Bräuninger (Tübingen University), 2008–2009
- PhD research project of Yi-Zen Chu (Yale University), 2005–2006

▷ Conference/School Series Responsibilities:

- workshop on Large TPCs for low energy rare event detection,
  member of the Advisory Committee 2018
- GGI Lectures on the Theory of Fundamental Interactions,
  organizer since 2016
- TeVPA "TeV Particle Astrophysics Conference" series,
  member of the Scientific Organizing Committee since 2012
- PONT d'Avignon "Progress on Old and New Themes in cosmology" series,
  initiator and organizer since 2008

▷ Conference Organization:

- RPP 2018 "Rencontres Physique des Particules",
  Paris, April 2018 – organizer with K. Benakli, M. Joyce, P. Slavich and J. Silk
- PONT d'Avignon 2017 "Progress on Old and New Themes in cosmology",
  Avignon, April 2017 – organizer with Ph. Brax, C. Caprini, Ch. Marinoni, G. Servant and N. Tamanini
- *Journée Matière Noire* (Dark Matter day),
  Paris, France, dec 2016 – member of the Organizing Committee
- 6^{th} Amsterdam-Paris-Stockholm meeting,
  Gouvieux, France, aug 2016 – main organizer
- Theory LHC France general meeting,
  Orsay, nov 2016 – member of the Organizing Committee
- Warsaw Workshop on Non-Standard Dark Matter,
  Warsaw, jun 2016 – member of the International Advisory Committee
- Gamma rays and Dark Matter,
  Obergurgl, December 2015 – organizer with D. Berge, J. Conrad, O. Reimer, Ch. Weniger
- Planck 2014 "From the Planck scale to the electroweak scale",
  Paris, May 2014 – organizer with K. Benakli, E. Dudas, S. Lavignac and H. Partouche
- PONT d'Avignon 2014 "Progress on Old and New Themes in cosmology",
  Avignon, April 2014 – organizer with C. Caprini, G. Servant and Ph. Brax
- ICTP Workshop on the Future of Dark Matter Astro-Particle Physics,
  Trieste, Oct 2013 – organizer with G. Zaharijas, P. Serpico et al.
- DMUH11 "CERN TH-Institute: Dark Matter Undeground and in the Heavens",
  CERN, Geneva, July 2011 – main organizer
- PPC 2011 "Workshop on the Interconnections between Particle Physics and Cosmology",
  CERN, Geneva, June 2011 – member of the local organizing committee
- PONT d'Avignon 2011 "Progress on Old and New Themes in cosmology",
  Avignon, April 2011 – organizer with C. Caprini, G. Servant and Ph. Brax
- DMaa "Dark Matter All Around",
  Paris, December 2010 – member of the local organizing committee
- ICHEP 2010 "International Conference on High Energy Physics",
  Paris, July 2010 – member of scientific committee, of local committee, proceedings editor
- TeVPA 2010 "TeV Particle Astrophysics Conference",
  Paris, July 2010 – member of the local organizing committee

– TANGO in PARIS "Testing Astroparticle with the New GeV-TeV Observations: Positrons And electRons, Identifying the Sources",
Paris, May 2009 – member of the local organizing committee

– PONT d'Avignon 2008 "Progress on Old and New Themes in cosmology",
Avignon, April 2008 – organizer with G. Servant and Ph. Brax

▷ Conference Convenership:

– TeVPA 2016 "TeV Particle Astrophysics Conference",
CERN, September 2016 – session organizer: "Dark Matter Indirect Detection"

– Texas Symposium on Relativistic Astrophysics,
Geneva, December 2015 – session organizer: "Dark Matter"

– IFT Madrid Workshop - "Physics Challenges in the face of LHC-13",
Madrid, September 2014 – session organizer: "Dark Matter"

– APP 2014 "AstroParticle Physics 2014",
Amsterdam, June 2014 – session co-organizer: "Indirect Dark Matter Searches"

– IFAE 2014 "Incontri di Fisica delle Alte Energie 2014",
L'Aquila, Italy, April 2014 – session co-organizer: "Cosmic Frontier (DM, neutrinos, cosmic rays)"

– WIN 2013 "XXIV Weak Interactions and Neutrino Workshop",
Natal, Brazil, September 2013 – session co-organizer: "Astroparticle Physics"

– ICATPP 2011 "Astroparticle, Particle, Space Physics & Detectors for Physics Applications",
Como, October 2011 – session co-organizer: "Production of CR from Exotic Matter & Astro Sources"

– ECFA Study of "Physics and Detectors for a Linear Collider 2010",
Geneva, October 2010 – co-convener: "Connection to Cosmology"

– CRICATPP 2010 "Cosmic Rays Int. Conf. on Advanced Technology in Particle Physics",
Como, October 2010 – session co-organizer: "Production of CR from exotic matter"

– COSMO 2009,
CERN, September 2009 – parallel session convener: "Dark Matter"

– ENTApP Dark Matter Visitor's Program,
DESY - 25-29 Feb 2008, Hamburg, Germany – convener

▷ Meeting Series Organization:

– monthly meetings *Initiative for Cosmology and Astroparticle Physics* at IAP, Paris
from 2018 – with J. Silk, B. Wandelt, N. Kaiser

– french *GDR/IRN TeraScale*
from 2013 – Dark Matter coordinator with E. Moulin

– yearly mini-workshops at IPhT and LPTHE on Dark Matter (*NewDark* project)
from 2013 to 2017 – local organization

– french *GDR Neutrino*
from 2008 to 2013 – theory coordinator with S. Lavignac

– *Rencontres IPhT/SPP*, regular tri-annual meetings theorists $\leftrightarrow$ experimentalists in particle physics and cosmology at Saclay
2008–2009 – organizer with E. Mazzucato

– mini-workshops at IPhT on the Physics of ElectroWeak Symmetry Breaking and LHC
2008–2009 – local organization

▷ Seminar Organization:
- AstroParticle and Phenomenology friday seminar series, CERN-TH, 2010
- Particle and Cosmology seminar series, IPhT CEA/Saclay, 2007–2009
- High Energy Theory seminar series, Yale University, 2004–2005

▷ Grant Reviewer:
- for the FWF Austrian Science Fund, 2018
- for the Swiss National Science Foundation, 2018
- for the University of Calabria (Italy), 2017
- for the Israeli Science Foundation, 2017
- for the University of Grenoble, 2016
- for the Research Grants Council of Hong Kong, 2016, 2017
- for the ULB Bruxelles, 2016
- for the FWO Belgium, 2016
- for the CEA Eurotalents, 2015, 2017
- for the NWO The Netherlands, 2015
- for the FNRS Belgium, 2015, 2016, 2017
- for the Polish National Science Center, 2014, 2015
- for the CONICYT, Chile, 2014
- for the ERC (European Research Council), 2009, 2014, 2016
- for the European Commission Research Executive Agency, 2014, 2015, 2016, 2017, 2018
- for the Italian Ministry of University (FIRB, PRIN, Montalcini), Italy, 2013, 2015, 2016
- for the ANVUR (Research and University Evaluation National Agency), Italy, 2012, 2016
- for the Région Rhônes-Alpes, France, 2012
- for the Académie universitaire Louvain, Belgium, 2011
- for the NSERC (Natural Science and Engineering Research Council) of Canada, 2008

▷ Evaluation committee member:
- PhD of Glenn Robbins at Lyon-1 University, September 2018
- PhD of Stephen Lonsdale at Melbourne University, May 2018
- PhD of Maria Giulia Ratti at Milano University, February 2018
- PhD of Giovanni Grilli di Cortona at SISSA Trieste, September 2016
- PhD of Sami Caroff at University of Grenoble, September 2016 (rapporteur)
- PhD of Thomas Lacroix at Institut d'Astrophysique de Paris, July 2016
- HDR of Nathalie Besson at Paris 7 Diderot University, November 2015
- PhD of Michele Lucente at Orsay University, September 2015
- PhD of Tiziana Scarnà at ULB Bruxelles, December 2014
- PhD of Marco Farina at Scuola Normale Superiore Pisa, October 2013
- PhD of Daniel Albornoz-Vasquez at Annecy, September 2011
- PhD of Gilles Vertongen at ULB Bruxelles, September 2009

▷ Journal Referee (since 2004):

- Nature, Physical Review Letters, Physical Review X, Astrophysical Journal Letters, Nuclear Physics B, Physics Letters B, JHEP, JCAP, Physical Review D, Science Advances, MNRAS, Progress of Theoretical Physics, Advanced Space Research, European Journal of Physics C, European Journal of Physics Conferences, International Journal of Modern Physics A, Annalen der Physik, Frontiers, Advances in High Energy Physics, Journal of Scientific Research and Reports
- 'Outstanding referee' awards: Physics Letters B 2009, Nuclear Physics 2013, EPJ 2014, IJMPA 2016.

