



**Universiteit  
Leiden**  
The Netherlands

## **Light weighed: on the statistics and systematics of weak gravitational lensing**

Smit, D.M.

### **Citation**

Smit, D. M. (2021, December 8). *Light weighed: on the statistics and systematics of weak gravitational lensing*. Retrieved from <https://hdl.handle.net/1887/3245825>

Version: Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/3245825>

**Note:** To cite this publication please use the final published version (if applicable).

---

# Bibliography

---

- Abazajian, K., Adelman-McCarthy, J. K., Agüeros, M. A., et al. 2003, *AJ*, 126, 2081
- Appenzeller, I., Fricke, K., Fürtig, W., et al. 1998, *The Messenger*, 94, 1
- Bacon, D. J., Refregier, A. R., & Ellis, R. S. 2000, *MNRAS*, 318, 625
- Barnard, E. E. 1906, *Popular Astronomy*, 14, 579
- Barrodale, I. & Roberts, F. D. K. 1973, *SIAM Journal on Numerical Analysis*, 10, 839
- Bartelmann, M. 1996, *A&A*, 313, 697
- Bartelmann, M. & Maturi, M. 2017, *Scholarpedia*, 12, 32440
- Bartelmann, M. & Schneider, P. 2001, *Phys. Rep.*, 340, 291
- Beaton, A. E. & Tukey, J. W. 1974, *Outliers in Statistical Data* (New York: Wiley)
- Begeman, K., Belikov, A. N., Boxhoorn, D. R., & Valentijn, E. A. 2013, *Experimental Astronomy*, 35, 1
- Bellagamba, F., Maturi, M., Hamana, T., et al. 2011, *MNRAS*, 413, 1145
- Bellagamba, F., Roncarelli, M., Maturi, M., & Moscardini, L. 2018, *MNRAS*, 473, 5221
- Bellagamba, F., Sereno, M., Roncarelli, M., et al. 2019, *MNRAS*, 484, 1598
- Benítez, N. 2000, *ApJ*, 536, 571
- Benjamin, J., Van Waerbeke, L., Heymans, C., et al. 2013, *MNRAS*, 431, 1547
- Berlind, A. A., Frieman, J., Weinberg, D. H., et al. 2006, *ApJS*, 167, 1
- Bernstein, G. M. 2010, *MNRAS*, 406, 2793
- Bernstein, G. M. & Armstrong, R. 2014, *MNRAS*, 438, 1880
- Bernstein, G. M. & Jarvis, M. 2002, *AJ*, 123, 583
- Bertin, E. & Arnouts, S. 1996, *A&AS*, 117, 393
- Bonnet, H. & Mellier, Y. 1995, *A&A*, 303, 331
- Bosma, A. 1981, *AJ*, 86, 1825
- Brainerd, T. G., Blandford, R. D., & Smail, I. 1996, *ApJ*, 466, 623
- Bridle, S., Balan, S. T., Bethge, M., et al. 2010, *MNRAS*, 405, 2044
- Brouwer, M. M., Cacciato, M., Dvornik, A., et al. 2016, *MNRAS*, 462, 4451

