# Curriculum Vitae Shea C. Garrison-Kimmel

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# **Professional Appointments**

Postdoctoral Scholar, California Institute of Technology

August 2018 - present

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• Einstein Fellow, California Institute of Technology

August 2015 - August 2018

## **Education**

• Ph.D. in Physics and Astronomy, University of California, Irvine

Awarded June 2015

• M.S. in Physics and Astronomy, University of California, Irvine

Awarded Dec 2010

• B.S. in Physics and Astronomy, concentration in Computer Science, Haverford College Awarded May 2009

# **Fellowships and Awards**

Einstein Postdoctoral Fellowship, NASA

 Awarded July 2015

 Chancellor's Club Dissertation Fellowship, University of California, Irvine

 Awarded Dec 2014

 Price Prize, Ohio State University

 Chancellor's Fellowship, University of California, Irvine
 Awarded Feb 2009

 Summer Research Fellowship, University of California, Irvine
 Awarded Feb 2009

## **Research Interests**

Galaxy formation and theoretical cosmology, such as:

- Placing the Milky Way in its proper cosmological context as a member of the Local Group
- Numerical simulations of structure formation on both large and small scales
- Constraining the behavior of dark matter by comparing with local galactic properties
- The impact of environment on dwarf galaxy evolution
- The formation and evolution of the smallest galaxies in the Universe
- Comparing theoretical predictions with observational data to constrain baryonic processes
- Using gravitational wave observations to probe galaxy formation and binary star evolution

#### **Professional Service**

• Created and organized inaugural GalFRESCA workshop

Summer 2016

• Co-organized second and third annual GalFRESCA workshops

Summer 2017, 2018

• Twice served on NASA Astrophysics Theory Program grant review panel

# **Teaching and Mentoring**

## **Teaching experience**

• University of California, Irvine, Teaching Assistant

Sept 2009 - June 2010 and March 2014 - June 2014

• California State Summer School for Mathematics and Science, Teaching Assistant July 2010, 2011, and 2012

• Haverford College, Physics Clinic Tutor

Feb 2007 - May 2009

## **Mentoring and Advising Experience**

- Mentored Jaspreet Lally, then a rising junior at University of California, Irvine, on how to run and analyze simulations of dwarf galaxies in isolation with a time varying potential to search for core formation, resulting in an authorship on Garrison-Kimmel et al., 2013. Jaspreet successfully graduated the following year.
- Mentored Kyle Lee, then a sophomore at Chapman University, on how to set up, simulate, and analyze cosmological simulations, resulting in an authorship on Garrison-Kimmel et al., 2014 and helping to secure his current position in a Ph.D. program at Stony Brook University.
- Mentored Emma Bardwell, then a rising sophomore at Case Western University, on a project exploring the relationship between halo mass and galaxy stellar mass, and the impact of scatter in that relation, resulting in an authorship on Garrison-Kimmel et al., 2016.
- Mentored Kris Burke, then a senior at University of California, Irvine, on simulating the cosmological evolution of galaxies with a central potential to explore the impact of the Milky Way disk on the substructure population with minimal CPU cost, resulting in an authorship on a paper in preparation. Kris has since continued into a M.Sc. program at Texas A&M.
- Aided Dr. Astrid Lamberts in mentoring the summer research of Kaliden Drango, then an entering undergraduate at Caltech who built the initial machinery for applying binary population synthesis models to the FIRE simulations to make gravitational wave predictions.
- Currently co-advising Ivanna Escala, a graduate student at Caltech, on a study comparing galactic evolution as inferred from one-zone chemical evolution models applied to simulated dwarf galaxies to the actual evolution of those dwarfs.