▷ Memberships in research networks:

- French *Groupement de Recherche* (GDR) / *International Research Network* (IRN) TeraScale
  since 2013
- *Theory LHC France* Initiative
  2015 – 2016
- ERC Advanced Grant *Dark Matters* (PI J. Silk)
  2011 – 2017, senior team member
- *UniverseNet* European Research and Training Network (coordinator S. Sarkar)
  2008 – 2011
- *UniLHC* European Research and Training Network (coordinator I. Antoniadis)
  2009 – 2013
- *Phys@Col&Cos* Agence Nationale de la Recherche (ANR) grant (coordinators C. Savoy)
  2006 – 2008
- *DarkPhys* ANR grant (coordinators G. Servant et P. Brax)
  2006 – 2008
- French *Groupement de Recherche* (GDR) Neutrinos
  2006 – 2013

▷ Memberships:

- Société Française de Physique (since 2007)
- Associazione Alunni Scuola Normale Superiore

▷ Outreach:

- Public lectures (in english, french or italian): CERN (several occasions, 2010 to 2012), Vipava (2016), Avignon (2016), Crema (2016), Paris (2017), Nantes (2018), Montgeron (2018)
  typically 50 to 300 people in the audience
- Lectures in high schools: Como (2016), Vimercate (2016, 2017), Lugano (2016), Seregno (2017), Ravenna (2017, 2018)
- Lectures to Italian high school teachers at CERN (2014, 2015, 2016, 2017, 2018)
  4 to 6 hours on Particle Physics beyond the SM and Cosmology (basic and advanced levels)
- Q&A sessions at screenings of the docu-movie 'Particle Fever' (2014)
- CERN hang-out on Dark Matter (2013): collective online interview and discussion
  around 500 online participants and around 5000 offline viewers
- CERN official guide, including CMS and AD (2010 – 2012)

– Occasional consulting for the Physics Education Research group of CERN
– Organization of a general public lecture on Einstein and GR, Palais Papes, Avignon (2017)
about 200 attendees
– Organization of 'art & science' exhibition by artist Berta Sesé, Palais Papes, Avignon (2017)
– Popular articles, communications and interviews: see on page 13

List of Publications:

Other non-published (refereed and non-refereed) works can be found on my personal webpage.

41. M. Boudaud and M. Cirelli,
"Voyager-1 $e^{\pm}$ further constrain Primordial Black Holes as Dark Matter,"
arXiv:1807.03075 [astro-ph.HE].

40. I. Baldes, M. Cirelli, P. Panci, K. Petraki, F. Sala, M. Taoso,
"Asymmetric dark matter: residual annihilations and self-interactions,"
SciPost Phys. **4** (2018) 041 [arXiv:1712.07489 [hep-ph]].

39. M. Cirelli, P. Panci, K. Petraki, F. Sala, M. Taoso,
"Dark Matter's secret liaisons: phenomenology of a dark U(1) sector with bound states,"
JCAP **1705** (2017) 05, 036 [arXiv:1612.07295 [hep-ph]].

38. M. Cirelli and M. Taoso,
"Updated galactic radio constraints on Dark Matter ",
JCAP **1607** (2016) 07, 041 [arXiv:1604.06267 [hep-ph]].

37. M. Cirelli, T. Hambye, P. Panci, F. Sala, M. Taoso,
"Gamma ray tests of Minimal Dark Matter",
JCAP 1510 (2015) 10, 026 [arXiv:1507.05519 [hep-ph]].

36. J. Buch, M. Cirelli, G. Giesen, M. Taoso,
"PPPC 4 DM secondary: A Poor Particle Physicist Cookbook for secondary radiation from DM",
JCAP **1509** (2015) 09, 037 [arXiv:1505.01049 [hep-ph]].

35. G. Giesen, M. Boudaud, Y. Genolini, V. Poulin, M. Cirelli, P. Salati, P. D. Serpico,
"AMS-02 $\bar{p}$, at last! Secondary astrophysical component and immediate implications for DM",
JCAP **1509** (2015) 09, 023 [arXiv:1504.04276 [astro-ph.HE]].

34. M. Boudaud, M. Cirelli, G. Giesen, P. Salati,
"A fussy revisitation of antiprotons as a tool for Dark Matter searches",
JCAP **1505** (2015) 05, 013 [arXiv:1412.5696 [astro-ph.HE]].

33. M. Cirelli, F. Sala, M. Taoso,
"Wino-like Minimal Dark Matter and future colliders",
JHEP **1410** (2014) 033 [JHEP **1501** (2015) 041], arXiv:1407.7058 [hep-ph].

32. M. Cirelli, D. Gaggero, G. Giesen, M. Taoso, A. Urbano,
"Antiproton constraints on the GeV gamma-ray excess: a comprehensive analysis",
JCAP **1412** (2014) 12, 045, arXiv:1407.2173 [hep-ph].

31. M. Cirelli, N. Fornengo, M. Taoso, A. Vittino,
"Anti-helium from Dark Matter annihilations",
JHEP **1408** (2014) 009, arXiv:1401.4017 [hep-ph].

30. P. Baratella, M. Cirelli, A. Hektor, J. Pata, M. Piibeleht, A. Strumia,
"PPPC 4 DMν: A Poor Particle Physicist Cookbook for neutrinos from DM annihil. in the Sun",
JCAP **1403** (2014) 053, arXiv:1312.6408 [hep-ph].

29. M. Cirelli, P. D. Serpico, G. Zaharijas,
"Bremsstrahlung gamma rays from light Dark Matter",
JCAP **1311** (2013) 035, arXiv:1307.7152 [astro-ph.HE].

28. E. Del Nobile, M. Cirelli, P. Panci,
"Tools for model-independent bounds in direct dark matter searches",
JCAP **1310** (2013) 019, arXiv:1307.5955 [hep-ph].

27. M. Cirelli, G. Giesen,
"Antiprotons from Dark Matter: Current constraints and future sensitivities",
JCAP **1304** (2013) 015, arXiv:1301.7079 [hep-ph].

26. G. Belanger, C. Boehm, M. Cirelli, J. Da Silva, A. Pukhov,
"PAMELA and FERMI-LAT limits on the neutralino-chargino mass degeneracy",
JCAP **1211** (2012) 028, arXiv:1208.5009 [hep-ph].

25. M. Cirelli, E. Moulin, P. Panci, P. D. Serpico, A. Viana,
"Gamma ray constraints on Decaying Dark Matter"
Phys. Rev. **D86** (2012) 083506, arXiv:1205.5283 [astro-ph.CO].

24. M. Cirelli, P. Panci, G. Servant, G. Zaharijas,
"Consequences of DM/antiDM Oscillations for Asymmetric WIMP Dark Matter",
JCAP **1203** (2012) 015, arXiv: 1110.3809 [hep-ph].

23. P. Ciafaloni, M. Cirelli, D. Comelli, A. De Simone, A. Riotto, A. Urbano,
"Initial State Radiation in Majorana Dark Matter Annihilations",
JCAP **1110** (2011) 034, arXiv:1107.4453 [hep-ph].

22. P. Ciafaloni, M. Cirelli, D. Comelli, A. De Simone, A. Riotto, A. Urbano,
"On the Importance of Electroweak Corrections for Majorana Dark Matter Indirect Detection",
JCAP **1106** (2011) 018, arXiv:1104.2996 [hep-ph].

21. M. Cirelli, G. Corcella, A. Hektor, G. Hutsi, M. Kadastik, P. Panci, M. Raidal, F. Sala, A. Strumia,
"PPPC 4 DM ID: A Poor Particle Physicist Cookbook for Dark Matter Indirect Detection",
JCAP **1103** (2011) 051, arXiv:1012.4515 [hep-ph].

20. M. Cirelli, J. Cline,
"Can multistate dark matter annihilation explain the high-energy cosmic ray lepton anomalies?"
Phys. Rev. **D 82** (2010) 023503, arXiv:1005.1779 [hep-ph].

19. M. Cirelli, P. Panci, P. D. Serpico
"Diffuse gamma ray constraints on annihilating or decaying Dark Matter after Fermi"
Nucl. Phys. B **840** (2010) 284-303, arXiv:0912.0663 [astro-ph.CO].

18. M. Cirelli, F. Iocco, P. Panci
"Constraints on Dark Matter annihilations from reionization and heating of the intergalactic gas"
JCAP 10 (2009) 009, arXiv:0907.0719 [astro-ph.CO].

17. M. Cirelli, P. Panci
"Inverse Compton constraints on the Dark Matter e+e- excesses"
Nucl. Phys. B **821** (2009) 399-416, arXiv:0904.3830 [astro-ph.CO].

16. C. B. Braeuninger, M. Cirelli
"Anti-deuterons from heavy Dark Matter"
Phys. Lett. B **678** (2009) 20-31, arXiv:0904.1165 [hep-ph].

15. M. Cirelli, A. Strumia
"Minimal Dark Matter: Model and results"
New J. of Phys. 11 (2009) 105005 *(invited review)*, arXiv:0903.3381 [hep-ph].

