

# Daniel Gruen

Professor for Astrophysics, Cosmology, and Artificial Intelligence

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## Education

- **Ph.D. Physics, LMU Munich** 10/2011 – 05/2015  
Thesis: Weak Lensing by Galaxy Clusters: from Pixels to Cosmology  
Advisor: Prof. Ralf Bender, Dr. Stella Seitz  
*summa cum laude*, URA and LMU thesis awards
- **M.Sc. Thesis, University of Pennsylvania** 10/2010 – 09/2011  
Thesis: Weak Lensing by Galaxy Clusters: Methods for Future Surveys  
Advisor: Prof. Gary Bernstein
- **B.Sc. and M.Sc., Physics, LMU Munich** 10/2006 – 09/2011

## Research Positions

- **Full Professor** at LMU Munich since 07/2021  
Chair for Astrophysics, Cosmology, and Artificial Intelligence
- **Panofsky Fellow** at SLAC National Accelerator Laboratory / KIPAC 11/2019 – 06/2021  
Junior leader of Lensing, Surveys, Cosmology research group
- **NASA Einstein Fellow and Postdoctoral Researcher** at Stanford University 12/2015 – 11/2019  
Advisors: Prof. Steven Allen, Prof. Risa Wechsler
- **Research Assistant** at LMU Munich / UPenn 10/2010 – 11/2015  
Advisors: Prof. Gary Bernstein, Dr. Stella Seitz

## Research Achievements

- **Co-led Dark Energy Survey weak lensing working group** 2016–2021, including coordination towards the leading lensing cosmology results, twice [[DES 2018](#), [goo.gl/n8w7Ua](http://goo.gl/n8w7Ua), [DES 2021](#), [Amon, Gruen+2021](#)]
- **Developed custom machine learning architectures**, based on artificial neural networks [[Gruen+2010](#)], decision trees [[Gruen+2017](#)], self-organizing maps [[Buchs, Davis, Gruen+2019](#)], and conditional generative adversarial networks, for cosmological applications
- **Reduced systematic uncertainty in weak lensing shape measurement** [[Gruen+2010](#); [Gruen+2015](#); [Zuntz+2018](#); [MacCrann+2021](#)] and redshift calibration [[Gruen+2017](#); [Hoyle & Gruen+2018](#); [Buchs & Davis, Gruen+2019](#); [Myles & Alarcon+2021](#)]
- Designed a new statistic to efficiently probe the **non-Gaussian probability distribution of matter** and galaxy density with lensing, from the first idea to cosmology results [[Gruen+2016](#); [Gruen+2018](#)]
- Developed and applied leading methods for weak lensing calibration of **cluster masses for cosmology** [[Gruen+2014](#); [Gruen+2015a](#); [Melchior & Gruen+2017](#); [McClintock, Varga, Gruen+2018](#)]
- Pioneered use of new **covariance** methods to quantify and reduce uncertainties in weak lensing probes [[Gruen+2015a](#); [Melchior & Gruen+2017](#); [Gruen+2018](#); [McClintock, Varga, Gruen+2018](#)]
- Provided **first detection of the correlation of extragalactic gamma-ray emission and dark matter density** as traced by gravitational lensing [[Ammazzalorso & Gruen+2020](#) and [space.com](http://space.com)]

## Publications

340 publications, 14 as first/corresponding author, over 17,000 citations, h-index 60 (August 2021)

## Talks

Gave more than 100 talks at conferences / collaboration meetings / seminars / colloquia / outreach events

