

# María Gómez Rocha

European Centre for Theoretical Studies  
in Nuclear Physics and Related Areas (ECT\*)  
Strada delle Tabarelle, 286  
I-38123 Villazzano Trento (TN), Italy

Phone: (+39) 0461 314726  
Email: gomezr@ectstar.eu  
www: www.ectstar.eu  
ORCID: 0000-0002-9513-5797

## PERSONAL

Born on May 31, 1985.  
City of birth: Madrid, Spain.

## MAIN AREAS OF RESEARCH

Quantum chromodynamics; hadron physics and hadron structure; renormalization group procedure for effective particles; light-front and point-form Hamiltonian dynamics; Bethe-Salpeter/Dyson-Schwinger equations; Coulomb-gauge QCD; relativistic quantum mechanics.

## EDUCATION

### PhD in Theoretical Physics (with distinction).

University of Graz, January 2013.

FWF doctoral-program "Hadrons in Vacuum, Nuclei and Stars".

Thesis entitled: "*Electroweak hadron structure within a relativistic point-form approach*".

Thesis advisor: Prof. Wolfgang Schweiger.

### Masters Degree in Fundamental Physics.

Universidad Complutense de Madrid, Oct 2008 - June 2009.

Masters thesis entitled: "*Poincaré algebra of gauge theories in Coulomb gauge*".

Master's advisor: Prof. Felipe J. Llanes Estrada.

### Undergraduate 5-yr degree in Physics, "Licenciatura".

Universidad Complutense de Madrid, 2003-2008.

## CURRENT POSITION

**Since September 2015:** Post-doc position at the European centre for theoretical studies in nuclear physics and related areas (ECT\*), Trento, Italy.

## CONTRACTS HELD:

- **2009 – 2012:** PhD Student at the Physics Institute, University of Graz.
- **2013 – 2014:** Postdoc at the University of Graz under FWF project P25121.
- **2014 – 2015:** Research contract at HEPHY, Vienna.
- **2015 – present:** Postdoc at ECT\*, Trento, Italy.

Teaching contracts are in a separate section.

## PARTICIPATION IN RESEARCH PROJECTS

- FWF-P25121, “Hadrons in Covariant Models of Quantum Chromodynamics” (Principal investigator: A. Krassnigg). April 2013 - July 2014.
- FWF Doktoratskolleg DK-plus W1203-N16, “Hadrons in vacuum, nuclei and stars” (Principal investigators: R. Alkofer, C. Gatttringer, C. B. Lang, W. Plessas, W. Schweiger), September 2009 - December 2012.
- ÖAD WTZ FR 14/2011 “Proton-antiproton annihilation into meson pairs...” (Principal investigators: B. Pire, W. Schweiger), 2009-2012.

## INTERNATIONAL CONFERENCES AND OTHER SCIENTIFIC EVENTS

1. **Light Cone 2016, September 5th-8th 2016, IST, University of Lisbon, Portugal.**  
Title of contribution: From asymptotic freedom toward heavy quarkonia using RGPEP.  
Type of presentation: **talk**.
2. **XIIth Quark Confinement and the Hadron spectrum, August 28th - September 3rd 2016, Macedonia Palace, Thessaloniki, Greek.**  
Title of contribution: Asymptotic freedom in the Hamiltonian approach to binding of colour.  
Type of presentation: **talk**.
3. **Light Cone 2015, September 21st-25th, INFN Frascati National Laboratories, Frascati, Italy.**  
Title of contribution: Asymptotic Freedom of Gluons in Hamiltonian Dynamics.  
Type of presentation: **talk**.
4. **Light Cone 2014, May 26th-30th 2014, NC State University, Raleigh, NC, USA.**  
Title of contribution: Consequences of a dressed quark-gluon vertex in heavy-light mesons.  
Type of presentation: **talk**.
5. **Light Cone 2012, July 8th - 13th 2012, Cracow, Poland.**  
Title of contribution: Electroweak Hadron Structure withing a Point-Form Approach.  
Type of presentation: **talk**.
6. **QNP2012, April 16th - 20th 2012, Palaiseau, France.**  
Title of contribution: Electroweak Hadron Structure in Point-Form Dynamics.  
Type of presentation: **talk**.
7. **Light Cone 2011, May 23rd -27th 2011, Dallas, Texas.**  
Title of contribution: Form-factors of few-body systems – point-form vs. front-form.  
Type of presentation: **talk**.
8. **49th Schladming Winter School. Internationale Universitätswochen für Theoretische Physik, “The renormalization group”. Schladming, Austria, February 26th-March 5th 2011.**  
Title of contribution: Point-form calculations of form-factors of heavy-light systems.  
Type of presentation: **poster**.
9. **21st European Conference on few-body problems in physics, Salamanca, Spain, August, 29th-September, 3rd .**  
Title of contribution: Form-factors of few-body systems in point-form relativistic quantum mechanics: the Isgur-Wise function.  
Type of presentation: **talk**.

