

N-PACT Compilation 2021

Norwegian Particle, Astroparticle
and Cosmology Theory community

Introduction

N-PACT is a network aimed at all researchers at Norwegian academic institutions (and Norwegians at CERN) working on Theoretical Particle physics, Astroparticle physics, or Cosmology. The network compiles an annual summary of the combined scientific activity of the network members (this document), and runs an annual workshop and an email list: npact@uis.no. Workshop venues: 19.-22. June 2017, University of Stavanger, 28.-31. May 2018, University of Stavanger. 5.-6. August 2019, University of Oslo. Jun 2020, University of Agder (cancelled due to COVID-19). The 25. June 2021, University of Stavanger (Fysikermøte 2021).

N-PACT enters as the official entity for PACT in the Norwegian contribution to the European Particle Physics Strategy Document (*Research Plans of the Norwegian Particle, Astroparticle and Nuclear Physics Communities till 2025*). It is stated:

For Norwegian theory, activities at and in connection with CERN play a major role, but rather than focusing on a specific experiment, the theory community takes a broader view and combines its interest in not only particle physics but also astrophysics and cosmology in the N-PACT theory collaboration. It is important that these theory activities be given an enhanced visibility in the European Strategy Update.

And in the section devoted to theory research activities, it says:

The Norwegian community in particle, astroparticle, and cosmology theory (NPACT) is coalescing and is represented here in a single section. A new networking activity has been initiated, connecting all six institutions where theory activities currently exist. As the result of a recent generational turnover, the majority of the network members are newly appointed staff at the six institutions and are of relatively young age (< 50 y). The network is working towards net growth, as well as increasing Norway's participation in CERN theory activities and the Norwegian quota there. To be successful, we see a need for funding opportunities for theory activities distinct from experiments, mirroring the role played by the Theoretical Physics Division at CERN.

This is then followed by a description of the specific PACT research activities.



Figure 1: Network members and their affiliations in Norway

Member profiles

University of Agder



Nils-Erik Bomark,
Associate Professor.

At UiA since 2015. SUSY phenomenology, NMSSM, Dark Matter. How to teach particle physics non-technically.

University of Bergen



**Jörn Kersten,
Professor.**

At UiB since 2014. SUSY phenomenology, self-interacting dark matter, physics of the early universe, cosmology, neutrino physics.



**Konrad Tywniuk,
Researcher (Group Leader).**

At UiB since 2018. Heavy-ion physics, hard probes (jet quenching, heavy bosons), finite temperature theory, cosmology.



**Johannes Isaksen,
Ph.D. student.**

At UiB since 2020. Heavy-ion physics, jet quenching.



**Per Osland,
Professor (emer.).**

At UiB since 1987. Particle phenomenology, Extended Higgs sector, CP violation, Dark Matter.



**Yilun Du,
Postdoc.**

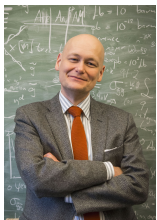
At UiB since 2019. Heavy-ion physics, jet quenching.



**Adam Takacs,
Ph.D. student**

At UiB since 2019. Heavy-ion physics, jet quenching.

University of Oslo



**Are Raklev,
Professor.**

At UiO since 2010. Particle Phenomenology, SUSY, Dark Matter. LHC, CERN, GAMBIT.



**Torsten Bringmann,
Professor.**

At UiO since 2013. BSM particle physics and cosmology. Astrophysical probes of dark matter: indirect detection and structure formation. Dark-SUSY, GAMBIT, CTA.



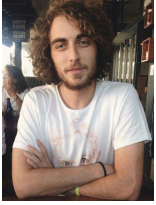
**David Mota,
Professor.**

At UiO since 2011. General Relativity, Cosmology.



**Anders Kvellestad,
Postdoc.**

At UiO/Imperial College since 2017. BSM global fits, LHC phenomenology, supersymmetry, two-Higgs-doublet models, machine learning and Bayesian methods. GAMBIT.



