Reginald Christian Bernardo, Ph.D.

reginaldchristianbernardo@gmail.com
https://reggiebernardo.weebly.com/
https://github.com/reggiebernardo

Research Interests

Gravitational Waves, Cosmology, Dark Energy, Black Holes, Alternative Gravity

Highlights

Codes (/1)

- **PTAfast**: PTA correlations from stochastic gravitational wave background, ascl:2211.001.

Papers (/31)

- R. C. Bernardo and K.-W. Ng, Stochastic gravitational wave background phenomenology in a pulsar timing array, arXiv:2208.12538 [gr-qc], *To appear in Phys. Rev. D*.
- R. C. Bernardo and K.-W. Ng, Pulsar and cosmic variances of pulsar timing-array correlation measurements of the stochastic gravitational wave background, JCAP 11 (2022) 046, arXiv:2209.14834 [gr-qc].
- R. C. Bernardo, D. Grandon, J. Levi Said, and V. H. Cardenas, Parametric and nonparametric methods hint dark energy evolution, Phys. Dark Univ. 36 (2022) 101017, arXiv:2111.08289 [astro-ph.CO].
- R. C. Bernardo, J. Levi Said, M. Caruana, and S. Appleby, Well-tempered Minkowski solutions in teleparallel Horndeski theory, 2022 Class. Quantum Grav. 39 015013, arXiv:2108.02500 [gr-qc].
- R. C. Bernardo, Gravitational wave signatures from dark sector interactions, Phys. Rev. D 104, 024070 (2021), arXiv:2103.02311 [gr-qc].

Employment History

- 2021 – pres. **Postdoctoral Fellow,** Institute of Physics, Academia Sinica, Taiwan
- 2021 – 2021 **Assistant Professor,** National Institute of Physics, University of the Philippines
- 2015 – 2020 **Instructor,** National Institute of Physics, University of the Philippines

Education

- 2017 – 2020 **Ph.D. Physics, University of the Philippines Diliman**
  Thesis title: *Compact objects, cosmologies, and gravitational perturbations in scalar-tensor theories of gravity*
- 2015 – 2017 **M.Sc. Physics, University of the Philippines Diliman**
  Thesis title: *Some consequences of the generalized uncertainty principle: energy levels, thin-layer quantization, and quantum dynamics*
- 2010 – 2015 **B.Sc. Physics, University of the Philippines Diliman**
  Thesis title: *Bound states, quantum scattering, and dynamics in one-dimensional systems with minimal length*

Research Papers

Articles

1. Bernardo, R. C., & Lee, Y.-R. (2022). Hubble constant by natural selection: Evolution chips in the Hubble tension. arXiv: 2212.02203 [astro-ph.CO]

2. Bernardo, R. C., Grandón, D., Levi Said, J., & Cárdenas, V. H. (2022). Dark energy by natural evolution: Constraining dark energy using Approximate Bayesian Computation. arXiv: 2211.05482 [astro-ph.CO]

3. Bernardo, R. C., & Ng, K.-W. (2022a). Stochastic gravitational wave background phenomenology in a pulsar timing array. arXiv: 2208.12538 [gr-qc]

4. Villegas, K. H. A., & Bernardo, R. C. (2022). Quantum and higher curvature corrections to the anti-de Sitter black hole. arXiv: 2208.07663 [gr-qc]

5. Bernardo, R. C., & Ng, K.-W. (2022b). Looking out for the Galileon in the nanohertz gravitational wave sky. arXiv: 2206.01056 [astro-ph.CO]

6. Bernardo, R. C., & Chen, C.-Y. (2022). Dressed black holes in the new tensor-vector-scalar theory. arXiv: 2202.08460 [gr-qc]

7. Appleby, S., & Bernardo, R. C. (2022). Tadpole cosmology: self tuning without degeneracy. *JCAP*, *07*(07), 035. doi:10.1088/1475-7516/2022/07/035. arXiv: 2202.08672 [astro-ph.CO]