- Burnham, R. J. 1978, *Burnham's Celestial Handbook: An Observer's Guide to the Universe Beyond the Solar System*, Vol. 1 (New York: Dover Publications)
- Cacciato, M., van den Bosch, F. C., More, S., Mo, H., & Yang, X. 2013, *MNRAS*, 430, 767
- Capaccioli, M. & Schipani, P. 2011, *The Messenger*, 146, 2
- Carollo, C. M., Cibinel, A., Lilly, S. J., et al. 2013, *ApJ*, 776, 71
- Chwolson, O. 1924, *Astronomische Nachrichten*, 221, 329
- Clampitt, J. & Jain, B. 2016, *MNRAS*, 457, 4135
- Clowe, D., Bradač, M., Gonzalez, A. H., et al. 2006, *ApJ*, 648, L109
- Clowe, D., Gonzalez, A., & Markevitch, M. 2004, *ApJ*, 604, 596
- Coe, D., Benítez, N., Sánchez, S. F., et al. 2006, *AJ*, 132, 926
- Colless, M., Dalton, G., Maddox, S., et al. 2001, *MNRAS*, 328, 1039
- Cooray, A. & Sheth, R. 2002, *Phys. Rep.*, 372, 1
- Cramér, H. 1946, *Mathematical Methods of Statistics*, Princeton mathematical series (Princeton University Press)
- Crittenden, R. G., Natarajan, P., Pen, U.-L., & Theuns, T. 2002, *ApJ*, 568, 20
- Curtis, H. D. 1917, *PASP*, 29, 206
- Dark Energy Survey Collaboration, Abbott, T., Abdalla, F. B., et al. 2016, *MNRAS*, 460, 1270
- de Jong, J. T. A., Verdoes Kleijn, G. A., Boxhoorn, D. R., et al. 2015, *A&A*, 582, A62
- de Jong, J. T. A., Verdoes Kleijn, G. A., Erben, T., et al. 2017, *A&A*, 604, A134
- de Jong, J. T. A., Verdoes Kleijn, G. A., Kuijken, K. H., & Valentijn, E. A. 2013, *Experimental Astronomy*, 35, 25
- Dresser, R. 1992, *The Hastings Center Report*, 22, 24
- Driver, S. P., Hill, D. T., Kelvin, L. S., et al. 2011, *MNRAS*, 413, 971
- Duffy, A. R., Schaye, J., Kay, S. T., & Dalla Vecchia, C. 2008, *MNRAS*, 390, L64
- Dvornik, A., Cacciato, M., Kuijken, K., et al. 2017, *MNRAS*, 468, 3251
- Dyson, F. W., Eddington, A. S., & Davidson, C. 1920, *Philosophical Transactions of the Royal Society of London Series A*, 220, 291
- Eddington, A. S. 1920, *Space, time and gravitation. an outline of the general relativity theory*
- Einstein, A. 1917, *Sitzungsberichte der Königlich Preußischen Akademie der Wissenschaften (Berlin)*, 142

- Eke, V. R., Baugh, C. M., Cole, S., et al. 2004, MNRAS, 348, 866
- Eke, V. R., Frenk, C. S., Baugh, C. M., et al. 2004, MNRAS, 355, 769
- Erben, T., Hildebrandt, H., Lerchster, M., et al. 2009, A&A, 493, 1197
- Erben, T., Hildebrandt, H., Miller, L., et al. 2013, MNRAS, 433, 2545
- Erben, T., Schirmer, M., Dietrich, J. P., et al. 2005, Astronomische Nachrichten, 326, 432
- Erben, T., Van Waerbeke, L., Bertin, E., Mellier, Y., & Schneider, P. 2001, A&A, 366, 717
- Evans, A. K. D. & Bridle, S. 2009, ApJ, 695, 1446
- Falk, M. 1997, Annals of the Institute of Statistical Mathematics, 49, 615
- Feigelson, E. D. 1988, Bulletin d'Information du Centre de Donnees Stellaires, 35, 197
- Feigelson, E. D. 2009, arXiv e-prints, arXiv:0903.0416
- Feigelson, E. D. & Babu, G. J. 2013, Statistical Methods for Astronomy, ed. T. D. Oswalt & H. E. Bond (Springer, Dordrecht), 445
- Fenech Conti, I., Herbonnet, R., Hoekstra, H., et al. 2017, MNRAS, 467, 1627
- Finoguenov, A., Guzzo, L., Hasinger, G., et al. 2007, ApJS, 172, 182
- Ford, J., Hildebrandt, H., Van Waerbeke, L., et al. 2012, ApJ, 754, 143
- Foreman-Mackey, D., Hogg, D. W., Lang, D., & Goodman, J. 2013, PASP, 125, 306
- Freeland, E., Tran, K.-V. H., Irwin, T., et al. 2011, ApJ, 742, L34
- Freeman, K. C. 1970, ApJ, 160, 811
- Gal, R. R., Lemaux, B. C., Lubin, L. M., Kocevski, D., & Squires, G. K. 2008, ApJ, 684, 933
- George, M. R., Leauthaud, A., Bundy, K., et al. 2012, ApJ, 757, 2
- Gibson, S. 2017, The Pleiades, retrieved from <http://www.naic.edu/~gibson/pleiades/>
- Gilbank, D. G., Gladders, M. D., Yee, H. K. C., & Hsieh, B. C. 2011, AJ, 141, 94
- Giocoli, C., Marulli, F., Moscardini, L., et al. 2021, A&A, 653, A19
- Gladders, M. D. & Yee, H. K. C. 2005, ApJS, 157, 1
- Gonzalez, A. H., Tran, K.-V. H., Conbere, M. N., & Zaritsky, D. 2005, ApJ, 624, L73
- Gonzalez, A. H., Zaritsky, D., Dalcanton, J. J., & Nelson, A. 2001, ApJS, 137, 117
- Hard, R. 2004, The Routledge Handbook of Greek Mythology (London: Routledge)
- Heck, A., Murtagh, F., & Ponz, D. 1985, The Messenger, 41, 22
- Herbonnet, R., Buddendiek, A., & Kuijken, K. 2017, A&A, 599, A73