#### References

## Philip F. Hopkins\*

Professor TAPIR, Department of Astronomy Caltech

phopkins@caltech.edu Postdoc advisor

#### **Andrew Wetzel**

Assistant Professor Department of Physics University of California, Davis awetzel@ucdavis.edu

#### **Evan Kirby**

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#### **James S. Bullock\***

Professor
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#### **Beth Willman**

Thesis advisor

NCOA Deputy Director Steward Observatory University of Arizona bwillman@lsst.org

#### **Manoj Kaplinghat**

Associate Professor Department of Physics & Astronomy University of California, Irvine mkapling@uci.edu

## Mike Boylan-Kolchin\*

Assistant Professor Department of Astronomy University of Texas at Austin mbk@astro.as.utexas.edu

## Michael C. Cooper

Assistant Professor Department of Physics & Astronomy University of California, Irvine cooper@uci.edu

#### Annika Peter

Assistant Professor Department of Physics & Astronomy Ohio State University peter.33@osu.edu

## **First Author Publications**

## Peer-reviewed publications

[1] The origin of the diverse morphologies and kinematics of Milky Way-mass galaxies in the FIRE-2 simulations, **S. Garrison-Kimmel**, P. F. Hopkins, A. Wetzel, K. El-Badry, R. E. Sanderson, J. S. Bullock, X. Ma, F. van de Voort, Z. Hafen *et al.*. MNRAS **481**, 4133–4157 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.481.4133G

- [2] Not so lumpy after all: modelling the depletion of dark matter subhaloes by Milky Way-like galaxies, **S. Garrison-Kimmel**, A. Wetzel, J. S. Bullock, P. F. Hopkins, M. Boylan-Kolchin, C.-A. Faucher-Giguère, D. Kereš, E. Quataert, R. E. Sanderson *et al.*. MNRAS **471**, 1709–1727 (2017). https://ui.adsabs.harvard.edu/#abs/2017MNRAS.471.1709G
- [3] Organized chaos: scatter in the relation between stellar mass and halo mass in small galaxies, **S. Garrison-Kimmel**, J. S. Bullock, M. Boylan-Kolchin, and E. Bardwell. MNRAS **464**, 3108–3120 (2017). https://ui.adsabs.harvard.edu/#abs/2017MNRAS.464.3108G
- [4] Running with BICEP2: implications for small-scale problems in CDM, S. Garrison-Kimmel, S. Horiuchi, K. N. Abazajian, J. S. Bullock, and M. Kaplinghat. MNRAS 444, 961–970 (2014). https://ui.adsabs.harvard.edu/#abs/2014MNRAS.444.961G
- [5] *Too big to fail in the Local Group*, **S. Garrison-Kimmel**, M. Boylan-Kolchin, J. S. Bullock, and E. N. Kirby. *MNRAS* **444**, 222–236 (2014). https://ui.adsabs.harvard.edu/#abs/2014MNRAS.444..222G
- [6] ELVIS: Exploring the Local Volume in Simulations, S. Garrison-Kimmel, M. Boylan-Kolchin, J. S. Bullock, and K. Lee. MNRAS 438, 2578–2596 (2014). https://ui.adsabs.harvard.edu/#abs/2014MNRAS.438.2578G
- [7] Can feedback solve the too-big-to-fail problem?, S. Garrison-Kimmel, M. Rocha, M. Boylan-Kolchin, J. S. Bullock, and J. Lally. MNRAS 433, 3539–3546 (2013). https://ui.adsabs.harvard.edu/#abs/2013MNRAS.433.3539G

## Papers under review

- [1] Star formation histories of dwarf galaxies in the FIRE simulations: dependence on mass and Local Group environment, **S. Garrison-Kimmel**, A. Wetzel, P. F. Hopkins, R. Sanderson, K. El-Badry, A. Graus, T. Chan, R. Feldmann, M. Boylan-Kolchin *et al.*. arXiv:1903.10515 (2019). https://ui.adsabs.harvard.edu/#abs/2019arXiv190310515G
- [2] The Local Group on FIRE: Dwarf galaxy populations across a suite of hydrodynamic simulations, **S. Garrison-Kimmel**, P. F. Hopkins, A. Wetzel, J. S. Bullock, M. Boylan-Kolchin, D. Keres, C.-A. Faucher-Giguere, K. El-Badry, A. Lamberts *et al.*. arXiv:1806.04143 (2018). https://ui.adsabs.harvard.edu/#abs/2018arXiv180604143G