**Jake Gordin,
Ph.D. student**

At UiO since 2018. High energy astrophysics.



**Lasse Lorentz Braseth,
Ph.D. student.**

At UiO since 2020.

University of Stavanger



**Anders Tranberg,
Professor.**

At UiS since 2013. Finite temperature and out-of-equilibrium field theory, cosmology, baryogenesis, inflation and gravitational waves. CERN, LISA.



**Tomas Brauner,
Professor.**

At UiS since 2015. Finite-temperature and -density field theory, phase diagram of QCD, effective field theory, spontaneous symmetry breaking.



**Sigbjørn Hervik,
Professor.**

At UiS since 2009. GR, Modified Gravity, Differential Geometry.



**Alex Nielsen,
Associate Professor.**

At UiS since 2019. Gravitational waves, General Relativity, Black holes



**Aleksi Kurkela,
Associate Professor.**

At UiS/CERN since 2014. Heavy-ion collisions, QCD at finite temperature, density. Compact stars. LHC, CERN.



**Germano Nardini,
Associate Professor.**

At UiS since 2018. Cosmological phase transitions, gravitational waves, beyond Standard Model physics.



**Alexander Rothkopf,
Associate Professor.**

At UiS since 2018. Lattice QCD, numerical field theory, out-of-equilibrium field theory.



**Eirik Svanes,
Associate Professor.**

At UiS since 2019. String theory, mathematical physics.



Paul de Medeiros,
Associate Professor.
 At UiS since 2017. Mathematical
 Physics, String theory.



Rasmus Larsen,
Postdoc.
 At UiS since 2020. Lattice field theory,
 QCD.



David McNutt
Associate Professor.
 At UiS since 2017. General Relativity,
 Cosmology.



Jahed Abedi,
Postdoc.
 At UiS since 2021. Gravitational
 Waves.



Helena Kolesova,
Postdoc.
 At UiS since 2018. Finite-temperature
 field theory, symmetry breaking.



Divyarani Chandrababu Geetha,
Ph.D. student.
 At UiS since 2021. Electroweak phase
 transition, Gravitational waves.



Georgios Filios,
Ph.D. student.
 At UiS since 2018. Effective Field The-
 ory, phases of QCD.



Mark Bogers,
Ph.D. student.
 At UiS since 2015. Symmetry breaking
 in quantum field theory.



Daniel Alvestad,
Ph.D. student.
 At UiS since 2019. Lattice field theory,
 Monte Carlo simulations.



Gerhard Ungersb/ack,
Ph.D. student.
 At UiS since 2021. Non-equilibrium
 field theory, lattice field theory.



Paolo Marcoccia,
Ph.D. student.
 At UiS since 2019. Gravitational
 waves.



Oleg Komoltsev,
Ph.D. student.
 At UiS since 2021. QCD phase dia-
 gram and neutron stars.



Gaurang Parkar,
Ph.D. student.
 At UiS since 2019. Lattice QCD, Non-equilibrium field theory.



Jonas El Gammal,
Ph.D. student.
 At UiS since 2021. Gravitational waves and phase transitions.

NTNU, Trondheim



Jens Oluf Andersen,
Professor.
 At NTNU since 2005. QCD at finite temperature and density: Quark-gluon plasma, finite-density QCD and quark matter, phase transitions.



Michael Kachelriess,
Professor.
 At NTNU since 2005. High energy astrophysics, dark matter, neutrino physics.



Marius Solberg,
Associate Professor.
 At NTNU since 2016. Works on N-Higgs doublet models, quantum field theory, particle phenomenology.



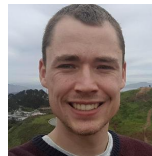
Foteini Oikonomou,
Associate Professor.
 At NTNU since 2020. Cosmic Rays, Multi-messenger astrophysics.



Prabal Adhikari,
Associate Professor.
 At NTNU since 2019. QCD in extreme conditions.



Magdalena Eriksson,
Ph.D. student.
 At NTNU/UiS since 2019. Quantum fields in cosmology.