8. Bernardo, R. C., Chen, C.-Y., Said Levi, J., & Kung, Y.-H. (2022). Confronting quantum-corrected teleparallel cosmology with observations. *JCAP*, *04*(04), 052. doi:10.1088/1475-7516/2022/04/052. arXiv: 2111.11761 [gr-qc]

9. Bernardo, R. C., Grandón, D., Said Levi, J., & Cárdenas, V. H. (2022). Parametric and nonparametric methods hint dark energy evolution. *Phys. Dark Univ.*, *36*, 101017. doi:10.1016/j.dark.2022.101017. arXiv: 2111.08289 [astro-ph.CO]

10. Bernardo, R. C., & Ng, K.-W. (2022c). Pulsar and cosmic variances of pulsar timing-array correlation measurements of the stochastic gravitational wave background. *JCAP*, *11*, 046. doi:10.1088/1475-7516/2022/11/046. arXiv: 2209.14834 [gr-qc]

11. Palpal-latoc, C. J., Bernardo, R. C., & Vega, I. (2022). Testing time-delayed cosmology. *Eur. Phys. J. C*, *82*(1148). doi:10.1140/epjc/s10052-022-11126-x. arXiv: 2111.10742 [astro-ph.CO]

12. Bernardo, R. C., Said, J. L., Caruana, M., & Appleby, S. (2021a). Well-Tempered Minkowski Solutions in Teleparallel Horndeski Theory. doi:10.1088/1361-6382/ac36e4. arXiv: 2108.02500 [gr-qc]

13. Bernardo, R. C. (2021a). Gravitational wave signatures from dark sector interactions. *Phys. Rev. D*, *104*(2), 024070. doi:10.1103/PhysRevD.104.024070. arXiv: 2103.02311 [gr-qc]

14. Bernardo, R. C. (2021b). Inflationary quantum dynamics and backreaction using a classical-quantum correspondence. *Eur. Phys. J. C*, *81*(11), 994. doi:10.1140/epjc/s10052-021-09781-7. arXiv: 2109.08508 [gr-qc]

15. Bernardo, R. C. (2021c). Self-tuning kinetic gravity braiding: Cosmological dynamics, shift symmetry, and the tadpole. *JCAP*, *03*, 079. doi:10.1088/1475-7516/2021/03/079. arXiv: 2101.00965 [gr-qc]

16. Bernardo, R. C., & Levi Said, J. (2021a). A data-driven Reconstruction of Horndeski gravity via the Gaussian processes. *JCAP*, *09*, 014. doi:10.1088/1475-7516/2021/09/014. arXiv: 2105.12970 [astro-ph.CO]

17. Bernardo, R. C., & Levi Said, J. (2021b). Towards a model-independent reconstruction approach for late-time Hubble data. *JCAP*, *08*, 027. doi:10.1088/1475-7516/2021/08/027. arXiv: 2106.08688 [astro-ph.CO]

18. Bernardo, R. C., Said, J. L., Caruana, M., & Appleby, S. (2021b). Well-tempered teleparallel Horndeski cosmology: a teleparallel variation to the cosmological constant problem. *JCAP*, *10*, 078. doi:10.1088/1475-7516/2021/10/078. arXiv: 2107.08762 [gr-qc]

19. Bernardo, R. C., & Vega, I. (2021). Stealth black hole perturbations in kinetic gravity braiding. *J. Math. Phys.*, *62*(7), 072501. doi:10.1063/5.0048929. arXiv: 2007.06006 [gr-qc]

20 Bernardo, R. C., Celestial, J., & Vega, I. (2020). Stealth black holes in shift symmetric kinetic gravity braiding. *Phys. Rev. D*, *101*(2), 024036. doi:10.1103/PhysRevD.101.024036. arXiv: 1911.01847 [gr-qc]