- Heymans, C., Bell, E., Rix, H.-W., et al. 2006, *MNRAS*, 372, 758
- Heymans, C., Rowe, B., Hoekstra, H., et al. 2012a, *MNRAS*, 421, 381
- Heymans, C., Van Waerbeke, L., Bacon, D., et al. 2006, *MNRAS*, 368, 1323
- Heymans, C., Van Waerbeke, L., Miller, L., et al. 2012b, *MNRAS*, 427, 146
- Hildebrandt, H., Choi, A., Heymans, C., et al. 2016, *MNRAS*, 463, 635
- Hildebrandt, H., Erben, T., Kuijken, K., et al. 2012, *MNRAS*, 421, 2355
- Hildebrandt, H., Muzzin, A., Erben, T., et al. 2011, *ApJ*, 733, L30
- Hildebrandt, H., Van Waerbeke, L., & Erben, T. 2009, *A&A*, 507, 683
- Hildebrandt, H., Viola, M., Heymans, C., et al. 2017, *MNRAS*, 465, 1454
- Hinshaw, G., Nolta, M. R., Bennett, C. L., et al. 2007, *ApJS*, 170, 288
- Hirata, C. & Seljak, U. 2003, *MNRAS*, 343, 459
- Hirata, C. M., Mandelbaum, R., Seljak, U., et al. 2004, *MNRAS*, 353, 529
- Hirata, C. M. & Seljak, U. 2004, *Phys. Rev. D*, 70, 063526
- Hoekstra, H. 2003, *MNRAS*, 339, 1155
- Hoekstra, H. 2004, *MNRAS*, 347, 1337
- Hoekstra, H. 2005, in *Maps of the Cosmos*, ed. M. Colless, L. Staveley-Smith, & R. A. Stathakis, Vol. 216, 140
- Hoekstra, H., Franx, M., Kuijken, K., et al. 2001, *ApJ*, 548, L5
- Hoekstra, H., Franx, M., Kuijken, K., & Squires, G. 1998, *ApJ*, 504, 636
- Hoekstra, H., Hartlap, J., Hilbert, S., & Van Uitert, E. 2011, *MNRAS*, 412, 2095
- Hoekstra, H. & Jain, B. 2008, *Annual Review of Nuclear and Particle Science*, 58, 99
- Hoekstra, H., Mahdavi, A., Babul, A., & Bildfell, C. 2012, *MNRAS*, 427, 1298
- Hoekstra, H., Yee, H. K. C., & Gladders, M. D. 2004, *ApJ*, 606, 67
- Ivezić, Ž., Kahn, S. M., Tyson, J. A., et al. 2019, *ApJ*, 873, 111
- Jarvis, M. & Jain, B. 2004, arXiv e-prints, arXiv:astro-ph/0412234
- Jarvis, M., Schechter, P., & Jain, B. 2008, arXiv e-prints, arXiv:0810.0027
- Jarvis, M., Sheldon, E., Zuntz, J., et al. 2016, *MNRAS*, 460, 2245
- Johnston, D. E., Sheldon, E. S., Wechsler, R. H., et al. 2007, arXiv e-prints, arXiv:0709.1159
- Just, D. W., Zaritsky, D., Tran, K.-V. H., et al. 2011, *ApJ*, 740, 54