### Selected Conference Talks

<i>AAS Winter</i> , invited, Weak Lensing in DES Y3	Honolulu, HI	01/2020
<i>APS April</i> , invited, Cosmology from DES	Denver, CO	04/2019
<i>Cosmology and Structure formation</i> , invited	Seoul, South Korea	11/2018
<i>SUGAR-RUSH</i> , invited, DES overview	Shanghai, China	06/2018
<i>Rencontres de Blois</i> , invited, DES overview	Blois, France	06/2018
<i>Dark Universe</i> , invited, DES WL overview	Garching, Germany	10/2017
<i>APS DPF</i> , invited announcement of DES Y1 results	Fermilab, IL, video: <a href="https://goo.gl/n8w7Ua">goo.gl/n8w7Ua</a>	08/2017
<i>DESI collaboration meeting</i> , invited, DES review	Berkeley, CA	06/2017
<i>GravLens2016</i> , Weak lensing by galaxy troughs	Leiden, Netherlands	07/2016
<i>PACCD</i> , invited, brighter/fatter effect in DECam	Brookhaven, NY	12/2014

### Selected Seminars/Colloquia

Physics Colloquium on weak lensing cosmology	UC Santa Cruz, CA	01/2019
Spitzer Memorial Lecture on cosmology	CSU East Bay, CA	11/2018
Colloquium on accurate redshifts for cosmology	AURA / Gemini, Chile	10/2018
Cosmology Seminar on weak lensing	Caltech, CA	08/2018
Astronomy Colloquium on weak lensing cosmology	UHawaii Manoa, HI	11/2017
Astrophysics Colloquium on weak lensing cosmology	UMelbourne, Australia	11/2017
EPFL / CERN / UGeneva meeting on DES WL	UGeneva, Switzerland	11/2017
Joint Astrophysics Colloquium on DES weak lensing	ESO Garching, Germany	10/2017
Special Seminar on DES weak lensing	CEA Saclay, France	10/2017
LineA Webinar on weak lensing for cosmology	Rio de Janeiro, remotely	10/2017
Panelist on clusters of galaxies in WFIRST / LSST	Caltech, CA	09/2016
LBNL INPA Seminar on DES weak lensing	Berkeley, CA	02/2016
ITC Lunch Seminar on galaxy troughs	Harvard, MA	01/2016
Cosmology Seminar on galaxy troughs	MPA Garching, Germany	11/2015
UCL Cake Seminar on galaxy troughs	London, UK	06/2015
KIPAC Tea Talk on covariance of cluster WL	Stanford, CA	05/2015
Cosmology Seminar on cluster weak lensing	MPA Garching, Germany	01/2014
Cosmology Seminar on optimal cluster weak lensing	Alfa Bonn, Germany	08/2012
Seminar on shape estimates with neural networks	UPenn, PA	09/2009

## Grants and Awards

- Successful grant proposals as main author (>2.5M\$) and co-author (>13M\$)
- PI and Co-I of successful proposals for >100 orbits of HST and >700h of ground-based telescope time
- UK STFC Ernest Rutherford Fellowship, 2019 (offered and declined)
- Royal Society University Research Fellowship, 2019 (offered and declined)
- Tenure-track professorship at a US state flagship university, 2019 (offered and declined)
- Dark Energy Survey builder status (for 2 FTE years of infrastructure work)
- [University Research Association](#) and LMU Munich Graduate Thesis Award 2016
- Scholarships by German National Merit Foundation (Studienstiftung), Max Weber-Program of the State of Bavaria, Bayerische EliteAkademie, DAAD (B.Sc. and M.Sc. studies)

## Professional Service

- Co-coordinator of the [Dark Energy Survey](#) weak lensing working group (>100 members, 2016–2021)
- Main organizer of 4 [lighthouse](#) workshops at Stanford, funded by KIPAC, DES, and LSSTC
- Departmental service, including postdoc search committees, PAVES, and SLACmass/Snowmass
- 35 nights of telescope observing at CTIO, Keck, KPNO, and Wendelstein observatory
- Reviewer for A&A, ApJ, JATIS, JCAP, JInst, MNRAS, Nature, PASJ, Physics Letters, Elsevier Books; NASA ESSF, HST TAC, RGC of Hong Kong; DES and LSST-DESC internal reviewer