21 Bernardo, R. C., & Vega, I. (2019a). Hair-dressing Horndeski: An approach for obtaining hairy solutions in cubic Horndeski gravity. *Phys. Rev. D*, *99*(12), 124049. doi:10.1103/PhysRevD.99.124049. arXiv: 1902.04988 [gr-qc]

22 Bernardo, R. C., & Vega, I. (2019b). Tailoring cosmologies in cubic shift-symmetric Horndeski gravity. *JCAP*, *10*, 058. doi:10.1088/1475-7516/2019/10/058. arXiv: 1903.12578 [gr-qc]

23 Bernardo, R. C. S., & Esguerra, J. P. H. (2018). Maximally-localized position, Euclidean path-integral, and thermodynamics in GUP quantum mechanics. *Annals Phys.*, *391*, 293–311. doi:10.1016/j.aop.2018.02.015

24 Bernardo, R. C. S., & Esguerra, J. P. H. (2017). Euclidean path integral formalism in deformed space with minimum measurable length. *J. Math. Phys.*, *58*(4), 042103. doi:10.1063/1.4979797

25 Cruz, P. C. S., Bernardo, R. C. S., & Esguerra, J. P. H. (2017). Energy levels of a quantum particle on a cylindrical surface with non-circular cross-section in electric and magnetic fields. *Annals of Physics*, *379*, 159–174. doi:https://doi.org/10.1016/j.aop.2017.02.004

26 Bernardo, R. C. S., & Esguerra, J. P. H. (2016a). Energy levels of one-dimensional systems satisfying the minimal length uncertainty relation. *Annals Phys.*, *373*, 521–531. doi:10.1016/j.aop.2016.07.035

27 Bernardo, R. C. S., & Esguerra, J. P. H. (2016b). Quantum scattering in one-dimensional systems satisfying the minimal length uncertainty relation. *Annals Phys.*, *375*, 444–459. doi:10.1016/j.aop.2016.10.022

28 Esguerra, J. P., Bernardo, R. C., Vallejos, J. D., & Canda, J. J. (2015). Reply to comment on 'wind-influenced projectile motion'. *European Journal of Physics*, *36*(6), 068004. doi:10.1088/0143-0807/36/6/068004

29 Bernardo, R. C., Esguerra, J. P., Vallejos, J. D., & Canda, J. J. (2015). Wind-influenced projectile motion. *European Journal of Physics*, *36*(2), 025016. doi:10.1088/0143-0807/36/2/025016

30 Bernardo, R. C. S., & Esguerra, J. P. H. (2015b). Exactly Solvable Dynamical Models with a Minimal Length Uncertainty. *Few Body Syst.*, *56*(4-5), 219–229. doi:10.1007/s00601-015-0978-8. arXiv: 1602.02240 [hep-th]

31 Bernardo, R. C. S., & Palisoc, C. P. (2014). Wronskian method for bound state central force problem. *European Journal of Physics*, *35*(3), 035024. doi:10.1088/0143-0807/35/3/035024

Workshops & Invited Talks

- **2023 Annual Meeting of the Physical Society of Taiwan (TPS2023)**, 16 - 18 January 2023, hosted by the National Cheng Kung University, Taiwan, Talk: "Stochastic gravitational wave background correlation signals in a pulsar timing array"
- **19th Rencontres du Vietnam 2023: Theory meeting experiments (TMEX-2023)**, 5 - 11 January 2023, hosted by the International Centre for Interdisciplinary Science Education, Quy Nhon, Vietnam, Talk: "Stochastic gravitational wave background correlations in a pulsar timing array"
- **PTAfast: Finding the Galileon and other degrees of freedom in the nanohertz GW sky**, 2 December 2022, Invited Talk (given virtually) at the CosPA (Cosmology and Particle Astrophysics) 2022 Symposium, Asia Pacific Center for Theoretical Physics, Korea
- **Stochastic gravitational wave background phenomenology in a pulsar timing array**, 27 October 2022, Invited Seminar at the Department of Physics, National Tsing Hua University, Taiwan
- **The 31st Workshop on General Relativity and Gravitation in Japan (JGRG31)**, 24 - 28 October 2022, virtual, hosted by the University of Tokyo, Japan, Talk: "Stochastic gravitational wave background phenomenology beyond Einstein"