- Kacprzak, T., Bridle, S., Rowe, B., et al. 2014, MNRAS, 441, 2528
- Kacprzak, T., Zuntz, J., Rowe, B., et al. 2012, MNRAS, 427, 2711
- Kaiser, N. & Squires, G. 1993, ApJ, 404, 441
- Kaiser, N., Squires, G., & Broadhurst, T. 1995, ApJ, 449, 460
- Kaiser, N., Wilson, G., & Luppino, G. A. 2000, arXiv e-prints, astro
- Kalas, P., Graham, J. R., Chiang, E., et al. 2008, Science, 322, 1345
- Kapteyn, J. C. 1922, ApJ, 55, 302
- Kautsch, S. J., Gonzalez, A. H., Soto, C. A., et al. 2008, ApJ, 688, L5
- Kelvin, L. 1904, Baltimore Lectures on Molecular Dynamics and the Wave Theory of Light (London, England: C.J. Clay and Sons)
- Kilbinger, M. 2015, Reports on Progress in Physics, 78, 086901
- Kitching, T. D., Balan, S. T., Bridle, S., et al. 2012, MNRAS, 423, 3163
- Kitching, T. D., Miller, L., Heymans, C. E., Van Waerbeke, L., & Heavens, A. F. 2008, MNRAS, 390, 149
- Koekemoer, A. M., Fruchter, A. S., Hook, R. N., & Hack, W. 2003, in HST Calibration Workshop : Hubble after the Installation of the ACS and the NICMOS Cooling System, ed. S. Arribas, A. Koekemoer, & B. Whitmore, 337
- Krupp, E. 1991, Griffith Observer, 55, 1
- Kuijken, K. 1999, A&A, 352, 355
- Kuijken, K. 2006, A&A, 456, 827
- Kuijken, K. 2011, The Messenger, 146, 8
- Kuijken, K. & Gilmore, G. 1989, MNRAS, 239, 651
- Kuijken, K., Heymans, C., Hildebrandt, H., et al. 2015, MNRAS, 454, 3500
- Kyselka, W. 1993, Hawaiian Journal of History, 27, 174
- Lagattuta, D. J. 2011, PhD thesis, University of California, Davis
- Lambas, D. G., Maddox, S. J., & Loveday, J. 1992, MNRAS, 258, 404
- Lauer, T. R., Postman, M., Weaver, H. A., et al. 2021, ApJ, 906, 77
- Laureijs, R., Amiaux, J., Arduini, S., et al. 2011, arXiv e-prints, arXiv:1110.3193
- Le Fèvre, O., Guzzo, L., Meneux, B., et al. 2005, A&A, 439, 877