14. G. Bertone, M. Cirelli, A. Strumia, M. Taoso
"Gamma-ray and radio tests of the e+e- excess from DM annihilations"
JCAP 03 (2009) 009, arXiv:0811.3744 [hep-ph].

13. M. Cirelli, M. Kadastik, M. Raidal, A. Strumia
"Model-independent implications of the $e^{\pm}, \bar{p}$ cosmic ray spectra on properties of Dark Matter"
Nucl. Phys. B **813** (2009) 1-21, arXiv:0809.2409 [hep-ph].

12. M. Cirelli, R. Franceschini, A. Strumia
"Minimal Dark Matter predictions for galactic positrons, anti-protons, photons"
Nucl. Phys. B **800** (2008) 204-220, arXiv:0802.3378 [hep-ph].

11. M. Cirelli, A. Strumia, M. Tamburini
"Cosmology and Astrophysics of Minimal Dark Matter"
Nucl. Phys. B **787** (2007) 152-175, arXiv:0706.4071 [hep-ph].

10. M. Cirelli, Y.-Z. Chu
"Sterile neutrinos, lepton asymmetries, primordial light elements: how much of each?"
Phys. Rev. D **74** (2006) 085015, arXiv:astro-ph/0608206.

9. M. Cirelli, A. Strumia
"Cosmology of neutrinos and extra light particles after WMAP3"
JCAP 12 (2006) 013, arXiv:astro-ph/0607086.

8. M. Cirelli, N. Fornengo, A. Strumia
"Minimal Dark Matter"
Nucl. Phys B **753** (2006) 178, arXiv:hep-ph/0512090.

7. M. Cirelli, N. Fornengo, T. Montaruli, I. Sokalski, A. Strumia and F. Vissani
"Spectra of neutrinos from dark matter annihilations"
Nucl. Phys. B **727** (2005) 99, arXiv:hep-ph/0506298.

6. M. Cirelli, M.C. Gonzalez-Garcia, C. Peña-Garay
"Mass varying neutrinos in the Sun"
Nucl. Phys. B **719** (2005) 219, arXiv:hep-ph/0503028.

5. M. Cirelli, G. Marandella, A. Strumia. F. Vissani
"Probing Oscillations into Sterile Neutrinos with astrophysics, cosmology and experiments"
Nucl. Phys. B **708** (2005) 215-267, arXiv:hep-ph/0403158.

4. G. Cacciapaglia, M. Cirelli, A. Romanino
"Signatures of Supernova Neutrino Oscillations into Extra Dimensions"
Phys. Rev. D **68** (2003) 033013, arXiv:hep-ph/0302246.

3. G. Cacciapaglia, M. Cirelli, Y. Lin, A. Romanino
"Bulk neutrinos and core collapse supernovae"
Phys. Rev. D **67** (2003) 053001, arXiv:hep-ph/0209063.

2. G. Cacciapaglia, M. Cirelli, G. Cristadoro
"Muon anomalous magnetic moment in a calculable model with one extra dimension"
Nucl. Phys. B **634** (2002) 230-246, arXiv:hep-ph/0111288.

1. G. Cacciapaglia, M. Cirelli, G. Cristadoro
"Gluon fusion production of the Higgs boson in a calculable model with one extra dimension"
Phys. Lett. B **531** (2002) 105-111, arXiv:hep-ph/0111287.

(Selected) list of Proceedings & similar:

24. L. Oakes *et al.* [HESS Collaboration],
"Dark matter line searches towards dwarf galaxies with H.E.S.S,"
PoS ICRC **2017** (2018) 905.

23. M. Cirelli,
"Gamma-ray signatures of Dark Matter,"
EPJ Web Conf. **136** (2017) 01004.

22. M. Cirelli,
"Status of (Direct and) Indirect Dark Matter searches,"
PoS CORFU **2015** (2016) 026.

21. G. Giesen, Y. Génolini, V. Poulin, M. Cirelli, P. Salati, P. Serpico and M. Boudaud,
"A fussy revisitation of antiprotons as a tool for Dark Matter searches,"
PoS ICRC **2015** (2016) 1184.

20. M. Cirelli,
"Dark Matter indirect detection: Some anomalies and many constraints,"
EPJ Web Conf. **121** (2016) 06002.

19. M. Cirelli,
"Dark matter indirect searches: charged cosmic rays,"
J. Phys. Conf. Ser. **718** (2016) no.2, 022005.

18. T. Golling *et al.*,
"Physics at a 100 TeV pp collider: beyond the Standard Model phenomena,"
CERN Yellow Report (2017) no.3, 441-634 [arXiv:1606.00947 [hep-ph]].

17. M. Cirelli,
"Status of Indirect (and Direct) Dark Matter searches",
PoS ICRC **2015** (2016) 014, arXiv:1511.02031 [astro-ph.HE].

16. M. Cirelli,
"Dark Matter Indirect Detection amid hints and constraints,"
PoS NEUTEL **2015** (2015) 020.

15. M. Cirelli,
"Dark Matter indirect detection: recent developments and perspectives,"
PoS CORFU **2014** (2014) 047.

14. M. Cirelli,
"Dark Matter searches: A theoretical perspective,"
Nuovo Cim. C **035** (2012) no.06, 29 [Frascati Phys. Ser. **57** (2013) 29].

13. M. Cirelli,
"Dark Matter Indirect searches: phenomenological and theoretical aspects,"
J. Phys. Conf. Ser. **447** (2013) 012006.

12. M. Cirelli,
"Tools for dark matter indirect detection,"
Frascati Phys. Ser. **54** (2012) 32.

11. M. Cirelli,
"Recent developments in theory and phenomenology of dark matter,"
Nuovo Cim. C **033N5** (2010) 35.

10. G. Brooijmans, B. Gripaios, F. Moortgat, Jose Santiago, P. Skands, C. Balazs *et al.*,
"Les Houches 2011: Physics at TeV Colliders New Physics Working Group Report",
Proceedings of Les Houches workshop 2011, arXiv:1203.1488 [hep-ph].

9. M. Cirelli,
"Indirect Searches for Dark Matter: a status review",
Proceedings of Lepton-Photon 2011, arXiv: 1202.1454 [hep-ph], Pramana **79** (2012) 1021-1043.

8. M. Cirelli,
"Dark matter, cosmic rays and neutrinos: Status circa 2010,"
Nucl. Phys. Proc. Suppl. **217** (2011) 237.

7. M. Cirelli,
"Hoping to indirectly detect dark matter with cosmic rays,"
AIP Conf. Proc. **1304** (2010) 152.

6. P. Brun, G. Bertone, M. Cirelli, E. Moulin, J.-F. Glicenstein, F. Iocco, L .Pieri
"The Cosmic Ray Lepton Puzzle"
Proceedings of the French Astronomy and Astrophyics Society, arXiv:1001.5408 [astro-ph.HE].

5. M. Cirelli,
"Non-standard neutrinos and Cosmology,"
Nucl. Phys. Proc. Suppl. **188** (2009) 339.

4. M. Cirelli, A. Strumia
"Minimal Dark Matter predictions and the PAMELA positron excess"
Proceedings of Physics, PoS(iDM2008)089, arXiv:0808.3867 [astro-ph].

3. M. Cirelli,
"Sterile Neutrinos in Astrophysical and Cosmological Sauce",
Proceedings of Pascos 2004 and of IFAE 2004, arXiv:astro-ph/0410122.

2. M. Cirelli
"Neutrinos in Extra Dimensions and Supernovae"
Proceedings of the 38th Rencontres de Moriond – Electroweak Interactions and unified theories, ed. J. Trân Thanh Vân, World Publishers, arXiv:hep-ph/0305141.

1. M. Cirelli
"Muon g-2 in a model with one extra dimension"
Proceedings of the 37th Rencontres de Moriond EW, arXiv:hep-ph/0205140.

Popular Articles and other publications:

+ M. Cirelli,
Book review of "Particle Physics in the LHC era"
by G. Barr, R. Devenish, R. Walczak, and T. Weidberg, Oxford University Press 2016,
Physics Today 70, 2017.

+ "Dark is the new Black",
Scientia Publications, 2016.

+ M. Cirelli,
"Dark matter candidates",
Newsletter of the Euclid Education & Public Outreach activity, 2014.

+ P. Brun, M. Cirelli,
"Shedding light on the dark sides of the Universe" (in french),
ScintillationS (CEA/IRFU magazine), June 2012.

+ M. Cirelli, C. Bonvin
"Theory of Dark Matter" (in french)
Clefs du CEA, October 2009

+ M. Cirelli, F. Zamponi
"On the academic recruitment system in Italy" (in italian and in english),
La Stampa (italian daily newspaper), October 2007

+ interviews with Nature (UK), Scientific American (USA), ScienceNews (USA), New Scientist (UK), Cosmos Magazine (Australia), The Australian (Australia), The Times Online (UK), Mumbai News (India), EmmeCiQuadro and ilSussidiario.net (Italy), Physics Today (UK), Radio Dee-Jay (Italy), Science & Vie (France), CERN Bulletin (Switzerland), Physics World (UK), Science & Avenir (France), Quanta Magazine (USA)...