Jonas Tjemsland,
Ph.D. student.
 At NTNU since 2019. High energy astrophysics, cosmic antimatter.

HVL, Vestlandet



Odd Magne Øgreid,
Associate Professor.
 At HVL since 1999. Works on particle phenomenology, extended Higgs sector, CP-violation.

HiØ, Østlandet



Mikjel Thorsrud,
Associate Professor.
At HiØ since 2014. General relativity,
cosmology.

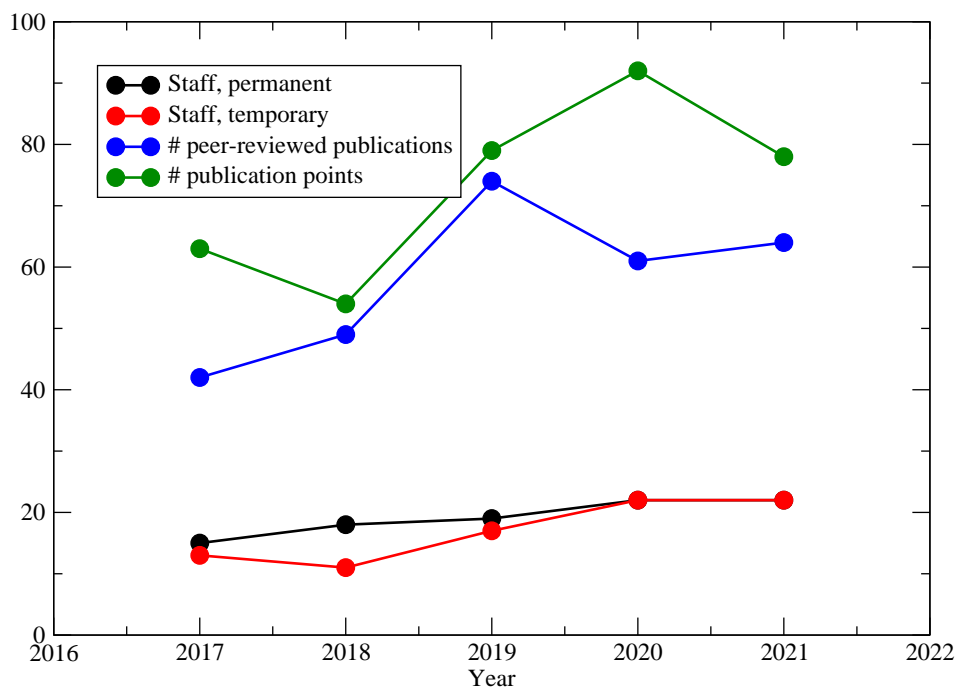


Figure 2: Members (senior and junior), number of publications and publication points over time.

Combined publication list

Metrics:

- 64 peer reviewed journal publications, published during 2021.
- 78 publication points, using new formula,

$$\sum \left[\sqrt{\frac{\text{Authors/affiliations in NPACT}}{\text{All authors/affiliations}}} \times \text{If International} \times \text{Publication level score} \right]$$

where: *If International* is 1 if all authors are Norwegian, 1.3 otherwise; *Publication level score* is either 1 or 3, depending on the journal; *Authors/affiliations* count author/affiliation combinations (a single author with two affiliations counts twice); and where *All authors/affiliations* for a single publication is capped at 10 (for instance for GAMBIT).