- Le Fèvre, O., Saisse, M., Mancini, D., et al. 2003, in Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, Vol. 4841, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, ed. M. Iye & A. F. M. Moorwood, 1670–1681
- Leauthaud, A., Finoguenov, A., Kneib, J.-P., et al. 2010, *ApJ*, 709, 97
- Leauthaud, A., Massey, R., Kneib, J.-P., et al. 2007, *ApJS*, 172, 219
- Lee, D. T. & Schachter, B. J. 1980, *International Journal of Computer & Information Sciences*, 9, 219
- Lee, H. 2007, in *Astronomical Society of the Pacific Conference Series*, Vol. 371, *Statistical Challenges in Modern Astronomy IV*, ed. G. J. Babu & E. D. Feigelson, 425
- Lemaux, B. C., Gal, R. R., Lubin, L. M., et al. 2012, *ApJ*, 745, 106
- Lesci, G. F., Marulli, F., Moscardini, L., et al. 2020, arXiv e-prints, arXiv:2012.12273
- Malmquist, K. G. 1925, *Meddelanden fran Lunds Astronomiska Observatorium Serie I*, 106, 1
- Mandelbaum, R. 2018, *ARA&A*, 56, 393
- Mandelbaum, R., Hirata, C. M., Ishak, M., Seljak, U., & Brinkmann, J. 2006, *MNRAS*, 367, 611
- Mandelbaum, R., Miyatake, H., Hamana, T., et al. 2018, *PASJ*, 70, S25
- Mandelbaum, R., Rowe, B., Armstrong, R., et al. 2015, *MNRAS*, 450, 2963
- Mandelbaum, R., Seljak, U., Cool, R. J., et al. 2006, *MNRAS*, 372, 758
- Mandelbaum, R., Seljak, U., & Hirata, C. M. 2008, *JCAP*, 8, 6
- Mandelbaum, R., Seljak, U., Kauffmann, G., Hirata, C. M., & Brinkmann, J. 2006, *MNRAS*, 368, 715
- Margoniner, V. E., Lubin, L. M., Wittman, D. M., & Squires, G. K. 2005, *AJ*, 129, 20
- Markevitch, M., Gonzalez, A. H., David, L., et al. 2002, *ApJ*, 567, L27
- Massey, R., Heymans, C., Bergé, J., et al. 2007, *MNRAS*, 376, 13
- Massey, R., Stoughton, C., Leauthaud, A., et al. 2010, *MNRAS*, 401, 371
- Mather, J. C. 1982, *Optical Engineering*, 21, 769
- Maturi, M., Bellagamba, F., Radovich, M., et al. 2019, *MNRAS*, 485, 498
- McFarland, J. P., Verdoes-Kleijn, G., Sikkema, G., et al. 2013, *Experimental Astronomy*, 35, 45
- Mead, A. J., Peacock, J. A., Heymans, C., Joudaki, S., & Heavens, A. F. 2015, *MNRAS*, 454, 1958

- Melchior, P. & Viola, M. 2012, *MNRAS*, 424, 2757
- Miller, L., Heymans, C., Kitching, T. D., et al. 2013, *MNRAS*, 429, 2858
- Miller, L., Kitching, T. D., Heymans, C., Heavens, A. F., & Van Waerbeke, L. 2007, *MNRAS*, 382, 315
- Miyatake, H., More, S., Mandelbaum, R., et al. 2015, *ApJ*, 806, 1
- Monroe, J. T., Tran, K.-V. H., & Gonzalez, A. H. 2017, *ApJ*, 836, 7
- Mosteller, F. & Tukey, J. W. 1977, *Data Analysis and Regression: a Second Course in Statistics* (Reading, MA: Addison Wesley), p. 133
- Navarro, J. F., Frenk, C. S., & White, S. D. M. 1996, *ApJ*, 462, 563
- Neto, A. F., Gao, L., Bett, P., et al. 2007, *MNRAS*, 381, 1450
- Norris, R. P. & Norris, B. R. M. 2021, in *Advancing Cultural Astronomy*, ed. E. Boutsikas, S. McCluskey, & J. Steele, *Historical & Cultural Astronomy* (Springer, Cham)
- Oguri, M., Bayliss, M. B., Dahle, H., et al. 2012, *MNRAS*, 420, 3213
- Oguri, M., Miyazaki, S., Hikage, C., et al. 2018, *PASJ*, 70, S26
- Oguri, M., Takada, M., Okabe, N., & Smith, G. P. 2010, *MNRAS*, 405, 2215
- Oort, J. H. 1932, *Bull. Astron. Inst. Netherlands*, 6, 249
- Parker, L., Hudson, M. J., Carlberg, R. G., & Hoekstra, H. 2005, *ApJ*, 634, 806
- Parker, L. C., Hoekstra, H., Hudson, M. J., Van Waerbeke, L., & Mellier, Y. 2007, *ApJ*, 669, 21
- Peacock, J. A. & Smith, R. E. 2000, *MNRAS*, 318, 1144
- Peebles, P. J. E. 1970, *AJ*, 75, 13
- Penzias, A. A. & Wilson, R. W. 1965, *ApJ*, 142, 419
- Planck Collaboration, Ade, P. A. R., Aghanim, N., et al. 2014, *A&A*, 571, A16
- Preparata, F. P. & Shamos, M. I. 1985, *Computational Geometry* (New York: Springer), 95–149
- Radovich, M., Puddu, E., Bellagamba, F., et al. 2017, *A&A*, 598, A107
- Rao, C. R. 1945, *Bull. Calcutta Math. Soc.*, 37, 81
- Refregier, A. 2003, *MNRAS*, 338, 35
- Refregier, A. & Bacon, D. 2003, *MNRAS*, 338, 48
- Refregier, A., Kacprzak, T., Amara, A., Bridle, S., & Rowe, B. 2012, *MNRAS*, 425, 1951