+ long interview with Hugo Ctiborsky, in the context of the "Scientific research: the Invisible" project, La Femis (french National High School of Image and Sound Professions)

Editor:

– ICHEP 2010 Proceedings, published by Proceedings of Science 2011, PoS ICHEP2010 (2010).

Main invited plenary talks at Conferences

- Dark Matters - Joe Silk's 75th birthday - 11-13 Dec 2017, Paris, France
- ICRC 2015 - International Cosmic Ray Conference - 30 Jul - 6 Aug 2015, The Hague, NL
  Rapporteur talk
- PANIC 2014 - Particles and Nuclei International Conference - 25-29 Aug 2014, Hamburg, Germany
- DISCRETE 2012 - Physics of Discrete Symmetries, 3-7 Dec 2012, Lisbon, Portugal
- Strong and Electroweak Matter (SEWM) 2012 - 9-13 Jul 2012, Swansea, UK
- Lepton-Photon 2011 - 22-27 Aug 2011, Mumbai, India
- NOW 2010 - 5-11 Sep 2010, Conca Specchiulla, Italy
- PASCOS 2009 - 6-10 Jul 2009, Hamburg, Germany
- Moriond EW 2009 - 7-13 Mar 2009, La Thuile, Italy
- NUFACT 06 - 24-30 Aug 2006, Irvine CA, Usa

Lectures

- *invited lectures* – "Dark Matter Phenomennology",
  cours de l'IPhT Saclay, 10h lectures, Jun-Jul 2018, Saclay, France

- *invited lectures* – "Dark Matter",
  Master course at Università Milano Statale, 4h lectures, 2016, 2017, 2018, Milano, Italy

- *invited topical lecture* – "Overview of the status of Particle and Astroparticle Physics",
  Master course at École Normale Supérieure, 1h, Nov 2017, Paris, France

- *invited lectures* – "Dark Matter with cosmic rays",
  International School of Space Science 2017, 2h, 12-16 Jun 2017, GSSI L'Aquila, Italy

- *invited lectures* – "Dark Matter",
  ISAPP school 'Physics & Astrophysics of CR in Space', 3h lectures, 12-20 Sep 2016, Milano, Italy

- *invited lectures* – "Astroparticles of Dark Matter",
  6th IDPASC school, 6h lectures, 23 May - 1 Jun 2016, Vipava, Slovenia

- *invited lectures* – "Dark Matter",
  PhD course at Università Milano Bicocca, 8h lectures, 23-26 Feb 2015, Milano, Italy

- *invited lectures* – "Dark Matter models and Indirect Detection",
  Doctoral Program of 'Suisse Romande', 16h lectures, Nov-Dec 2013, Lausanne, Switzerland

- *invited lectures* – "Dark Matter",
  Sixth TRR33 Winter School, 4h lectures, 9-14 Dec 2012, Passo del Tonale, Italy

- *invited lectures* – "Dark Matter searches",
  Retreat of the graduate school 'Symmetry Breaking', 22-24 Sep 2012, Mainz, Germany

- *invited lectures* – "Dark Matter",
  ICTP Summer School on Cosmology 2012, 16-17 Jul 2012, Trieste, Italy

- *invited lectures* – "Introduction to the Dark Components of the Universe" and "Neutrinos as a dark component of the Universe",
  ISAPP (International School on Astro-Particle Physics) - 8 -15 Jul 2011, Heidelberg, Germany

- *invited lecture* – "Dark Matter indirect detection",
  UniverseNet School and Meeting - 12 -18 Sep 2010, Lecce, Italy

- *invited lectures* – "Hoping to indirectly detect Dark Matter with cosmic rays",
  Carpathian Summer School of Physics 2010 - 20 Jun - 3 Jul 2010, Sinaia, Romania

- *invited lectures* – "Dark Matter",
  UniverseNet School and Meeting - 28 Sep - 2 Oct 2009, Autonoma Barcelona, Spain

- *invited lectures* – "Dark Matter in cosmic rays",
  Ecole de Physique des Astroparticules - 7-12 Sep 2009, OHP, Saint Michel l'Observatoire, France

- *invited lectures* – "Dark Matter", Roma 2 Tor Vergata - 5-6 Feb 2009, Roma, Italy

Other conferences

- IRN TeraScale Durham - 4-7 Sep 2018, Durham, UK
- TeVPA 2018 - 27-31 Aug 2018, Berlin, Germany
- *invited talk* – PACTS 2018 - 18-22 Jun 2018, Tallinn, Estonia
- IRN TeraScale- 30 May - 1 Jun 2018, Strasbourg, France
- *invited talk* – XXXVI Convegno Nazionale di Fisica Teorica - 23-26 May 2018, Cortona, Italy
- Conference Pierre Binetruy - 3-4 May 2018, Paris, France
- RPP 2018 - 11-13 Apr 2018, Jussieu, Paris, France
- *invited talk* – Dark Matter at the dawn of discovery - 9-11 Apr 2018, Heidelberg, Germany
- *invited talk* – LHC Results forum - webminar - Feb 2018
- *invited talk* – UK Annual Theory Meeting - 19 Dec 2017, Durham, UK
- IRN Terascale - 13-15 Dec 2017, Marseille, France
- Journée Matière Noire - 30 Nov 2017, APC, Paris, France
- *invited talk* – 50 years LPTHE anniversary - 27-28 Nov 2017, Paris, France
- 7th Amsterdam-Paris-Stockholm workshop - 11-13 Oct 2017, Kasteel Woerden, The Netherlands
- *invited talk* – Workshop on Particle Physics and Cosmology TOOLS - 9-14 Sep 2017, Corfu, Greece
- *invited talk* – EDU-2107 Exploring the Dark Universe - 23-29 Jul 2017, Quy Nhon, Vietnam
- *invited talk* – DSU 2017 - Dark Side of the Universe - 10-14 Jul 2016, Daejeon, South Korea
- GDR TeraScale - 3-5 Jul 2017, Montpellier, France
- Astronomy and Science from the Moon - 22 Jun 2017, IAP, Paris, France
- *invited talk* – Dark Matter Signatures - 12-14 Jun 2017, Odense, Denmark
- *invited talk* – A TPC for MeV astrophysics - 12-14 Apr 2017, Palaiseau, France
- *invited talk* – 1st PRISMA Symposium: A Matter of Flavor - 19-22 Feb 2017, Mainz, Germany
- *invited talk* – Fayet Fest - 8-9 Dec 2016, Paris, France
- *invited talk* – 8th Symposium large TPCs low-E rare event detection - 5-7 Dec 2016, Paris, France
- *invited talk* – Journée Matière Noire - 1 Dec 2016, APC, Paris, France
- GDR TeraScale - 23-25 Nov 2016, Jussieu, Paris, France
- Theorie LHC France general meeting - 7-9 Nov 2016, Orsay, France
- *convener* – TeVPA 2016 - 12-16 Sep 2016, CERN, Switzerland
- *organizer* – 6th Amsterdam-Paris-Stockholm workshop, 29-31 Aug 2016, Gouvieux, France

- *talk* – PPC 2016 - 11-15 Jul 2016, São Paulo, Brazil
- *invited talk* – RICAP 2016 - 21-24 Jun 2016, Villa Tuscolana, Frascati, Roma, Italy
- Warsaw Workshop on Non-Standard Dark Matter - 2-6 Jun 2016, Warsaw, Poland
- *invited talk* – KEK Theory Meeting on Particle Physics, 9-12 Feb 2016, Tsukuba, Japan
- *convener* – Texas Symposium Relativistic Astrophysics 2015 - 13-18 Dec 2015, Geneva, Switzerland
- *organizer* – Gamma rays and Dark Matter, December 2015, Obergurgl, Austria
- *invited talk* – Prospects in Low Mass Dark Matter - 30 Nov - 1 Dec 2015, Munich, Germany
- *invited talk* – Journée de la Société Française de Physique - 25 Nov 2015, Paris, France
- *invited talk* – Particle Cosmology and Beyond 2015 - 16-19 Nov 2015, Kanazawa, Japan
- 5^{th} Amsterdam-Paris-Stockholm meeting - 21-23 sep 2015, Djurönäset, Sweden
- *invited talk* – INFIERI Network School - Sep 2015, Hamburg, Germany
- *invited talk* – The String Theory Universe - 7-11 Sep 2015, Leuven, Belgium
- *invited talk* – TAUP 2015 - 7-11 Sep 2015, Torino, Italy
- *invited talk* – Corfu Summer Institute 2015, 1-11 Sep 2015, Corfu, Greece
- *invited talk* – WIN 2015 - Weak Interactions & Neutrinos, 8-13 Jun 2015, Heidelberg, Germany
- Beyond WIMPs: from theory to detection - 28 May - 1 Jun 2015 Hagoshrim Kibbutz, Israel
- GDR TeraScale IPhT Saclay - 30 Mar - 1 Apr 2015, IPhT Saclay, France
- *invited talk* – Neutrino Telescopes 2015 - 2-6 Mar 2015, Venezia, Italy
- RPP 2015 - Rencontres des Physique des Particules, 15-16 Jan 2015, Paris, France
- GDR TeraScale - 11-13 Dec 2014, Heidelberg, Germany
- *invited talk* – CosPa 3rd meeting - CosmoParticle physics in Belgium - 19 Nov 2014, Liège, Belgium
- *invited talk* – RICAP 2014 - 30 Sep - 3 Oct 2014, Noto, Sicily, Italy
- 4^{th} Amsterdam-Paris-Stockholm meeting - 29 sep-1 oct 2014, Amsterdam, The Netherlands
- *invited talk* – 100^{esimo} Congresso Società Italiana di Fisica - 22-26 Sep 2014, Pisa, Italy
- *convener* – IFT Madrid Workshop Physics Challenges of LHC-13, 15-26 Sep 2014, Madrid, Spain
- *invited talk* – Rencontres du Vietnam VHEPU 2014, 3-9 Aug 2014, Quy Nhon, Vietnam
- *invited talk* – ICHEP 2014 - 2-9 Jul 2014, Valencia, Spain
- *invited talk* – Higgs Symposium - 30 Jun - 4 Jul 2014, Edinburgh, Scotland
- Astroparticle Physics 2014 - 23-28 Jun 2014, Amsterdam, The Netherlands
- *invited talk* – SWAPS - Strategy Workshop on Astroparticle, 11-13 Jun 2014, Cartigny, Switzerland
- *invited talk* – APC-Perimeter-Solvay workshop, 10-13 Jun 2014, Paris, France