Workshops & Invited Talks (continued)

- **The stochastic gravitational wave background in a pulsar timing array**, 6 October 2022, Invited Seminar at the Department of Physics, National Taiwan Normal University, Taiwan
- **The stochastic gravitational wave background in a pulsar timing array**, 4 October 2022, Invited Seminar at the Department of Electrophysics, National Yang Ming Chiao Tung University, Taiwan
- **NCTS The Future is Illuminating**, 28 - 30 June 2022, virtual, hosted by the National Center for Theoretical Sciences Physics Division, Hsinchu Hub, Taiwan, Talk: "Beyond Einstein phenomenology in the nanohertz gravitational wave sky"
- **Quantum Field Theory in Curved Spacetimes Workshop**, 23 - 27 May 2022, virtual, Talk: "Back-reaction of modes on inflationary dynamics through a classical-quantum correspondence"
- **Self-tuning phenomenology through degeneracy and beyond**, 29 March 2022, Invited Seminar at the Department of Physics, National Taiwan Normal University, Taiwan
- **Asia-Pacific School and Workshop on Gravitation and Cosmology 2022**, 19 - 22 March 2022, virtual, hosted by the Department of Physics, Soochow, Taiwan and GSROC (Taiwan), Talk: "Self-tuning beyond degeneracy through the cosmic tadpole"
- **The cosmological constant problem, Fab Four, and well-tempered cosmology**, 18 February 2022, Invited Seminar at the Institute of Physics, Academia Sinica, Taiwan
- **Gravitational wave signatures from dark sector interactions**, 27 December 2021, Invited Seminar at the National Center for Theoretical Sciences Physics Division, National Taiwan University, Taiwan
- **The 30th Workshop on General Relativity and Gravitation in Japan (JGRG30)**, 6 - 10 December 2021, virtual, hosted by the Waseda University, Japan, Talk: "Towards well-tempered dark energy and teleparallel gravity"
- **LeCosPA 4th International Symposium Unity of Physics – From Plasma Wakefields to Black Holes**, 29 November - 3 December 2021, hosted by the Leung Center for Cosmology and Particle Astrophysics, National Taiwan University, Talk: "Progress on well-tempered cosmology: new teleparallel extensions and observational status"
- **Brookhaven Forum: Opening New Windows to the Universe (BF2021)**, 3 - 5 November 2021, virtual, hosted by the Brookhaven National Laboratory, Talk: "Towards a model-independent reconstruction approach for late-time Hubble data"
- **The dark Universe: Theory and data assemblies**, 20 - 22 October 2021, Invited Talk (given virtually) at the Proceedings of the 39th Samahang Pisika ng Pilipinas Physics Conference, Physics Society of the Philippines
- **8th Korea-Japan workshop on Dark Energy**, 18 - 22 October 2021, virtual, hosted by the Yukawa Institute for Theoretical Physics, Kyoto University, Japan, Talk: "Towards well-tempered dark energy models"
- **AAPPS-DACG Workshop 2021 on Astrophysics, Cosmology and Gravitation**, 4 - 8 October 2021, virtual, hosted by the Asia Pacific Center for Theoretical Physics, Korea, Talk: "A data-driven reconstruction of Horndeski gravity using late-time Hubble data"
- **Black Holes Inside and Out (BHIO2021)**, 27 September - 1 October 2021, virtual, hosted by the Tokyo Institute of Technology and the Yukawa Institute of Theoretical Physics, Japan and the Florida Space Institute, US, Poster: "Gravitational wave signatures from dark sector interactions"
- **Alternative Gravities and Fundamental Cosmology (ALTECOSMOFUN'21)**, 6 - 10 September 2021, virtual, hosted by the Szczecin Cosmology Group, Institute of Physics, University of Szczecin, Poland, Talk: "A data-driven reconstruction of Horndeski gravity using late-time Hubble data"
- **Iberian Cosmology Meeting (IberiCOS 2021)**, 29 March - April 1 2021, virtual, hosted by the University of Coimbra and Instituto Superior Técnico, University of Lisbon, Portugal, Talk: "New scaling solutions in coupled vector dark energy"