- Rhodes, J., Refregier, A., & Groth, E. J. 2000, *ApJ*, 536, 79
- Rhodes, J. D., Massey, R. J., Albert, J., et al. 2007, *ApJS*, 172, 203
- Robotham, A. S. G., Norberg, P., Driver, S. P., et al. 2011, *MNRAS*, 416, 2640
- Rodríguez, S. & Padilla, N. D. 2013, *MNRAS*, 434, 2153
- Rubin, V. C. 1983, *Scientific American*, 248, 96
- Rykoff, E. S., Rozo, E., Hollowood, D., et al. 2016, *ApJS*, 224, 1
- Schirmer, M. 2013, *ApJS*, 209, 21
- Schneider, M. D., Hogg, D. W., Marshall, P. J., et al. 2015, *ApJ*, 807, 87
- Schneider, P. 2003, arXiv e-prints, astro
- Schneider, P. 2006, in *Saas-Fee Advanced Course 33: Gravitational Lensing: Strong, Weak and Micro*, ed. G. Meylan, P. Jetzer, P. North, P. Schneider, C. S. Kochanek, & J. Wambsganss, 269–451
- Schneider, P. & Seitz, C. 1995, *A&A*, 294, 411
- Schrabback, T., Erben, T., Simon, P., et al. 2007, *A&A*, 468, 823
- Schrabback, T., Hartlap, J., Joachimi, B., et al. 2010, *A&A*, 516, A63
- Schwarzschild, M. 1954, *AJ*, 59, 273
- Seitz, C. & Schneider, P. 1995, *A&A*, 297, 287
- Seitz, C. & Schneider, P. 1997, *A&A*, 318, 687
- Seljak, U. 2000, *MNRAS*, 318, 203
- Sellentin, E., Heymans, C., & Harnois-Déraps, J. 2018, *MNRAS*, 477, 4879
- Sérsic, J. L. 1963, *Boletín de la Asociación Argentina de Astronomía La Plata Argentina*, 6, 41
- Sérsic, J. L. 1968, *Atlas de Galaxias Australes*
- Sifón, C., Cacciato, M., Hoekstra, H., et al. 2015a, *MNRAS*, 454, 3938
- Sifón, C., Hoekstra, H., Cacciato, M., et al. 2015b, *A&A*, 575, A48
- Slipher, V. M. 1915, *Popular Astronomy*, 23, 21
- Smit, M., Dvornik, A., Radovich, M., et al. 2021, arXiv e-prints, arXiv:2109.12009, *accepted*
- Smit, M. & Kuijken, K. 2018, *A&A*, 609, A103
- Smit, M., Schrabback, T., Velandier, M., et al. 2015, *A&A*, 582, A82