- *organizer* – Planck 2014 - 26-30 May 2014, Paris, France
- *invited talk* – Workshop on the future of AstroParticle Physics in space, 8-9 May 2014, Pisa, Italy
- *invited talk* – Ibericos Meeting, 28-30 Apr 2014, Aveiro, Portugal
- *organizer* – PONT d'Avignon 2014 - 14-18 Apr 2014, Palais des Papes, Avignon, France
- Rencontres de Physique des Particules, 20-22 Jan 2014, Strasbourg, France
- A passion for particles: A conference in honour of Riccardo Barbieri - 19-20 Dec 2013, Pisa, Italy
- 3$^{\text{rd}}$ Amsterdam-Paris-Stockholm meeting, 16-18 Dec 2013, Paris, France
- *organizer* – ICTP Workshop on the Future of DM Astro-Particle Physics, Oct 2013, Trieste, Italy
- *invited talk* – From Higgs to Dark Matter Symposium, 6 Dec 2013, Roma3, Roma, Italy
- *invited talk* – The Violent Universe, IoP Research Meeting, 31 Oct - 1 Nov 2013, London, UK
- *invited talk* – GDR TeraScale, 28-30 Oct 2013, Annecy, France
- *invited talk* – New Perspectives in DM Workshop, 22-25 Oct 2013, Lyon, France
- *convener* – WIN 2013, Weak Interactions & Neutrino Workshop, 16-21 Sep 2013, Natal, Brazil
- *invited talk* – Corfu Summer Institute 2013, 31 Aug-11 Sep 2013, Corfu, Greece
- *invited discussion* – Invisibles13 Workshop, 15-19 Jul 2013, Durham, UK
- Planck 2013 - 20-24 May 2013, Bonn, Germany
- *invited talk* – Portoroz 2013, 14-18 April 2013, Portoroz, Slovenia
- *invited talk* – Second Amsterdam-Paris-Stockholm meeting, 25-27 Mar 2013, Stockholm, Sweden
- *invited talk* – Neutrinos at the forefront of EP- and astro-physics, 22-24 Oct 2012, Lyon, France
- *invited talk* – 2nd KIAS Phenomenology Workshop, 10-14 Sep 2012, Seoul, South Korea
- *invited talk* – New Paths to Particle DM - 29-30 March 2012, Oxford, UK
- *invited talk* – Rencontres de Physique de la Vallee d'Aoste - 26 Feb - 3 Mar 2012, La Thuile, Italy
- *invited talk* – Bethe Program, Nov 2011, Bonn, Germany
- *invited talk* – IDEALS Workshop, 10-12 Nov 2011, SISSA Trieste, Italy
- *talk* – CERN-TH retreat - 2-4 Nov 2011, Les Houches, France
- *invited talk* – GGI Dark Workshop, 25-27 Oct 2011, Galileo Galilei Institute, Firenze, Italy
- *invited talk* – DESY 2011 - Desy Theory Workshop, 27-30 Sep 2011, DESY, Hamburg, Germany
- *invited talk* – LC11 Workshop, 12-16 Sep 2011, Trento, Italy
- *talk* – 15th Lomonosov Conf. on Elementary Particle Physics - 18-24 Aug 2011, Moskow, Russia
- *invited talk* – IDAPP 2days Meeting, 20-22 Jun 2011, Paris, France
- *organizer* – PONT d'Avignon 2011 - 18-22 Apr 2011, Palais des Papes, Avignon, France

- *invited talk* – Rencontres de Physique des Particules, 14 Jan 2011, Clermont-Ferrand, France
- *convener* – IWLC2010, Int. Workshop on Linear Colliders, 18-22 Oct 2010, Geneva, Switzerland
- *convener* – CRICATPP 2010, 7-8 Oct 2010, Como, Italy
- *talk* – COSMO 2010 - 27 Sep - 1 Oct 2010, Tokyo, Japan
- *invited talk* – IoA Conference Darkness Visible - 2-6 Aug 2010, I. of Astronomy, Cambridge, UK
- *organizer* – ICHEP 2010 - 21-28 Jul 2010, Palais des Congres, Paris, France
- *organizer* – TeVPA - 19-23 Jul 2010, Paris, France
- Planck 2010, From the Planck scale to the EW scale, 31 May - 4 Jun 2010, CERN, Switzerland
- *invited talk* – GGI DM conference - 17-21 May 2010, Galileo Galilei Institute, Firenze, Italy
- *invited talk* – Rencontres de Physique de la Vallee d'Aoste - 28 Feb - 6 Mar 2010, La Thuile, Italy
- KITP workshop Direct, Indirect & Collider Signals of DM - 7-18 Dec 2010, Santa Barbara, CA
- 13$^{\text{th}}$ JLAC Journée des Lacs Alpins de Cosmologie - 24 Nov 2010, Genève, Switzerland
- *invited talk* – Gamma ray diffuse emission mini-workshop - 18 Nov 2009, Zürich, Switzerland
- *talk* – CERN-TH retreat - 4-6 Nov 2010, Les Houches, France
- GDR Neutrino - 28-29 Oct 2009, Strasbourg, France
- *invited talk* – CCAPP Symposium - 12-14 Oct 2009, Columbus, OH
- *convener* – COSMO 2009 - 7-11 September 2009, CERN, Geneva, Switzerland
- *invited talk* – 12th Marcel Grossmann Meeting on GR - 12-18 Jul 2009, Unesco, Paris, France
- *invited talk* – Joint ICTP-INFN-SISSA conference on LHC - 29 Jun - 2 Jul 2009, Trieste, Italy
- *invited talk* – New Lights on Dark Matter - 11-13 Jun 2009, Perimeter Institute, Waterloo, Canada
- *invited talk* – Rencontre at the Colegio de España - 4-5 Jun 2009, Paris, France
- *invited talk* – TANGO workshop - 4-6 May 2009, IAP, Paris, France
- GDR Neutrino - 27-28 Apr 2009, LPNHE Jussieu, Paris, France
- *invited talk* – GDR TeraScale - 30 Mar - 1 Apr 2009, Grenoble, France
- *invited talk* – Rencontres Physique Particules - 23-25 Mar 2009, Ecole Polytechnique, France
- *invited review talk* – Dutch Astroparticle Meeting, 20 Mar 2009, Leiden, The Netherlands
- *invited talk* – Frontiers in Neutrino Physics - 16-18 Mar 2009, APC, Paris, France
- *invited talk* – Neutrino Telescopes Venice 2009 - 10-13 Mar 2009, Venice, Italy
- *invited talk* – IPhT Departmental Meeting - 15-17 Oct 2008, Batz-sur-Mer, France
- *invited talk* – UniverseNET school and meeting - 22-26 Sep 2008, Oxford, UK
- *talk* – NOW 2008, Neutrino Oscillation Workshop - 6-13 Sep 2008, Conca Specchiulla, Italy