## **Nth Author Publications**

#### Peer-reviewed publications

- [1] The suppression of star formation on the smallest scales: what role does environment play?, M. Rodriguez Wimberly, M. Cooper, S. Fillingham, M. Boylan-Kolchin, J. Bullock, and **S. Garrison-Kimmel**. MNRAS **483**, 4031–4039 (2019). https://ui.adsabs.harvard.edu/#abs/2019MNRAS.483.4031R
- [2] Formation, vertex deviation and age of the Milky Way's bulge: input from a cosmological simulation with a late-forming bar, V. P. Debattista, O. A. Gonzalez, R. E. Sand erson, K. El-Badry, **S. Garrison-Kimmel**, A. Wetzel, C.-A. Faucher-Giguère, and P. F. Hopkins. MNRAS 716 (2019). https://ui.adsabs.harvard.edu/#abs/2019MNRAS.tmp..716D

[3] Where are the most ancient stars in the Milky Way?, K. El-Badry, J. Bland-Hawthorn, A. Wetzel, E. Quataert, D. R. Weisz, M. Boylan-Kolchin, P. F. Hopkins, C.-A. Faucher-Giguère, D. Kereš et al.. MNRAS 480, 652–668 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.480..652E

- [4] Warm FIRE: simulating galaxy formation with resonant sterile neutrino dark matter, B. Bozek, A. Fitts, M. Boylan-Kolchin, **S. Garrison-Kimmel**, K. Abazajian, J. S. Bullock, D. Kereš, C.-A. Faucher-Giguère, A. Wetzel et al.. MNRAS 483, 4086–4099 (2019). https://ui.adsabs.harvard.edu/#abs/2019MNRAS.483.4086B
- [5] Environmental quenching of low-mass field galaxies, S. P. Fillingham, M. C. Cooper, M. Boylan-Kolchin, J. S. Bullock, **S. Garrison-Kimmel**, and C. Wheeler. MNRAS **477**, 4491–4498 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.477.4491F
- [6] Predicting the binary black hole population of the Milky Way with cosmological simulations, A. Lamberts, S. Garrison-Kimmel, P. Hopkins, E. Quataert, J. Bullock, C. .-A. Faucher-Giguère, A. Wetzel, D. Kereš, K. Drango et al.. MNRAS 480, 2704–2718 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.480.2704L
- [7] Reconciling Observed and Simulated Stellar Halo Masses, R. E. Sanderson, **S. Garrison-Kimmel**, A. Wetzel, T. Keung Chan, P. F. Hopkins, D. Kereš, I. Escala, C.-A. Faucher-Giguère, and X. Ma. *ApJ* **869**, 12 (2018). https://ui.adsabs.harvard.edu/#abs/2018ApJ...869...12S
- [8] Modeling the Impact of Baryons on Subhalo Populations with Machine Learning, E. O. Nadler, Y.-Y. Mao, R. H. Wechsler, S. Garrison-Kimmel, and A. Wetzel. ApJ 859, 129 (2018). https://ui.adsabs.harvard.edu/ #abs/2018ApJ...859..129N
- [9] *The origin of ultra diffuse galaxies: stellar feedback and quenching*, T. Chan, D. Kereš, A. Wetzel, P. Hopkins, C. .-A. Faucher-Giguère, K. El-Badry, **S. Garrison-Kimmel**, and M. Boylan-Kolchin. *MNRAS* **478**, 906–925 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.478..906C