- Spergel, D. N., Verde, L., Peiris, H. V., et al. 2003, *ApJS*, 148, 175
- Stark, A. A. 1977, *ApJ*, 213, 368
- Sunyaev, R. A. & Zeldovich, Y. B. 1970, *Ap&SS*, 7, 3
- Sunyaev, R. A. & Zeldovich, Y. B. 1972, *Comments on Astrophysics and Space Physics*, 4, 173
- Tempel, E., Tago, E., & Liivamägi, L. J. 2012, *A&A*, 540, A106
- Tinker, J. L., Robertson, B. E., Kravtsov, A. V., et al. 2010, *ApJ*, 724, 878
- Tran, K.-V. H., Moustakas, J., Gonzalez, A. H., et al. 2008, *ApJ*, 683, L17
- Tran, K.-V. H., Saintonge, A., Moustakas, J., et al. 2009, *ApJ*, 705, 809
- Tucker, W. H., Tananbaum, H., & Remillard, R. A. 1995, *ApJ*, 444, 532
- Tyson, J. A., Valdes, F., Jarvis, J. F., & Mills, A. P., J. 1984, *ApJ*, 281, L59
- Tyson, J. A., Valdes, F., & Wenk, R. A. 1990, *ApJ*, 349, L1
- Valentijn, E. A., McFarland, J. P., Snigula, J., et al. 2007, in *Astronomical Society of the Pacific Conference Series*, Vol. 376, *Astronomical Data Analysis Software and Systems XVI*, ed. R. A. Shaw, F. Hill, & D. J. Bell, 491
- van den Bosch, F. C., More, S., Cacciato, M., Mo, H., & Yang, X. 2013, *MNRAS*, 430, 725
- Van Leeuwen, F. 2009, *A&A*, 497, 209
- van Uitert, E., Cacciato, M., Hoekstra, H., et al. 2016, *MNRAS*, 459, 3251
- van Uitert, E., Hoekstra, H., Joachimi, B., et al. 2017, *MNRAS*, 467, 4131
- Van Uitert, E. & Schneider, P. 2016, *A&A*, 595, A93
- Van Waerbeke, L. 2000, *MNRAS*, 313, 524
- Van Waerbeke, L., Hildebrandt, H., Ford, J., & Milkeraitis, M. 2010, *ApJ*, 723, L13
- Van Waerbeke, L., Mellier, Y., Erben, T., et al. 2000, *A&A*, 358, 30
- Velandier, M., Kuijken, K., & Schrabback, T. 2011, *MNRAS*, 412, 2665
- Verdoes Kleijn, G., de Jong, J. T. A., Valentijn, E., et al. 2012, in *Astronomical Society of the Pacific Conference Series*, Vol. 461, *Astronomical Data Analysis Software and Systems XXI*, ed. P. Ballester, D. Egret, & N. P. F. Lorente, 237
- Viola, M., Cacciato, M., Brouwer, M., et al. 2015, *MNRAS*, 452, 3529
- Viola, M., Kitching, T. D., & Joachimi, B. 2014, *MNRAS*, 439, 1909
- Voigt, L. M. & Bridle, S. L. 2010, *MNRAS*, 404, 458

- Von der Linden, A., Allen, M. T., Applegate, D. E., et al. 2014, *MNRAS*, 439, 2
- Wittman, D. M., Tyson, J. A., Kirkman, D., Dell'Antonio, I., & Bernstein, G. 2000, *Nature*, 405, 143
- Wright, C. O. & Brainerd, T. G. 2000, *ApJ*, 534, 34
- Xue, Y.-J. & Wu, X.-P. 2000, *ApJ*, 538, 65
- Zhang, J., Luo, W., & Foucaud, S. 2015, *J. Cosmology Astropart. Phys.*, 1, 024
- Zhang, J., Zhang, P., & Luo, W. 2017, *ApJ*, 834, 8
- Zwicky, F. 1933, *Helvetica Physica Acta*, 6, 110
- Zwicky, F. 1937, *Physical Review*, 51, 290

---

# Publications

---

*“CFHTLenS: the CanadaFranceHawaii Telescope Lensing Survey – imaging data and catalogue products”*

**Authors:** Thomas Erben, Hendrik Hildebrandt, Lance Miller, Ludovic van Waerbeke, Catherine Heymans, Henk Hoekstra, Thomas D. Kitching, Yannick Mellier, Jonathan Benjamin, Chris Blake, Christopher Bonnett, Oliver-Mark Cordes, Jean Coupon, Liping Fu, Raphaël Gavazzi, Bryan Gillis, Emma Grocutt, Stephen D. J. Gwyn, Karianne Holhjem, Michael J. Hudson, Martin Kilbinger, Konrad Kuijken, Martha Milkeraitis, Barnaby T. P. Rowe, Tim Schrabbach, Elisabetta Semboloni, Patrick Simon, Merijn Smit, Ovidiu Toader, Sanaz Vafaei, Edo van Uiter, Malin Velander