- *talk* – iDM2008, Identification of Dark Matter - 18-22 Aug 2008, Stockholm, Sweden
- 12th Paris Cosmology Colloquium 2008 Ecole Chalonge - 17-19 Jul 2008, Paris, France
- PLANCK 2008, From the Planck scale to the EW scale - 19-23 May 2008, Barcelona, Spain
- *organizer* – PONT d'Avignon 2008 - 21-25 Apr 2008, Palais des Papes, Avignon, France
- GDR Neutrino - 10-11 Apr 2008, Saclay, France
- *convener* – ENTApP DM Visitor's Program DESY - 25-29 Feb 2008, Hamburg, Germany
- Dark Matter at Small Scales - 13-15 Feb 2008, APC, Paris, France
- *invited talk* – GDR SuSy - 12-14 Nov 2007, Bruxelles, Belgium
- *invited talk* – The Path to Neutrino Masses - 3-6 Sep 2007, Aarhus, Denmark
- *invited talk* – TeV Particle AstroPhysics - 27-31 Aug 2007, Venice, Italy
- *invited talk* – LHC-Cosmology Interplay CERN Theory Institute - 9-20 Jul 2007, CERN
- *invited talk* – GDR Neutrinos Plenary Meeting - 21-22 Jun 2007, APC, Paris, France
- *invited review talk* – Rencontre at the Colegio de España - 17-18 May 2007, Paris, France
- *invited talk* – GDR Neutrinos Plenary Meeting - 13-14 Mar 2007, LAPP, Annecy, France
- *invited short talk* – CERN Dark Matter Visitor Program - 5-9 Mar 2007, CERN
- *talk* – Rencontres de Physique de Particules 2007 - 28 Feb - 2 Mar 2007, Grenoble, France
- *invited talk* – Aspen Conference on Neutrinos Astrophysics - 28 Jan - 3 Feb 2007, Aspen
- Nobel Conference, Ecole d'Astrophysique D. Chalonge - 16 Dec 2006, Paris, France
- *talk* – ENTApP Annual Meeting (Theoretical Astroparticle) - 12-14 Dec 2006, Paris, France
- High Energy Physics in the LHC Era - 13-17 Nov 2006, LPNHE Jussieu, Paris, France
- Astroparticle Workshop - 23 Oct - 4 Nov 2006, Galileo Galilei Institute, Firenze, Italy
- *talk* – IFAE (Incontri sulla Fisica delle Alte Energie) - 19-21 April 2006, Pavia, Italy
- XI IFT-UAM/CSIC Christmas Workshop - 14 -16 Dec 2005, UAM, Madrid, Spain
- *talk* – QUEST Meeting 2005 - 12-13 Dec 2005, UAM, Madrid, Spain
- Tribute to John Bahcall - 29 Oct 2005, IAS, Princeton NJ
- *talk* – INFO 05, Implications of Neutrino Flavor Oscillations - 11-15 Jul 2005, Santa Fe NM
- Cosmic Connections – 17-23 Apr 2005, Quarrata, Italy
- COSMO 2004 - 17-21 Sep 2004, Toronto, Canada
- *talk* – PASCOS 2004 - 16-22 Aug 2004, Northeastern University, Boston MA, Usa
- IFAE (Incontri sulla Fisica delle Alte Energie) - 14-16 Apr 2004, Torino, Italy
- CAPP 2003, Cosmology And Particle Physics - 12-17 June 2003, CERN

- PLANCK 2003 – 26-31 May 2003, Madrid, Spain
- Pisa Week on Astro-Particle Physics and Cosmology: LSS and CMB, 5-9 May 2003
- *talk* – IFAE (Incontri sulla Fisica delle Alte Energie) - Lecce, Italy, 23-26 April 2003
- *talk* – Moriond 2003, EW Interactions & Unified Theories - 15-22 Mar 2003, Les Arcs, France
- PLANCK 2002 - Kazimierz, Poland, 25-29 May 2002
- *short talk* – Moriond 2002, EW Interactions & Unified Theories - 9-16 Mar 2002, France
- Corfu 2001, Summer Institute on Elementary Particles - 31 Aug-21 Sep 2001, Corfu, Greece
- PLANCK 2001 - 11-16 May 2001, La Londe les Maures, France
- IX National Seminar of Theoretical Physics - 4-15 Sep 2000, Parma, Italy

Invited Colloquia

- Mainz Physics Department, Germany (April 2018)
- Dortmund Physics Department, Germany (June 2017)
- École Normale Superiéure, Paris, France (February 2017)
- New York University Abu Dhabi, UAE (May 2016)
- Osservatorio di Merate, Italy (February 2016)
- CSNSM Orsay, France (November 2015)
- Colloque de l'Orme, CEA/Saclay, France (July 2015)
- LPTHE Colloquium, LPTHE Paris, France (June 2015)
- Scuola Galileiana Colloquium, Padova, Italy (May 2015)
- Theory Colloquium, Padova Physics Dept., Italy (November 2014)
- Laboratoire Francis Perrin, CNRS/CEA, France (December 2011)
- Dutch National Seminar, Amsterdam, The Netherlands (November 2011)
- CERN-TH Colloquium, CERN Theory Division (February 2011)
- 'Helmholtz Alliance' National German Seminar, Bonn, Th. Phys. Dep., Germany (January 2011)
- Heidelberg University Physics Department, Germany (May 2009)
- Federal University of Rio de Janeiro, Brazil (December 2008)
- IFT Saõ Paulo & University of Saõ Paulo, Brazil (November-December 2008)
- CERN-TH Colloquium, CERN Theory Division (October 2008)

Invited Seminars and other short term visits

- Ferrara Physics Dept, Italy (May 2018)
- DESY Hamburg, Germany (Nov 2017)
- ATLAS JDM meeting, CERN Geneva, Switzerland (Jun 2017)
- Niels Bohr Institute, Copenhagen, Denmark (Mar 2017)
- RTWH Aachen, Germany (Jul 2016)
- NICPB, Tallin, Estonia (Apr 2016)
- IPMU, Kashiwa, Japan (Feb 2016)
- Warsaw University Physics Department, Poland (Oct 2015)
- Louvain-la-Neuve, Belgium (Oct 2015)
- TUM Munich, Germany (Dec 2014)
- LAPP Annecy, France (Nov 2014)
- Milano University, Milano, Italy (Oct 2014)
- Gran Sasso Science Institute, L'Aquila, Italy (Mar 2014)
- IAP Paris, France (Feb 2014)
- TOTEM seminar, CERN, Geneva, Switzerland (Oct 2013)
- Aachen Doctoral School, Aachen, Germany (Oct 2013)
- Geneva University Physics Dept, Geneva, Switzerland (Oct 2013)
- DAMPT, Cambridge, UK (Apr 2013)
- Roma3 Physics Dept, Roma, Italy (Apr 2013)
- LPTHE/ENS Joint Seminar, Paris, France (Mar 2013)
- LPT Paris XI Orsay, France (Feb 2013)
- Scuola Normale Superiore, Pisa, Italy (Jan 2013)
- Padova Physics Department (Nov 2012)
- King's College London, UK (Nov 2012)
- ATLAS Astroparticle Forum, CERN, Switzerland (Nov 2012)
- Freiburg Physics Department, Germany (Jun 2012)
- CERN Collider Cross Talk, CERN, Switzerland (May 2012)
- Basel Physics Department, Switzerland (May 2012)
- SISSA, Trieste, Italy (Nov 2011)

- Niels Bohr Institute, Copenhagen, Denmark (Oct 2011)
- LNGS Gran Sasso, Italy (Mar 2011)
- SHEP Southampton, UK (Nov 2010)
- CP^3-Origins Center, Odense, Southern Denmark (Nov 2010)
- RWTH Aachen, Germany (May 2010)
- Université de Genève, Switzerland (Mar 2010)
- LPSC Grenoble, France (Dec 2009)
- LPNHE Jussieu, Paris, France (Nov 2009)
- IFT Granada, Spain (Nov 2009)
- Milano-Bicocca University, Italy (Oct 2009)
- ITP Warsaw, Poland (Oct 2009)
- IPHC Strasbourg, France (Sep 2009)
- LAPP, Annecy, France (Jun 2009)
- Imperial College, London, UK (May 2009)
- AstroParticle Theory group, Bielefeld, Germany (May 2009)
- ETH Zürich, Switzerland (April 2009)
- Max Planck Institute Heidelberg, Germany (January 2009)
- APC, Paris, France (December 2008)
- Autonoma University Barcelona, Spain (December 2008)
- LPT Paris XI Orsay, France (November 2008)
- Colloquium IPhT, Saclay, France (March 2008)
- CPT, Ecole Polytechnique, Palaiseau, France (March 2008)
- LPT, Paris XI Orsay, France (February 2008)
- LUTH, Observatoire de Paris, Meudon, France (November 2007)
- ULB Brussels, Belgium (October 2007)
- CPT Marseille, France (May 2007)
- IPN Lyon, France (April 2007)
- University of Wisconsin-Madison WI, Usa (February 2007)
- Fermilab, Batavia IL, Usa (February 2007)
- SPhT CEA/Saclay, France (April 2006)
- University of Washington, Seattle WA, Usa (February 2006)

- Harvard University, Cambridge MA, Usa (February 2006)
- New York University, New York NY, Usa (February 2006)
- EPFL, Lausanne, Switzerland (January 2006)
- Torino University, Italy (January 2006)
- ICTP, Trieste, Italy (January 2006)
- SPhT CEA/Saclay, France (December 2005)
- Institute for Advanced Study, Princeton NJ (October 2005)
- Zürich University, Switzerland (June 2005)
- Brookhaven National Lab, Upton NY (April 2005)
- SUNY Stony Brook NY, Usa (April 2005)
- UC Riverside CA, Usa (April 2005)
- UC Los Angeles CA (April 2005)
- UC Berkeley CA (April 2005)
- Harvard University, Cambridge MA, Usa (March 2005)
- Los Alamos National Lab, NM, Usa (March 2005)
- Cornell University, Ithaca NY, Usa (April 2004)
- Milano-Bicocca University, Italy (2003, 2004, 2006)
- Department of Physics at Pisa University (2002-2003)

Research Description:

My current research activity focuses on the intersections among

- Particle Theory Beyond the Standard Model,
- Neutrino Physics,
- Astrophysics and
- Cosmology.