References

- [1] T. Brauner, H. Kolešová and N. Yamamoto, Phys. Lett. B **823** (2021), 136767 doi:10.1016/j.physletb.2021.136767 [arXiv:2108.10044 [hep-ph]].
- [2] T. Brauner, JHEP **04** (2021), 045 doi:10.1007/JHEP04(2021)045 [arXiv:2012.00051 [hep-th]].
- [3] T. Brauner, JHEP **02** (2021), 218 doi:10.1007/JHEP02(2021)218 [arXiv:2008.12078 [hep-th]].
- [4] M. A. Mojahed and T. Brauner, Phys. Lett. B **822** (2021), 136705 doi:10.1016/j.physletb.2021.136705 [arXiv:2108.03189 [hep-th]].
- [5] A. Kurkela, A. Mazeliauskas and R. Törnkvist, JHEP **11** (2021), 216 doi:10.1007/JHEP11(2021)216 [arXiv:2104.08179 [hep-ph]].
- [6] T. Gorda, A. Kurkela, R. Paatelainen, S. Säppi and A. Vuorinen, Phys. Rev. D **104** (2021) no.7, 074015 doi:10.1103/PhysRevD.104.074015 [arXiv:2103.07427 [hep-ph]].
- [7] T. Gorda, A. Kurkela, R. Paatelainen, S. Säppi and A. Vuorinen, Phys. Rev. Lett. **127** (2021) no.16, 162003 doi:10.1103/PhysRevLett.127.162003 [arXiv:2103.05658 [hep-ph]].
- [8] K. Boguslavski, A. Kurkela, T. Lappi and J. Peuron, JHEP **05** (2021), 225 doi:10.1007/JHEP05(2021)225 [arXiv:2101.02715 [hep-ph]].
- [9] A. Huss, A. Kurkela, A. Mazeliauskas, R. Paatelainen, W. van der Schee and U. A. Wiedemann, Phys. Rev. Lett. **126** (2021) no.19, 192301 doi:10.1103/PhysRevLett.126.192301 [arXiv:2007.13754 [hep-ph]].

- [10] A. Huss, A. Kurkela, A. Mazeliauskas, R. Paatelainen, W. van der Schee and U. A. Wiedemann, *Phys. Rev. C* **103** (2021) no.5, 054903 doi:10.1103/PhysRevC.103.054903 [arXiv:2007.13758 [hep-ph]].
- [11] J. O. Andersen, M. Eriksson and A. Tranberg, *JHEP* **04** (2021), 273 doi:10.1007/JHEP04(2021)273 [arXiv:2011.12030 [hep-ph]].
- [12] P. Millington, Z. G. Mou, P. M. Saffin and A. Tranberg, *JHEP* **03** (2021), 077 doi:10.1007/JHEP03(2021)077 [arXiv:2011.02657 [hep-th]].
- [13] Z. G. Mou, P. M. Saffin and A. Tranberg, *JHEP* **02** (2021), 189 doi:10.1007/JHEP02(2021)189 [arXiv:2006.13620 [hep-th]].
- [14] D. Alvestad, R. Larsen and A. Rothkopf, *JHEP* **08** (2021), 138 doi:10.1007/JHEP08(2021)138 [arXiv:2105.02735 [hep-lat]].
- [15] A. Lehmann and A. Rothkopf, *JHEP* **07** (2021), 067 doi:10.1007/JHEP07(2021)067 [arXiv:2012.10089 [hep-lat]].
- [16] O. Ålund, Y. Akamatsu, F. Laurén, T. Miura, J. Nordström and A. Rothkopf, *J. Comput. Phys.* **425** (2021), 109917 doi:10.1016/j.jcp.2020.109917 [arXiv:2004.04406 [physics.comp-ph]].
- [17] M. A. Sedda, C. P. L. Berry, K. Jani, P. Amaro-Seoane, P. Auclair, J. Baird, T. Baker, E. Berti, K. Breivik and C. Caprini, *et al.* *Exper. Astron.* **51** (2021) no.3, 1427-1440 doi:10.1007/s10686-021-09713-z [arXiv:2104.14583 [gr-qc]].
- [18] R. Flauger, N. Karnesis, G. Nardini, M. Pieroni, A. Ricciardone and J. Torrado, *JCAP* **01** (2021), 059 doi:10.1088/1475-7516/2021/01/059 [arXiv:2009.11845 [astro-ph.CO]].
- [19] A. Sesana, N. Korsakova, M. A. Sedda, V. Baibhav, E. Barausse, S. Barke, E. Berti, M. Bonetti, P. R. Capelo and C. Caprini, *et al.* *Exper. Astron.* **51** (2021) no.3, 1333-1383 doi:10.1007/s10686-021-09709-9 [arXiv:1908.11391 [astro-ph.IM]].
- [20] B. S. Acharya, L. Foscolo, M. Najjar and E. E. Svanes, *JHEP* **05** (2021), 250 doi:10.1007/JHEP05(2021)250 [arXiv:2011.06998 [hep-th]].
- [21] B. S. Acharya, A. Kinsella and E. E. Svanes, *JHEP* **01** (2021), 197 doi:10.1007/JHEP01(2021)197 [arXiv:2010.07438 [hep-th]].
- [22] C. K. Watson, W. Julius, M. Gorban, D. D. McNutt, E. W. Davis and G. B. Cleaver, *Symmetry* **13** (2021) no.8, 1469 doi:10.3390/sym13081469 [arXiv:2107.10360 [gr-qc]].
- [23] D. D. McNutt, A. A. Coley and R. J. van den Hoogen, *J. Math. Phys.* **62** (2021) no.5, 052501 doi:10.1063/5.0051400 [arXiv:2105.06223 [gr-qc]].