Workshops & Invited Talks (continued)

- **International Webinar on Recent Developments in Cosmology and Modified Gravity (RDCM-2021)**, 9 - 11 March 2021, virtual, hosted by the Department of Mathematics, BITS-Pilani, Hyderabad Campus, India, Talk: "Gravitational waves from dark sector interactions"
- **SIGRAV International School 2021: Gravity of Compact Astrophysical Objects and Gravitational Waves**, 1 - 5 February 2021, virtual, hosted by the Italian Society of General Relativity and Gravitation, Italy
- **IV Joint ICTP-Trieste/ICTP-SAIFR School on Cosmology: Challenges for the Standard Cosmological Model**, 18 - 29 January 2021, virtual, hosted by IFT-UNESP, São Paulo, Brazil
- **The 29th Workshop on General Relativity and Gravitation in Japan (JGRG29)**, 25 - 29 November 2019, Kobe University, Japan, Talk: "Hairy black holes in kinetic gravity braiding"
- **2019 YITP Asian-Pacific Winter School and Workshop on Gravitation and Cosmology**, 11 - 15 February 2019, Yukawa Institute for Theoretical Physics, Kyoto University, Japan, Poster: "New solutions in Horndeski theory"
- **ICTP Summer School on Cosmology 2018**, 18 - 29 June 2018, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy

Conference Proceedings

Samahang Pisika ng Pilipinas (Physics Society of the Philippines)

1. Baybay, J. A. B., Bernardo, R. C., & Vega, M. F. I. (2020). Scattering of nonlinear bosonic fields: A case study in superradiance. In *Proceedings of the samahang pisika ng pilipinas* (Vol. 38, SPP-2020-5A–05). Retrieved from https://proceedings.spp-online.org/article/view/SPP-2020-5A-05
2. Bernardo, R. C., Angeles, J. M., & Vega, M. F. I. (2020). Cosmological dynamics in a self-tuning cubic horndeski theory. In *Proceedings of the samahang pisika ng pilipinas* (Vol. 38, SPP-2020-1E–05). Retrieved from https://proceedings.spp-online.org/article/view/SPP-2020-1E-05
3. Celestial, J. d. L., Bernardo, R. C. S., & Vega, M. F. I. G. (2019). Electrically-charged black holes in horndeski theory. In *Proceedings of the samahang pisika ng pilipinas* (Vol. 37, SPP-2019-3C–02). Retrieved from https://proceedings.spp-online.org/article/view/SPP-2019-3C-02
4. Villanueva, J. A. N., Bernardo, R. C. S., & Vega, M. F. I. G. (2019). Gravitational radiation from extreme-mass ratio inspirals in bald kinetic gravity braiding. In *Proceedings of the samahang pisika ng pilipinas* (Vol. 37, SPP-2019-3C–04). Retrieved from https://proceedings.spp-online.org/article/view/SPP-2019-3C-04
5. Bernardo, R. C., & Vega, M. F. I. (2018). No-go theorems in cubic sector of shift-symmetric horndeski gravity. In *Proceedings of the samahang pisika ng pilipinas* (Vol. 36, SPP-2018-1D–01). Retrieved from https://proceedings.spp-online.org/article/view/SPP-2018-1D-01
6. Bernardo, R. C. S., & Esguerra, J. P. H. (2015a). Energy levels of a quantum particle on a corrugated tube in a uniform electric field. In *Proceedings of the samahang pisika ng pilipinas* (Vol. 33, SPP-2015-PB–43). Retrieved from https://proceedings.spp-online.org/article/view/1249
7. Bernardo, R. C. S., & Esguerra, J. P. H. (2014). Tunneling through rectangular double barrier potential systems in quantum mechanics with minimal length uncertainty. In *Proceedings of the samahang pisika ng pilipinas* (Vol. 32, SPP2014-3B–05). Retrieved from https://proceedings.spp-online.org/article/view/1840
8. Bernardo, R. (2013). Effect of transverse uniform electric field on spinless quantum particle confined on the surface of an elliptic cylinder. In *Proceedings of the samahang pisika ng pilipinas* (Vol. 31, SPP2013-PA–9). Retrieved from https://proceedings.spp-online.org/article/view/SPP2013-PA-9