In particular, my main current interests lie in exploring the phenomenology of Dark Matter models, particularly via indirect detection methods (gamma rays, charged cosmic rays) and with a special attention to our recent proposal of Minimal Dark Matter, and in Neutrino Cosmology.

In the following, I briefly review my past research activity in some detail, and give an outlook of the open projects and directions.

I began my work in Particle Theory Beyond the SM by computing some relevant observables in the framework of the *theory proposed by R. Barbieri, L. Hall and Y. Nomura* (Phys. Rev. D63, 105007, 2001), an extension of the Standard Model to five dimensions endowed with a supersymmetric structure. The theory was remarkable in its providing a description of the mechanism of electroweak symmetry breaking thanks to the extra dimension, while ensuring calculability for several quantities, a property not so common among extra dimensional models.

In [1] cited above we found that the *production rate of the Higgs boson via gluon fusion* (which is the main channel at a hadron collider) is significantly suppressed, due to cancellations among the additional (Kaluza-Klein) states of the theory.
In [2] we showed that the theory was compatible with the precision measurements of *muon anomalous magnetic moment*, by explicitly computing all the relevant additional contributions to such a quantity and finding them small.

In [3], I shifted to a more general class of models, characterized by *large flat extra dimensions* accessible to a *sterile neutrino*. We analyzed the effects in the context of *supernova physics*, where resonant oscillations between the Standard Model electron neutrino and the additional sterile states provide an unconventional escape channel. We showed (via numerical and analytical work) how previous bounds could be largely overcome, thanks to a feedback mechanism that self-limits the energy loss, and we discussed positive effects towards supernova explosion.

In [4] we completed the previous analysis including the effects of muon and tau neutrinos escape, showing how a feedback prevents an unacceptable energy loss also in this case. For all the different scenarios, we discussed the signatures in the neutrino signal on Earth.

In [5] we performed a thorough analysis of oscillation signals generated by *one extra sterile neutrino*, extending previous analyses done in simple limiting cases and including the effects of established oscillations among active neutrinos. We considered as probes the solar, atmospheric, reactor and beam neutrinos, Big-Bang Nucleosynthesis (^{4}He, D), the Cosmic Microwave Background, Large Scale Structure, supernovæ and neutrinos from other astrophysical sources. We found no evidence for a sterile neutrino in the data, we identified the still allowed regions, and studied which future experiments could best probe them: sub-MeV solar experiments, more precise studies of CMB or BBN, future supernova explosions... I particularly was involved in the SN and cosmological studies.

In [6], we addressed the implications on *solar neutrino oscillations* of the recent proposal that the mass of the neutrinos and the field responsible for *dark energy* may be connected, leading to the effect of *mass varying neutrinos* depending on environment. We stressed the model independent consequences, finding in particular that a connection between the effective Δm^2 in the Sun and the absolute neutrino

mass scale is established in these scenarios. This leads to the possibility of explicitly testing the model and to other interesting consequences both for the neutrinos and for the mechanism of dark energy.

In [7] we presented results on neutrino fluxes from the *annihilation of Dark Matter particles* (neutralinos, KK dark matter, strongly interacting dark matter, GUT scale dark matter ...) accumulated in the center of the Earth and the Sun. They will be hopefully detected in the Neutrino Telescopes (ANTARES, ICECUBE, a large Cerenkov detector...). The neutrino fluxes carry precious information on the main properties of DM (its abundance, its mass and its annihilation branching ratios), opening unique windows on its nature and on the theory that encompasses it. We computed precisely the expected neutrino yield and, especially, the neutrino spectra, which are more free from astrophysical uncertainties. We developed the appropriate formalism to follow the neutrino production, the evolution of the fluxes in the matter of the Earth and the Sun (determined by flavor oscillations, absorptions/scatterings and tau regeneration) and in the vacuum and finally the detection signatures.

In [8] we explored a new approach to the Dark Matter problem: while Beyond-the-SM theories often provide DM candidates with a complex phenomenology and an ad-hoc method for stabilization (such as R-parity in SuSy), we looked for a viable candidate just adding to the SM a multiplet in some representation of $SU_L(2) \otimes U_Y(1)$. We found that a quintuplet with zero hypercharge provides a *new minimal candidate for Dark Matter* that is fully successful: weakly interacting, electrically neutral and (most importantly) automatically stable on cosmological time scales. We computed its distinctive phenomenology at colliders (the LHC) and in experiments of direct and indirect DM detection, finding that the particle can be detected in the next generation of experiments.

In [9] we investigated the *cosmology of ordinary neutrinos and of possible extra light particles*. We make use of the most recent (at the time) *data from Cosmic Microwave Background, Supernovæ type Ia, Large Scale Structure, Lyman-α forest, Baryon Acoustic Oscillation peaks* etc. We obtained stringent constraints on the neutrino mass, the effective neutrino density and the properties of proposed new interacting light particles that diminish the neutrino free-streaming. It should be noted that we performed all the analysis making use of numerical codes and tools written and developed by ourselves instead of the commonly used CMBfast-derived tools.

With [10] we investigated how unconventional cosmologies can relax the stringent bounds on sterile neutrinos. We opened the way to a possible *primordial leptonic asymmetry*, that has the effect of suppressing the production of sterile neutrinos in the Early Universe, therefore modifying the constraints from BBN and from LSS. We identified the portions of the parameter space that could be reopened by introducing a given asymmetry. In the case of the LSND sterile neutrino, we found that a primordial asymmetry of the order of 10^{-4} was needed in order to lift the conflicts with cosmology.

With [11] we revisited the computation of the cosmological relic abundance in the Minimal Dark Matter proposal introduced in [8], including *non-perturbative 'Sommerfeld' corrections*. These were found to have a very relevant effect in enhancing the DM annihilations. We also studied the peculiar behavior of the DM particles while crossing the Earth at Ultra High Energies, in order to assess the possible detectability in future cosmic ray and neutrino telescopes (e.g. ICECUBE, AUGER, ANTARES).

In [12] we precisely calculated the *indirect detection* signatures of the Minimal Dark Matter model of [8]. We computed the fluxes of positrons, antiprotons and gamma rays from the annihilations of DM particles in the galactic halo and their propagation in the galaxy (designing our own computational tools). We found distinctive and univocal predictions (the model has no free parameters). The enhancement in the annihilation cross section discussed in [11] put the foreseen fluxes within the reach of those that were upcoming experiments, PAMELA in particular.

When the PAMELA satellite announced preliminary data on the positron flux, showing confirmation for an excess over the expected background that previous experiments had already exposed, we compared in [Proceedings 4] the fluxes from Minimal DM annihilations predicted in [12] with such data. We found a remarkably good agreement, and we were able to determine the set of astrophysical parameters that

gives the best fit. Later, we summarized in [15] the status of the model.

In a subsequent paper [13], we performed a model independent analysis of the PAMELA preliminary data on positrons and anti-protons, together with less known (before our analysis) but relevant data from cosmic ray balloon experiments: ATIC and PPB-BETS. We looked for which DM models could explain the signals that appear in the data while remaining compatible with the searches in all other channels. We found that the PAMELA results alone, if due to DM annihilations, individuated a quite unusual DM particle: either very heavy (above 10 TeV) or lighter but annihilating mainly into leptonic channels such as DM DM $\to e^+e^-$. Adding the balloon datasets, only the second possibility was viable.

In [14] we pursued the model independent analysis of *multi-messenger indirect signatures* extending to gamma rays and synchrotron radiation from the galactic center and dwarf satellite galaxies. We found that these observations impose stringent constraints: a tension was present with the explanation of the PAMELA and ATIC data in terms of DM annihilations, unless the DM halo profile is significantly smoother than expected from numerical simulations.

In [16] we considered another interesting possible signal of DM indirect detection: *fluxes of anti-deuterium* synthetized in galactic annihilations. We focussed on the 'very heavy Dark Matter' scenarios individuated by the recent data, and we found promising perspectives especially for primary annihilation channels into quarks.