- [24] D. D. McNutt, W. Julius, M. Gorban, B. Mattingly, P. Brown and G. Cleaver, Phys. Rev. D **103** (2021) no.12, 124024 doi:10.1103/PhysRevD.103.124024 [arXiv:2104.08935 [gr-qc]].
- [25] I. Delgado Gaspar, R. A. Sussman, D. D. McNutt and A. A. Coley, Eur. Phys. J. C **81** (2021) no.4, 310 doi:10.1140/epjc/s10052-021-09113-9 [arXiv:2103.06862 [gr-qc]].
- [26] B. D. Normann and I. H. Brevik, Mod. Phys. Lett. A **36** (2021) no.27, 2150198 doi:10.1142/S0217732321501984 [arXiv:2107.13533 [gr-qc]].
- [27] F. Oikonomou, M. Petropoulou, K. Murase, A. Tohuvavohu, G. Vasilopoulos, S. Buson and M. Santander, JCAP **10** (2021), 082 doi:10.1088/1475-7516/2021/10/082 [arXiv:2107.11437 [astro-ph.HE]].
- [28] M. Kachelriess and J. Tjemsland, Astropart. Phys. **132** (2021), 102622 doi:10.1016/j.astropartphys.2021.102622 [arXiv:2104.06811 [hep-ph]].
- [29] J. O. Andersen, Eur. Phys. J. A **57** (2021) no.6, 189 doi:10.1140/epja/s10050-021-00491-y [arXiv:2102.13165 [hep-ph]].
- [30] M. Kachelriess, S. Ostapchenko and J. Tjemsland, Eur. Phys. J. A **57** (2021) no.5, 167 doi:10.1140/epja/s10050-021-00469-w [arXiv:2012.04352 [hep-ph]].
- [31] P. Adhikari, J. O. Andersen and M. A. Mojahed, Eur. Phys. J. C **81** (2021) no.5, 449 doi:10.1140/epjc/s10052-021-09212-7 [arXiv:2012.04339 [hep-ph]].
- [32] P. Adhikari, J. O. Andersen and M. A. Mojahed, Eur. Phys. J. C **81** (2021) no.2, 173 doi:10.1140/epjc/s10052-021-08948-6 [arXiv:2010.13655 [hep-ph]].
- [33] M. Linares and M. Kachelriess, JCAP **02** (2021), 030 doi:10.1088/1475-7516/2021/02/030 [arXiv:2010.02844 [astro-ph.HE]].
- [34] S. Koldobskiy, M. Kachelrieß, A. Lskavyan, A. Neronov, S. Ostapchenko and D. V. Semikoz, Phys. Rev. D **104** (2021) no.12, 123027 doi:10.1103/PhysRevD.104.123027 [arXiv:2110.00496 [astro-ph.HE]].
- [35] P. Athron *et al.* [GAMBIT], Eur. Phys. J. C **81** (2021) no.11, 992 doi:10.1140/epjc/s10052-021-09712-6 [arXiv:2106.02056 [hep-ph]].
- [36] T. Bringmann, P. F. Depta, M. Hufnagel, J. T. Ruderman and K. Schmidt-Hoberg, Phys. Rev. Lett. **127** (2021) no.19, 19 doi:10.1103/PhysRevLett.127.191802 [arXiv:2103.16572 [hep-ph]].
- [37] T. Binder, T. Bringmann, M. Gustafsson and A. Hryczuk, Eur. Phys. J. C **81** (2021), 577 doi:10.1140/epjc/s10052-021-09357-5 [arXiv:2103.01944 [hep-ph]].