- [10] Simulating galaxies in the reionization era with FIRE-2: morphologies and sizes, X. Ma, P. F. Hopkins, M. Boylan-Kolchin, C.-A. Faucher-Giguère, E. Quataert, R. Feldmann, S. Garrison-Kimmel, C. C. Hayward, D. Kereš et al.. MNRAS 477, 219–229 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.477..219M
- [11] Simulating galaxies in the reionization era with FIRE-2: galaxy scaling relations, stellar mass functions, and luminosity functions, X. Ma, P. F. Hopkins, S. Garrison-Kimmel, C.-A. Faucher-Giguère, E. Quataert, M. Boylan-Kolchin, C. C. Hayward, R. Feldmann, and D. Kereš. MNRAS 478, 1694–1715 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.478.1694M
- [12] *Gas kinematics, morphology and angular momentum in the FIRE simulations*, K. El-Badry, E. Quataert, A. Wetzel, P. F. Hopkins, D. R. Weisz, T. Chan, A. Fitts, M. Boylan-Kolchin, D. Kereš *et al.*. *MNRAS* **473**, 1930–1955 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.473.1930E
- [13] Formation of globular cluster candidates in merging proto-galaxies at high redshift: a view from the FIRE cosmological simulations, J.-h. Kim, X. Ma, M. Y. Grudić, P. F. Hopkins, C. C. Hayward, A. Wetzel, C.-A. Faucher-Giguère, D. Kereš, **S. Garrison-Kimmel** et al.. MNRAS **474**, 4232–4244 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.474.4232K
- [14] FIRE-2 simulations: physics versus numerics in galaxy formation, P. F. Hopkins, A. Wetzel, D. Kereš, C.-A. Faucher-Giguère, E. Quataert, M. Boylan-Kolchin, N. Murray, C. C. Hayward, **S. Garrison-Kimmel** et al.. MNRAS **480**, 800–863 (2018). https://ui.adsabs.harvard.edu/#abs/2018MNRAS.480..800H
- [15] A Testable Conspiracy: Simulating Baryonic Effects on Self-interacting Dark Matter Halos, O. D. Elbert, J. S. Bullock, M. Kaplinghat, **S. Garrison-Kimmel**, A. S. Graus, and M. Rocha. *ApJ* **853**, 109 (2018). https://ui.adsabs.harvard.edu/#abs/2018ApJ...853..109E
- [16] *Under pressure: quenching star formation in low-mass satellite galaxies via stripping*, S. P. Fillingham, M. C. Cooper, A. B. Pace, M. Boylan-Kolchin, J. S. Bullock, **S. Garrison-Kimmel**, and C. Wheeler. *MNRAS* **463**, 1916–1928 (2016). https://ui.adsabs.harvard.edu/#abs/2016MNRAS.463.1916F
- [17] When and where did GW150914 form?, A. Lamberts, S. Garrison-Kimmel, D. Clausen, and P. Hopkins. MN-RAS 463, L31–L35 (2016). https://ui.adsabs.harvard.edu/#abs/2016MNRAS.463L..31L