Another relevant test of the Dark Matter invoked to explain the positron excess in PAMELA is the flux of *gamma rays produced by inverse Compton scattering* of such energetic positrons on low energy ambient photons in the galactic halo. This signal has the advantage of being less sensitive to astrophysical details than the gamma rays from the Galactic Center discussed above. We computed this flux for several cases and for a range of DM models in [17], finding again stringent constraints.

In [18] we looked once again at the implications of Dark Matter annihilations, this time on the cosmological evolution of the universe. Indeed, the annihilations of Dark Matter during the epoch of galaxy formation inject charged particles and energy, producing *reionization and heating of the primordial gas*. Comparing with the observed optical depth (from CMB) and the measured temperature of the intergalactic gas we found relevant constraints on DM properties, in the particular for the PAMELA-motivated models. We also found general constraints for more 'ordinary' Dark Matter.

When the FERMI satellite started releasing data on diffuse gamma ray, we updated the constraints formerly obtained in [17] to take the new measurements into account ([19]), at the same time improving and enlarging the analysis (e.g. to the case of decaying DM).

In [20] we took a close look at a class of DM models often advertised as able to explain the cosmic ray excesses, namely models with *multistate DM* coupled to light hidden sector bosons. With a detailed calculation, we showed instead that such models suffer from several tensions with the gamma ray constraints and in reproducing the cosmological abundance of DM. They are therefore only very marginally viable.

Ref. [21] represents the coronation of a long effort directed to produce *'ingredients' and 'recipes' for DM indirect detection*, using state of the art calculations and in a consistent framework and provide this to the community for easy use. We computed the energy spectra of $e^\pm$, $\bar{p}$, $\bar{d}$, γ rays, ν and $\bar{\nu}$ from DM annihilations or decay in the Galaxy; the propagation functions for charged particles in the halo; the energy spectra of charged particles at the location of the Earth; the gamma ray fluxes from Inverse Compton scattering in the galactic halo and finally the spectra of extragalactic gamma rays. The concrete goal was that, from then on, the community had at disposal a suite of results which could make it easier to assess which DM models can explain possible signals that might appear in the data while remaining compatible with the searches in other channels, or producing predictions for other channels, in a full multi-messenger approach.

In Ref. [22] and [23] I participated in two analyses of the *impact of ElectroWeak corrections* (i.e. the emission of weak bosons) on the annihilation of DM particles. The process is important, because it can

lift the suppression which naturally depresses the cross section of Majorana DM particles annihilating into light fermions (known as helicity suppression), leading to very different resulting spectra.

In Ref. [24] I worked on the phenomenology of the so-called *Asymmetric Dark Matter* (aDM) scenario, which assumes the existence of a primordial asymmetry in the dark sector. We studied in particular the effect of oscillations between dark matter and its antiparticle on the re-equilibration of the initial asymmetry before freeze-out, which enable efficient annihilations to recouple. We calculated the evolution of the DM relic abundance and showed how oscillations re-open the parameter space of aDM models, in particular in the direction of allowing large (WIMP-scale) DM masses.

In Ref. [25] we derived new bounds on *decaying Dark Matter* from the gamma ray measurements of (i) the isotropic residual (extragalactic) background by the Fermi satellite and (ii) the Fornax galaxy cluster by the Hess telescope. We found that those from (i) were among the most stringent constraints currently available, for a large range of DM masses and a variety of decay modes, excluding half-lives up to $\sim 10^{26}$ to few 10^{27} seconds. In particular, they rule out the interpretation in terms of decaying DM of the $e^{\pm}$ spectral features in Pamela, Fermi and Hess, unless very conservative choices are adopted.

In Ref. [26] and [27] we derived *constraints on the DM annihilation cross section from the antiproton measurements* performed by Pamela, finding that they can be competitive with the gamma ray ones. In [26] we then apply them to specific SuSy models in order to constrain also an 'internal' property of the models: the mass splitting between charginos and neutralinos. In [27] we assessed also the sensitivity of the then-upcoming Ams experiment and its ability to reconstruct DM properties from a possible signal.

With [28] I moved to the phenomenology of *DM direct detection*: we discussed a powerful framework (based on *non-relativistic operators*) and provided a self-contained set of numerical tools to derive the bounds from some current experiments of the time on virtually any arbitrary model of Dark Matter.

In Ref. [29], we addressed the often-neglected role of *bremsstrahlung processes* on the interstellar gas in computing *indirect signatures of DM annihilation* in the Galaxy, particularly for light DM candidates in the phenomenologically interesting O(10) GeV mass range. We find that the effects of bremsstrahlung are important, or even dominant, in determining the γ-ray spectrum from DM.

Ref. [30] represents a significant upgrade of Ref. [7], in particular with the improved knowledge provided by Ref. [21]: we computed the *spectra of neutrinos from DM annihilations in the Sun* including electroweak correction, state of the art energy losses in solar matter (computed with Geant) and secondary neutrinos.

In Ref. [31] we explored the possible yield of *anti-Helium nuclei from galactic DM annihilations* (in analogy with the work in Ref. [16] on antideuterium): while in principle the prospects were good since the astrophysical background is very suppressed at the interesting energies, we found that only for very optimistic configurations it might be possible to achieve detection with current generation detectors.

Starting in 2010 another anomaly attracted a lot of attention in the community: a *GeV diffuse excess from the Galactic Center region*, possibly explained in terms of DM with a mass of tens of GeV annihilating in quarks or leptons with thermal annihilation cross section. In Ref. [32] we investigated the antiproton constraints on such an explanation. We treated with particular care the uncertainties related to the propagation of antiprotons in the Galaxy and in the proximity of the solar system (the so-called solar modulation effects). We found that, while the DM interpretation is ruled out for stringent assumptions, in the full case (thin propagation halos and/or a conservative treatment of solar modulation) no firm conclusion could be reached.

Ref. [33] approached a rather different topic: we considered an *electroweak triplet* as an extension of the Standard Model (a good DM candidate, if a symmetry like B-L is enforced) and performed an analysis of the reach for such a particle at the *high-luminosity LHC* and at a *futuristic 100 TeV pp collider*. We did so for the monojet, monophoton, vector boson fusion and disappearing tracks channels. For the large mass region, high energy and high luminosity conditions will be necessary.

In ref. [34] and ref. [35] I went back again to antiprotons. First we revisited the computation of the

astrophysical background and of the *DM antiproton fluxes* fully including some effects which are often considered subleading but actually prove to be quite relevant: diffusive reacceleration, energy losses (including tertiary component) and solar modulation. Then, as soon as the data from AMS came out, in [35] we reevaluated again the secondary astrophysical antiproton to proton ratio and its uncertainties, finding that there was no unambiguous evidence for a significant excess with respect to expectations, and we provided a first assessment of the updated Dark Matter constraints.

Ref. [36] constituted an upgrade and complement of [21], the collection of tools and recipes for DM indirect detection. We here focussed on *secondary radiation*: bremsstrahlung and Inverse Compton gamma rays and synchrotron radiation.

In ref. [37] we reconsidered the model of *Minimal Dark Matter*, almost ten years after we proposed it in [8], and computed its *updated gamma ray signatures*. We found that the model is constrained by the line searches from the Galactic Center: it is ruled out if the Milky Way possesses a cuspy profile such as NFW but it is still allowed if it has a cored one. We also explored a wider mass range, which applies to the case in which the relic abundance requirement is relaxed.

The work in ref. [38] derived bounds on annihilating or decaying Dark Matter from yet another aspect: the synchrotron radiation constrained by the radio surveys of the Galaxy. We employed the tools developed in [36] and we compared with standard and new surveys (such as e.g. those by the CMB satellite PLANCK). The derived bounds turn out to be not very stringent, but complementary to those obtained with other indirect detection methods, especially for dark matter annihilating into leptonic channels.

In ref. [39] we addressed a different kind of DM model, in which the DM particle (taken to be a Dirac fermion here) is charged under a *dark force* and couples to a *dark photon*. We studied thoroughly the cosmology and the phenomenology of this model, spanning large ranges for the DM mass and the dark photon mass. We focussed in particular on the issue of the formation of *DM bound states*, and its impact on the relic density computations, cosmology, direct and indirect detection signals. In ref. [40] we extended the same analysis to the case of *asymmetric* Dark Matter.

Ref. [41] dealt with a completely different kind of Dark Matter: *Primordial Black Holes* which could have been created by exotic processes in the Early Universe. We considered the production of sub-GeV electrons and positrons from their Hawking evaporation and compared the predicted flux to the data of the *Voyager-1 spacecraft*, the only probe capable of measuring them since it has crossed the edge of the heliosphere that acts as a shield to low-energy cosmic rays. We slightly improved and complemented the constraints for PBHs of mass $< 10^{16}$ grams.

During my laurea thesis work I also dealt with the physics of Strong Interactions and *Quantum Chromodynamics*. We derived a formula for a particular regime in Drell-Yan processes (the production of a lepton–antilepton pair in proton–antiproton collisions). Namely, the intersection of threshold production and small transverse momentum regimes. I had the opportunity of studying in a certain detail the resummation of soft gluon emissions.

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