- [38] P. Stöcker *et al.* [GAMBIT Cosmology Workgroup], Phys. Rev. D **103** (2021) no.12, 123508 doi:10.1103/PhysRevD.103.123508 [arXiv:2009.03287 [astro-ph.CO]].
- [39] J. J. Renk *et al.* [GAMBIT Cosmology Workgroup], JCAP **02** (2021), 022 doi:10.1088/1475-7516/2021/02/022 [arXiv:2009.03286 [astro-ph.CO]].
- [40] A. Acharyya *et al.* [CTA], JCAP **01** (2021), 057 doi:10.1088/1475-7516/2021/01/057 [arXiv:2007.16129 [astro-ph.HE]].
- [41] T. Bringmann, P. F. Depta, M. Hufnagel and K. Schmidt-Hoberg, Phys. Lett. B **817** (2021), 136341 doi:10.1016/j.physletb.2021.136341 [arXiv:2007.03696 [hep-ph]].
- [42] S. Bloor, T. E. Gonzalo, P. Scott, C. Chang, A. Raklev, J. E. Camargo-Molina, A. Kvellestad, J. J. Renk, P. Athron and C. Balázs, Eur. Phys. J. C **81** (2021) no.12, 1103 doi:10.1140/epjc/s10052-021-09828-9 [arXiv:2107.00030 [hep-ph]].
- [43] M. Khodadi, G. Lambiase and D. F. Mota, JCAP **09** (2021), 028 doi:10.1088/1475-7516/2021/09/028 [arXiv:2107.00834 [gr-qc]].
- [44] D. Wang and D. Mota, Phys. Dark Univ. **32** (2021), 100813 doi:10.1016/j.dark.2021.100813 [arXiv:2103.12358 [astro-ph.CO]].
- [45] E. Di Valentino, O. Mena, S. Pan, L. Visinelli, W. Yang, A. Melchiorri, D. F. Mota, A. G. Riess and J. Silk, Class. Quant. Grav. **38** (2021) no.15, 153001 doi:10.1088/1361-6382/ac086d [arXiv:2103.01183 [astro-ph.CO]].
- [46] S. Sahlu, J. Ntahompagaze, A. Abebe and D. F. Mota, Int. J. Geom. Meth. Mod. Phys. **18** (2021) no.02, 2150027 doi:10.1142/S0219887821500274
- [47] R. Hagala, A. D. Felice, D. F. Mota and S. Mukohyama, Astron. Astrophys. **653** (2021), A148 doi:10.1051/0004-6361/202040018 [arXiv:2011.14697 [astro-ph.CO]].
- [48] M. Martinelli *et al.* [Euclid], Astron. Astrophys. **649** (2021), A100 doi:10.1051/0004-6361/202039835 [arXiv:2010.12382 [astro-ph.CO]].
- [49] A. Mitra, J. Mifsud, D. F. Mota and D. Parkinson, Mon. Not. Roy. Astron. Soc. **502** (2021) no.4, 5563-5575 doi:10.1093/mnras/stab165 [arXiv:2010.00189 [astro-ph.CO]].
- [50] E. Di Valentino, L. A. Anchordoqui, Ö. Akarsu, Y. Ali-Haimoud, L. Amendola, N. Arendse, M. Asgari, M. Ballardini, S. Basilakos and E. Battistelli, *et al.* Astropart. Phys. **131** (2021), 102604 doi:10.1016/j.astropartphys.2021.102604 [arXiv:2008.11285 [astro-ph.CO]].
- [51] E. Di Valentino, L. A. Anchordoqui, Ö. Akarsu, Y. Ali-Haimoud, L. Amendola, N. Arendse, M. Asgari, M. Ballardini, S. Basilakos and E. Battistelli, *et al.* Astropart. Phys. **131** (2021), 102607 doi:10.1016/j.astropartphys.2021.102607 [arXiv:2008.11286 [astro-ph.CO]].