10. **Workshop “Dressing Hadrons”, Bled, Slovenia, July 4-11th 2010.**  
 Title of contribution: Heavy-light form factors. The Isgur-Wise function in Point-Form Relativistic Quantum Mechanics.  
 Type of presentation: **talk**.
11. **48th Schladming Winter School. Internationale Universitätswochen für Theoretische Physik, “Masses and constants”. Schladming, Styria, Austria, 27 February-10 March 2010.**  
 Title of contribution: Electromagnetic form factors of two-body systems in point-form relativistic quantum mechanics.  
 Type of presentation: **poster**.
12. **XXXII Biental de Física, Universidad de Castilla-La Mancha, Ciudad Real, 7- 11 September 2009.**  
 Title of contribution: Álgebra de Poincaré de la Cromodinámica Cuántica.  
 Type of presentation: **talk**.
13. **“Light Quark Masses and Hadron Physics”, Complutense University of Madrid, 2nd-5th July 2009.**  
 In assistance.
14. **47th th Schladming Winter School. Internationale Universitätswochen für Theoretische Physik, “Fundamental Challenges of QCD”, Schladming, Styria, Austria, 28 February - 7 March 2009.**  
 In assistance.

#### INVITED TALKS OR SEMINARS AT OTHER UNIVERSITIES

1. *Consequences of a dressed quark-gluon vertex in heavy-light mesons.*  
 Jefferson Lab. May 21st 2014, Newport News, VA, USA.  
 Host: Prof. Michael Pennington.
2. *Consequences of a dressed quark-gluon vertex in heavy-light mesons.*  
 Justus-Liebig Universität Giessen. Giessen, Germany, May 19th 2014.  
 Host: Dr. Richard Williams.
3. *Electroweak hadron structure within a relativistic point-form approach.*  
 Universidad Complutense de Madrid. Madrid, Spain, February 27th 2013.  
 Host: Prof. José R. Peláez.
4. *Electroweak hadron structure within a relativistic point-form approach.*  
 University of Tübingen. Tübingen, Germany, February 7th 2013.  
 Host: Prof. Hugo Reinhardt.
5. *Form factors of heavy-light systems. From point-form to front-form.*  
 University of Iowa. Iowa City, USA, June 1st 2011.  
 Host: Prof. William H. Klink.
6. *Poincaré algebra in Coulomb-gauge.*  
 Karl-Franzens University of Graz. Graz, Austria, 8th July 2009.  
 Host: Prof. Wolfgang Schweiger.

## SEMINARS GIVEN AT ECT\*

**Toward heavy-light mesons from a Dyson-Schwinger-Bethe-Salpeter approach.**

June 24th 2016.

**Asymptotic freedom in the front-form Hamiltonian for quantum chromodynamics of gluons.**

September 26th 2015.

**Meson spectra from Dyson-Schwinger-BS approach.** December 21st 2015.

## SEMINARS GIVEN AT THE UNIVERSITY OF GRAZ

**Towards heavy-light systems in a Dyson-Schwinger/Bethe-Salpeter approach.**

Spezialseminar für DissertantInnen: Relativistische Hadronphysik. Karl-Franzens University of Graz, December 16th, 2013.

**Electroweak Hadron Structure in Point-Form Dynamics – Heavy-Light Systems.**

Spezialseminar für DissertantInnen: Relativistische Hadronphysik. Karl-Franzens University of Graz, April 11st, 2012.

**Exchange Currents in Point-Form Relativistic Quantum Mechanics.**

Spezialseminar für DissertantInnen: Relativistische Hadronphysik. Karl-Franzens University of Graz, January 30th, 2012.

**Angular momentum decomposition in front-form dynamics.**

Spezialseminar für DissertantInnen: Relativistische Hadronphysik. Karl-Franzens University of Graz, July 21st, 2011.

**Form-factors of few-body systems. Point-form vs. front-form.**

PhD seminar. Karl-Franzens University of Graz. May 18th, 2011.

**Heavy-light form-factors. The spurious form factor contribution in PFRQM.**

PhD seminar. Karl-Franzens University of Graz. November 3rd, 2010.

**Heavy-light form-factors. The Isgur-Wise function in point-form relativistic quantum mechanics.**

PhD seminar. Karl-Franzens University of Graz. June 16th, 2010.

## OTHER MEETINGS

**Project steering workshop of FWF-project P25121, Graz, Austria, Jan. 8th - 10th 2014.**

Type of presentation: interactive seminar.