Skills

Languages	English, Filipino
Coding	Python, Mathematica, LaTeX
Misc.	Academic research, teaching, training, consultation, LaTeX typesetting and publishing

Teaching

Lecturer	Particle Physics, Thermodynamics, Relativity, and Quantum Mechanics for Engineering and Physics Majors
Lab	Elementary Mechanics, Thermodynamics, and Modern Physics for Engineering and Science Students
Grader	Mechanics, Electromagnetism, Quantum Theory, Statistical Mechanics, Solid State Physics, and General Gelativity for Undergraduate and Graduate Students

Admin

Organizer	High Energy Physics Seminar, August 2022–January 2023, Institute of Physics, Academia Sinica
	HEP Journal Club, February–July 2022, Institute of Physics, Academia Sinica
Head	Wellness Committee, A.Y. 2019-2020, National Institute of Physics, University of the Philippines Diliman
	Modern Physics Course Group, A.Y. 2018-2019, National Institute of Physics, University of the Philippines Diliman
	Elementary Mechanics Lab Course Group, A.Y. 2017-2018, National Institute of Physics, University of the Philippines Diliman
Member	Socials Committee, A.Y. 2015-2016, National Institute of Physics, University of the Philippines Diliman

Miscellaneous Experience

Service to the Community

Referee	Physical Review Journals, Classical and Quantum Gravity, Physics of the Dark Universe, Chinese Journal of Physics, Scientific Reports, Proceedings of the Physics Society of the Philippines
Editor	Topical Editor in Theoretical Physics, Proceedings of the Physics Society of the Philippines

Awards and Achievements

2020	**Most Outstanding Ph.D. Graduate**, College of Science, UPD
	Edgardo Gomez Award for Outstanding Ph.D. Graduate, College of Science, UPD
	Excellence in Graduate Studies, College of Science, UPD
2017	**Most Outstanding M.S. Graduate**, College of Science, UPD
2016	**Gawad Direktor bilang Natatanging Guro sa Laboratorio**, National Institute of Physics, UPD
2015	**Leticia Shahani Award for Best Undergraduate Thesis**, College of Science, UPD
	Magna Cum Laude, College of Science, UPD

Miscellaneous Experience (continued)

2012 – 2015 **Jose Maria Feliciano Undergraduate Scholar**, College of Science, UPD

2010 – 2015 **College and University Scholar**, College of Science, UPD

References

Kin-Wang Ng
Research Fellow
Institute of Physics *and* Institute of Astronomy and Astrophysics, Academia Sinica,
Taipei 11529, Taiwan
nkw@phys.sinica.edu.tw

Stephen Appleby
Junior Research Group Leader
Associate Professor
Asia Pacific Center for Theoretical Physics *and* Department of Physics, POSTECH,
Pohang 37673, Korea
stephen.appleby@apctp.org

Ian Vega
Professor
National Institute of Physics, University of the Philippines Diliman,
Quezon City 1101, Philippines
ivega@nip.upd.edu.ph

Jackson Levi Said
Associate Professor
Institute of Space Sciences and Astronomy *and* Department of Physics, University of Malta,
Msida, 2080 Malta
jackson.said@um.edu.mt