## Teaching and Mentoring Experience

Supervised and co-supervised 22 scientists at the high school to post-doctoral level,

- Patrick Gebhardt, PhD student at LMU, emulation of galaxy photometry, 2021 – ongoing,
- Bernardita Ried, M.Sc. student visiting from UChile, [PAVES](#), density split statistics, 2020 – ongoing,
- Sreyas Adirayu, [NCSSM](#) intern, artificial intelligence and non-Gaussian structure, 2020 – ongoing,
- George Halal, student rotation at Stanford, mock catalogs with cGANs, 2019 – 2020,
- Yunchong Wang, student rotation at Stanford, cluster cosmology, 2020, now PhD student w/ Abel,
- Ares Hernandez, PhD student at Stanford, Fermi LSS analysis, 2019 – ongoing,
- Anthony Flores, student rotation at Stanford, DESI clustering redshifts, 2019, now PhD student w/ Allen,
- Dylan Britt, PhD student at Stanford, galaxy-matter connection, 2019 – ongoing,
- Jamie McCullough, PhD student at Stanford, image simulations and ML photo- $z$ , 2019 – ongoing,
- Dr. Alexandra Amon, KIPAC Fellow, ML photo- $z$  & weak lensing cosmology, 2018 – ongoing,
- Alessa Ibrahim, [CAMPARE](#) intern at Stanford, density split statistics, 2018, now PhD student at TCU,
- Tiffany Tang, [RISE](#) intern at Stanford, density split statistics, 2018, now undergrad at Syracuse U,
- Romain Buchs, M.Sc. student visiting from EPFL, ML photo- $z$ , 2018, now at ETH Zürich,
- Justin Myles, PhD student at Stanford, ML photo- $z$  and cluster cosmology, 2018 – ongoing,
- Dr. Chun-Hao To, PhD student at Stanford, cluster cosmology, 2016 – 2021, now CCAPP fellow at OSU,
- Donny Flynn, undergrad intern at Stanford, cluster lensing, 2017, now co-founder at a software startup,
- Romy Rehmann, M.Sc. and PhD theses at LMU, cluster lensing, 2015 – ongoing
- Dr. Tamas Varga, M.Sc. and PhD theses at LMU, cluster lensing and ML, 2015 – 2020,
- Dmitry Grebenyuk, M.Sc. thesis at LMU, LSS, 2015/2016, now graduate student at U Melbourne,
- Dr. Oliver Friedrich, M.Sc. and PhD thesis at LMU, cosmology, 2014 – 2018, now postdoc at Cambridge,
- Dr. Ralf Kosyra, PhD thesis at LMU, cluster cosmology, 2014 – 2016, now engineer in the industry,
- Dr. Yi-Hao Chen, M.Sc. thesis at LMU, ML-based shape measurement, 2012/2013, now at Facebook.

Taught and co-taught 17 courses on

- *Origin and development of the cosmos* (Stanford, main lecturer 2020, guest lecturer 2017)
- *Introductory astrophysics* (Stanford, guest lecturer 2016 – 2018),
- *Advanced astrophysics* and *Large-scale structure* tutorials (LMU 2013 – 2015),
- *Astrophysics* labs (LMU, 2013 – 2015), *Physics* labs for students of medicine (LMU, 2008).

## Outreach

- Guide at [Point Bonita lighthouse](#), teaching >600 visitors about optics once a month, 2018-2020
- Public discussion with Prof. Gawiser / Hlozek / Scolnic on *Cosmology in Crisis?*, Tucson, 2020
- Outreach speaker at [Schloss Ringberg open day](#), 2015 and [Astronomy on Tap](#), San Francisco, 2017
- Commencement speaker at LMU Physics graduation ceremony, 2012 (M.Sc.) and 2015 (PhD)
- Winner of Munich [Science Slam](#), Oct 2013
- Winner of LMU Philosophy Essay Competition 2009, *Can scientific theories depict reality?*