[18] *Properties of resonantly produced sterile neutrino dark matter subhaloes*, S. Horiuchi, B. Bozek, K. N. Abaza-jian, M. Boylan-Kolchin, J. S. Bullock, **S. Garrison-Kimmel**, and J. Onorbe. *MNRAS* **456**, 4346–4353 (2016). https://ui.adsabs.harvard.edu/#abs/2016MNRAS.456.4346H

- [19] Resonant sterile neutrino dark matter in the local and high-z Universe, B. Bozek, M. Boylan-Kolchin, S. Horiuchi, **S. Garrison-Kimmel**, K. Abazajian, and J. S. Bullock. MNRAS **459**, 1489–1504 (2016). https://ui.adsabs.harvard.edu/#abs/2016MNRAS.459.1489B
- [20] Satellites of LMC-mass dwarfs: close friendships ruined by Milky Way mass haloes, A. Deason, A. Wetzel, S. Garrison-Kimmel, and V. Belokurov. MNRAS 453, 3568–3574 (2015). https://ui.adsabs.harvard.edu/#abs/2015MNRAS.453.3568D
- [21] Sweating the small stuff: simulating dwarf galaxies, ultra-faint dwarf galaxies, and their own tiny satellites, C. Wheeler, J. Oñorbe, J. S. Bullock, M. Boylan-Kolchin, O. D. Elbert, **S. Garrison-Kimmel**, P. F. Hopkins, and D. Kereš. MNRAS **453**, 1305–1316 (2015). https://ui.adsabs.harvard.edu/#abs/2015MNRAS.453.1305W
- [22] Taking care of business in a flash: constraining the time-scale for low-mass satellite quenching with ELVIS, S. P. Fillingham, M. C. Cooper, C. Wheeler, **S. Garrison-Kimmel**, M. Boylan-Kolchin, and J. S. Bullock. *MNRAS* **454**, 2039–2049 (2015). https://ui.adsabs.harvard.edu/#abs/2015MNRAS.454.2039F
- [23] Satellite Dwarf Galaxies in a Hierarchical Universe: Infall Histories, Group Preprocessing, and Reionization, A. R. Wetzel, A. J. Deason, and **S. Garrison-Kimmel**. ApJ **807**, 49 (2015). https://ui.adsabs.harvard.edu/#abs/2015ApJ...807...49W
- [24] *Core formation in dwarf haloes with self-interacting dark matter: no fine-tuning necessary*, O. D. Elbert, J. S. Bullock, **S. Garrison-Kimmel**, M. Rocha, J. Oñorbe, and A. H. Peter. *MNRAS* **453**, 29–37 (2015). https://ui.adsabs.harvard.edu/#abs/2015MNRAS.453...29E
- [25] Satellite Dwarf Galaxies in a Hierarchical Universe: The Prevalence of Dwarf-Dwarf Major Mergers, A. Deason, A. Wetzel, and **S. Garrison-Kimmel**. ApJ **794**, 115 (2014). https://ui.adsabs.harvard.edu/#abs/2014ApJ...794..115D
- [26] Cosmological simulations of decaying dark matter: implications for small-scale structure of dark matter haloes, M.-Y. Wang, A. H. Peter, L. E. Strigari, A. R. Zentner, B. Arant, **S. Garrison-Kimmel**, and M. Rocha. MNRAS **445**, 614–629 (2014). https://ui.adsabs.harvard.edu/#abs/2014MNRAS.445..614W
- [27] *Near-field limits on the role of faint galaxies in cosmic reionization.*, M. Boylan-Kolchin, J. Bullock, and **S. Garrison-Kimmel**. *MNRAS* **443**, L44–L48 (2014). https://ui.adsabs.harvard.edu/#abs/2014MNRAS.443L. .44B
- [28] *The Stellar-to-halo Mass Relation for Local Group Galaxies*, C. Brook, A. Di Cintio, A. Knebe, S. Gottlöber, Y. Hoffman, G. Yepes, and **S. Garrison-Kimmel**. *ApJ* **784**, L14 (2014). https://ui.adsabs.harvard.edu/#abs/2014ApJ...784L..14B
- [29] *Sterile neutrino dark matter bounds from galaxies of the Local Group*, S. Horiuchi, P. J. Humphrey, J. Oñorbe, K. N. Abazajian, M. Kaplinghat, and **S. Garrison-Kimmel**. *Phys. Rev. D* **89**, 025017 (2014). https://ui.adsabs.harvard.edu/#abs/2014PhRvD..89b5017H
- [30] How to zoom: bias, contamination and Lagrange volumes in multimass cosmological simulations, J. Oñorbe, S. Garrison-Kimmel, A. H. Maller, J. S. Bullock, M. Rocha, and O. Hahn. MNRAS 437, 1894–1908 (2014). https://ui.adsabs.harvard.edu/#abs/2014MNRAS.437.1894O
- [31] On the stark difference in satellite distributions around the Milky Way and Andromeda, B. Yniguez, S. Garrison-Kimmel, M. Boylan-Kolchin, and J. S. Bullock. MNRAS 439, 73–82 (2014). https://ui.adsabs.harvard.edu/#abs/2014MNRAS.439...73Y
- [32] Cosmological simulations with self-interacting dark matter I. Constant-density cores and substructure, M. Rocha, A. H. Peter, J. S. Bullock, M. Kaplinghat, **S. Garrison-Kimmel**, J. Oñorbe, and L. A. Moustakas. *MNRAS* **430**, 81–104 (2013). https://ui.adsabs.harvard.edu/#abs/2013MNRAS.430...81R

#### Papers under review

[1] Be it therefore resolved: Cosmological Simulations of Dwarf Galaxies with Extreme Resolution, C. Wheeler, P. F. Hopkins, A. B. Pace, **S. Garrison-Kimmel**, M. Boylan-Kolchin, A. Wetzel, J. S. Bullock, D. Keres, C.-A. Faucher-Giguere *et al.*. arXiv:1812.02749 (2018). https://ui.adsabs.harvard.edu/#abs/2018arXiv181202749W