**Workshop of the Graduiertenkolleg “Hadrons in Vacuum, Nuclei and Stars” 2011, Jena, Germany, Sept. 28th - Sept. 30th.**

Title of contribution: Deuteron form factors in point-form relativistic quantum mechanics.

Type of contribution: talk.

**Workshop of the Graduiertenkolleg “Hadrons in Vacuum, Nuclei and Stars” 2010, Todtmoos, Germany, Sept. 27th - Sept. 30th.**

Title of contribution: Heavy-light form factors. The Isgur-Wise function in point-form relativistic quantum mechanics.

Type of contribution: talk.

**Workshop of the Graduiertenkolleg “Hadrons in Vacuum, Nuclei and Stars” 2009, Hallstatt, Austria, Sept. 27th - Sept. 29th.**

Title of contribution: Poincaré algebra in gauge theories.

Type of contribution: **talk**.

Double Graduate Day Graz, April 28th-30th, 2010: *Some topics about gravity*.

In assistance.

Double Graduate Day Tübingen: Nov./Dec. 2009: *QCD and the Spin Structure of the Nucleons*.

In assistance.

## SHORT RESEARCH STAYS OR VISITS

**Faculty of Physics – University of Warsaw, Poland.**

February 29th - March 11th. Host: Prof. Stanisław D. Głazek.

**Faculty of Physics – University of Warsaw, Poland.**

October 30th - November 6th. Host: Prof. Stanisław D. Głazek.

**Jefferson Lab. Newport News, Virginia, USA.**

May 20th - 24th. Host: Prof. Michael Pennington.

**Department of Physics and Astronomy, University of Iowa, Iowa City, USA.**

May 28th - June 5th 2011. Host: Prof. W. H. Klink.

## TEACHING

1. **Quantum Mechanics**– exercises section.  
Summer semester 2015, University of Graz, in German.
2. **Functional analysis and partial differential equations** – exercises section.  
Winter semester 2014, University of Graz, in German.
3. **Mathematical Methods for Teaching Candidates** – exercises section.  
Summer semester 2013, University of Graz, in German.
4. **Linear Algebra** – exercises section.  
Winter semester 2012, University of Graz, in German.
5. **Differential and integral calculus** – exercises section.  
Winter semester 2011, University of Graz, in German.

## AWARDS

Gary McCarty Award 2016 [www.ilcacinc.org](http://www.ilcacinc.org).

## LANGUAGES

**Spanish:** Native. **English:** Fluent. **German:** Fluent. **Italian:** Fluent.

## LIST OF PUBLICATIONS

### A) Publications with peer-review process

- 1. Asymptotically free interactions in the Fock space.**  
S. D. Glazek, M. Gómez-Rocha.  
AIP Conf.Proc. 1735 (2016) 080005.
- 2. Leptonic decays of D-wave vector quarkonia.**  
A. Krassnigg, M. Gómez-Rocha, T. Hilger.  
J. Phys. Conf. Ser. 742: 012032 (2016) [arXiv:1603.07232]
- 3. Effects of a dressed quark-gluon vertex in vector heavy-light mesons and theory average of  $B_c^*$  meson mass.**  
M. Gómez-Rocha, T. Hilger, A. Krassnigg.  
Phys. Rev. D 93 (2016) 074010 [arXiv:1602.05002].
- 4. Asymptotic Freedom of Gluons in Hamiltonian Dynamics.**  
M. Gómez-Rocha, S. D. Glazek.  
Few Body Syst. 57 (2016) no.7, 509-513 [arXiv:1601.07801].
- 5. Asymptotic freedom of gluons in the Fock space.**  
S. D. Glazek, M. Gómez-Rocha.  
Acta Phys.Polon. B47 (2016) 225 [arXiv:1510.01609].
- 6. Effects of a dressed quark-gluon vertex in pseudoscalar heavy-light mesons.**  
M. Gómez-Rocha, T. Hilger, A. Krassnigg.  
Phys.Rev. D 92 (2015) no.5, 054030 [arXiv:1506.03686].
- 7. Asymptotic freedom in the front-form Hamiltonian for quantum chromodynamics of gluons.**  
M. Gómez-Rocha, S.D. Glazek.  
Phys.Rev. D 92 (2015) no.6, 065005 [arXiv:1505.06688].
- 8. Masses of  $J^{PC} = 1^{-+}$  exotic quarkonia in a Bethe-Salpeter-equation approach.**  
T. Hilger, M. Gómez-Rocha, A. Krassnigg.  
Phys. Rev. D 91 (2015) 114004 [arXiv:1503.08697].
- 9. Spectra of heavy quarkonia in a Bethe-Salpeter-equation approach.**  
T. Hilger, C. Popovici, M. Gomez-Rocha, A. Krassnigg.  
Phys. Rev. D 91 (91) 7, 076003 [arXiv:1409.3205].
- 10. First look at heavy-light mesons with a dressed quark-gluon vertex.**  
M. Gomez-Rocha, T. Hilger, A. Krassnigg.  
Few Body Syst. 56 (2015) no.6-9, 475-480 [arXiv:1408.1077].
- 11. Semileptonic meson decays in point-form relativistic quantum mechanics: unambiguous extraction of weak form factors.**  
M. Gomez-Rocha.  
Phys. Rev. D 90 (2014) 076003 [arXiv:1409.5239].
- 12. On a new approach to meson phenomenology with the Bethe-Salpeter equation.**  
C. Popovici, T. Hilger, M. Gomez-Rocha, A. Krassnigg.  
Few Body Syst. 56 (2015) no.6-9, 481-487 [arXiv:1407.7970].