- [52] E. Di Valentino, L. A. Anchordoqui, O. Akarsu, Y. Ali-Haimoud, L. Amendola, N. Arendse, M. Asgari, M. Ballardini, S. Basilakos and E. Battistelli, *et al.* *Astropart. Phys.* **131** (2021), 102606 doi:10.1016/j.astropartphys.2021.102606 [arXiv:2008.11283 [astro-ph.CO]].
- [53] E. Di Valentino, L. A. Anchordoqui, O. Akarsu, Y. Ali-Haimoud, L. Amendola, N. Arendse, M. Asgari, M. Ballardini, S. Basilakos and E. Battistelli, *et al.* *Astropart. Phys.* **131** (2021), 102605 doi:10.1016/j.astropartphys.2021.102605 [arXiv:2008.11284 [astro-ph.CO]].
- [54] Ø. Christiansen, J. Beltrán Jiménez and D. F. Mota, *Class. Quant. Grav.* **38** (2021) no.7, 075017 doi:10.1088/1361-6382/abdaf5 [arXiv:2003.11452 [gr-qc]].
- [55] P. M. Ferreira, B. Grzadkowski, O. M. Ogreid and P. Osland, *JHEP* **02** (2021), 196 doi:10.1007/JHEP02(2021)196 [arXiv:2010.13698 [hep-ph]].
- [56] N. E. Bomark, *Eur. J. Phys.* **42** (2021) no.3, 035403 doi:10.1088/1361-6404/abdb9e [arXiv:2110.15202 [physics.pop-ph]].
- [57] J. Barata, Y. Mehtar-Tani, A. Soto-Ontoso and K. Tywoniuk, *JHEP* **09** (2021), 153 doi:10.1007/JHEP09(2021)153 [arXiv:2106.07402 [hep-ph]].
- [58] A. Takacs and K. Tywoniuk, *JHEP* **10** (2021), 038 doi:10.1007/JHEP10(2021)038 [arXiv:2103.14676 [hep-ph]].
- [59] Y. Mehtar-Tani, D. Pablos and K. Tywoniuk, *Phys. Rev. Lett.* **127** (2021) no.25, 252301 doi:10.1103/PhysRevLett.127.252301 [arXiv:2101.01742 [hep-ph]].
- [60] Y. L. Du, D. Pablos and K. Tywoniuk, *JHEP* **21** (2020), 206 doi:10.1007/JHEP03(2021)206 [arXiv:2012.07797 [hep-ph]].
- [61] J. Barata, Y. Mehtar-Tani, A. Soto-Ontoso and K. Tywoniuk, *Phys. Rev. D* **104** (2021) no.5, 054047 doi:10.1103/PhysRevD.104.054047 [arXiv:2009.13667 [hep-ph]].
- [62] J. H. Isaksen and K. Tywoniuk, *JHEP* **21** (2020), 125 doi:10.1007/JHEP11(2021)125 [arXiv:2107.02542 [hep-ph]].
- [63] A. V. Olinto *et al.* [POEMMA], *JCAP* **06** (2021), 007 doi:10.1088/1475-7516/2021/06/007 [arXiv:2012.07945 [astro-ph.IM]].
- [64] P. Osland, A. A. Pankov and I. A. Serenkova, *Phys. Rev. D* **103** (2021) no.5, 053009 doi:10.1103/PhysRevD.103.053009 [arXiv:2012.13930 [hep-ph]].