- [2] *Phat ELVIS: The inevitable effect of the Milky Way's disk on its dark matter subhaloes*, T. Kelley, J. S. Bullock, **S. Garrison-Kimmel**, M. Boylan-Kolchin, M. S. Pawlowski, and A. S. Graus. arXiv:1811.12413 (2018). https://ui.adsabs.harvard.edu/#abs/2018arXiv181112413K
- [3] Dwarf Galaxies in CDM, WDM, and SIDM: Disentangling Baryons and Dark Matter Physics, A. Fitts, M. Boylan-Kolchin, B. Bozek, J. S. Bullock, A. Graus, V. Robles, P. F. Hopkins, K. El-Badry, **S. Garrison-Kimmel** et al.. arXiv:1811.11791 (2018). https://ui.adsabs.harvard.edu/#abs/2018arXiv181111791F
- [4] The Origins of the Circumgalactic Medium in the FIRE Simulations, Z. Hafen, C. .-A. Faucher-Giguere, D. Angles-Alcazar, J. Stern, D. Keres, C. Hummels, C. Esmerian, **S. Garrison-Kimmel**, K. El-Badry *et al.*. arXiv:1811.11753 (2018). https://ui.adsabs.harvard.edu/#abs/2018arXiv181111753H
- [5] Under the Firelight: Stellar Tracers of the Local Dark Matter Velocity Distribution in the Milky Way, L. Necib, M. Lisanti, S. Garrison-Kimmel, A. Wetzel, R. Sanderson, P. F. Hopkins, C.-A. Faucher-Giguère, and D. Kereš. arXiv:1810.12301 (2018). https://ui.adsabs.harvard.edu/#abs/2018arXiv181012301N
- [6] How low does it go? Too few Galactic satellites with standard reionization quenching, A. S. Graus, J. S. Bullock, T. Kelley, M. Boylan-Kolchin, S. Garrison-Kimmel, and Y. Qi. arXiv:1808.03654 (2018). https://ui.adsabs. harvard.edu/#abs/2018arXiv180803654G
- [7] Synthetic Gaia surveys from the FIRE cosmological simulations of Milky-Way-mass galaxies, R. E. Sanderson, A. Wetzel, S. Loebman, S. Sharma, P. F. Hopkins, **S. Garrison-Kimmel**, C.-A. Faucher-Giguère, D. Kereš, and E. Quataert. arXiv:1806.10564 (2018). https://ui.adsabs.harvard.edu/#abs/2018arXiv180610564S

## **Conference Proceedings**

- [1] Constraining the Physics of Low-Mass Satellite Galaxy Quenching, S. P. Fillingham, M. C. Cooper, M. Boylan-Kolchin, J. S. Bullock, **S. Garrison-Kimmel**, C. Wheeler, T. Kelley, A. B. Pace, and M. K. Rodriguez Wimberly. American Astronomical Society Meeting Abstracts #233 (2019). https://ui.adsabs.harvard.edu/#abs/2019AAS...23333902F
- [2] Decaying sterile neutrino dark matter in the Local Group, B. Bozek, M. Boylan-Kolchin, S. Horiuchi, S. Garrison-Kimmel, K. Abazajian, and J. Bullock. American Astronomical Society Meeting Abstracts #229 (2017). https://ui.adsabs.harvard.edu/#abs/2017AAS...22941806B
- [3] Cosmological simulations with self-interacting dark matter, M. Rocha, A. Peter, J. Bullock, M. Kaplinghat, S. Garrison-Kimmel, J. Onorbe, and L. Moustakas. Probes of Dark Matter on Galaxy Scales (2013). https://ui.adsabs.harvard.edu/#abs/2013pdmg.conf30203R
- [4] Gaps and Tails: The restricted N-body problem in colliding galaxies and the asteriod belt, A. Pancoast, S. Garrison-Kimmel, and P. Love. APS March Meeting Abstracts (2009). https://ui.adsabs.harvard.edu/#abs/2009APS..MAR.K1007P

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