13. **Hadron structure within the point form of relativistic quantum mechanics.**  
M. Gómez-Rocha, W. Schweiger, O. Senekowitsch.  
Few Body Syst. **55** (2014) 697-700 [arXiv:1311.1936].
14. **Electroweak form factors of heavy-light mesons – a relativistic point-form approach.**  
M. Gómez-Rocha, W. Schweiger.  
Phys. Rev. D **86** (2012) 053010 [arXiv:1206.1257].
15. **Angular momentum decomposition of chiral multiplets in front form.**  
M. Gómez-Rocha.  
Int. J. of Modern Physics A, **27** (2012) 1250163 [arXiv:1204.5362].
16. **Electroweak hadron structure within a point-form approach.**  
M. Gómez-Rocha, W. Schweiger.  
Acta Phys. Polon. Supp. **6** (2013) 365-370 [arXiv:1211.0868].
17. **Electroweak hadron structure in point-form dynamics – heavy-light systems.**  
M. Gómez-Rocha, W. Schweiger.  
PoS QNP2012, 067 (2012) [arXiv:1206.5150].
18. **Form-factors of few body systems – point-form vs. front-form.**  
M. Gómez-Rocha, E. P. Biernat, W. Schweiger.  
Few Body Syst. **52**, 397-401 (2012) [arXiv:1110.2355].
19. **Form factors of heavy-light systems in point-form relativistic quantum mechanics: the Isgur-Wise function.**  
M. Gómez Rocha, W. Schweiger.  
Few Body Syst. **50**, 227-229 (2011) [arXiv:1011.0547].
20. **Boost operators in Coulomb gauge QCD: The pion form factor and Fock expansions in  $\phi$  radiative decays.**  
M. Gómez Rocha, F. J. Llanes-Estrada, D. Schütte, and S. Villalba-Chávez.  
Eur. J. Phys. A **44**, (2010) 411-424 [arXiv:0910.1448].

### *B) Publications without peer-review process*

1. **Heavy-light form factors: the Isgur-Wise function in point-form relativistic quantum mechanics.**  
M. Gómez Rocha, W. Schweiger.  
Proceedings of “Bled 2010, Dressing hadrons” 29-32 (2010) [arXiv:1010.3080].
2. **Álgebra de Poincaré de la Cromodinámica Cuántica.**  
M. Gómez Rocha, F. J. Llanes-Estrada, S. Villalba Chávez.  
Proceedings of “Bienal de la Real Sociedad Española de 19<sup>o</sup> Encuentro Ibérico de Enseñanza de la Física” 275-276 (2009).

### *C) Preprints*

1. **From asymptotic freedom toward heavy quarkonia within the renormalization group procedure for effective particles .**  
M. Gómez-Rocha.  
[arXiv:1611.07300].
2. **Asymptotic freedom in the Hamiltonian approach to binding of color.**  
M. Gómez-Rocha.  
[arXiv:1611.07261].

3. **Investigating light-quarkonium spectra in a Bethe-Salpeter-equation approach.**  
T. Hilger, M. Gómez-Rocha, A. Krassnigg.  
[arXiv:1508.07183].

*D) In preparation*

1. **Aspects of open-flavor mesons in a comprehensive DSBSE study.**  
T. Hilger, M. Gómez-Rocha, A. Krassnigg, W. Lucha.
2. **Space- and timelike semileptonic meson transitions: About the role of nonvalence contributions in point-form relativistic quantum mechanics.**  
M. Gómez-Rocha, O. Senekowitsch, W. Schweiger.

*E) Works in progress*

1. **Binding force in heavy quarkonium using the renormalization group procedure for effective particles.**  
S. D. Głazek, M. Gómez-Rocha, K. Serafin, J. More.

December 21, 2016