**Published:** 2013, MNRAS, 433, 2545

**DOI:** 10.1093/mnras/stt928

*“Mass distribution in an assembling super galaxy group at  $z = 0.37$ ”*

**Authors:** Merijn Smit, Tim Schrabbach, Malin Velander, Konrad Kuijken, Anthony H. Gonzalez, John Moustakas, and Kim-Vy H. Tran

**Published:** 2015, A&A, 582, A82

**DOI:** 10.1051/0004-6361/201525905

*“Chasing the peak: optimal statistics for weak shear analyses”*

**Authors:** Merijn Smit and Konrad Kuijken

**Published:** 2018, A&A, 609, A103

**DOI:** 10.1051/0004-6361/201731410

*“AMICO galaxy clusters in KiDS-DR3: the impact of estimator statistics on the luminosity-mass scaling relation”*

**Authors:** Merijn Smit, Andrej Dvornik, Mario Radovich, Konrad Kuijken, Matteo Maturi, Lauro Moscardini, and Mauro Sereno

**Accepted:** 2021, A&A



---

# Curriculum Vitae

---

*“A hero is someone who simply got too frightened to use his good sense and run away, then somehow lived through it all.”*

– Raymond E. Feist, *Silverthorn*

This is the part where I get to talk about myself, the good, the bad and the beautiful. I realize hardly anyone will read this part, and I have taken the liberty in using the writing of it – with a cup of coffee and a wee dram of whisky – as a summarizing reflection on my life, as far as it pertains to my professional career of course, but – inescapably intertwined – also to the scientist and the person I have become.

I was born in Haarlem, The Netherlands, on the 7th of September in 1977. I suspect that – in a way, even at that age – I was already easily distracted and momentarily lost sight of the tasks right in front of me, as I stopped breathing right away. However, be it curiosity or stubbornness, I eventually got back to it and to this day, I still foster a passion for it, akin to that for astronomy.

For as long as I can remember, I enjoy understanding. And then imagining the alternative possibilities. As soon as I could read, I was hooked and essentially didn't put the books down, until well within adulthood. During my years in primary school, I was more than a handful. As soon as I understood something, my mind had already wandered down several other paths. It's not that school didn't interest me. It did. I wanted to understand everything in school. Yet I also wanted to understand, experience, explore and imagine a lot of other things as well and I simply didn't have time to dawdle, doing the same old exercises.

When hiking through the heathlands in Drenthe, on the Veluwe or the mountains in France, I was fascinated by maps and the explanations of my father, a teacher of geography and mathematics, about how and why the world was ordered as it was. I remember picking my mother's and father's brain about the differences between religions and, during the same summer holiday evenings, I kept asking for another challenge in determining the square root of a non integer number. I was swept away by the 3D shows in the then newly opened Omniversum, when my grandmother took me there. To this day I remember the shows about astronomy, the physics behind airplanes and dizzying and exhilarating journeys over strange landscapes or through the depths of the oceans. She even gave me a booklet called 'Welke ster is dat?' by W. Widmann, full of charts and constellations for each time of the year. I already had my own simple camera, and being allowed to use my father's Canon SLR on rare occasions was a treat. Unhindered by any talent for the sport, I still managed to make it to the first soccer team of the school through stubbornness and running around a lot, and boy was I proud when we won the local championship and entered the regional school championship for the first time in years.

My high school years I attended College Hageveld in Heemstede. It is the only categorical atheneum in The Netherlands, though I still had the opportunity to submerge myself in the classics, culminating in visiting Rome on a school trip and graduating in Latin besides Dutch, English, German, mathematics, physics, chemistry and biology. I wanted to take French,

geography and history as well, but the system wasn't flexible enough at the time. Hageveld was also a place that fostered creativity and curiosity, and I explored my first steps on stage, in writing and in music.

After extensive orienting visits to various universities all over the country, seriously contemplating philosophy, veterinary medicine, electrical or aerospace engineering, the choice for astronomy felt in hindsight as not just logical, but inevitable. I finally enjoyed a true challenge, as the sky was not the limit, but merely the start. The bigger the challenge, the stronger my interest, the higher my grades. The master courses in general relativity and gravitation, differential equations, cosmology and philosophy of science were among the highlights, some of which were the last to be taught in the classic Kamerlingh Onnes building. I also had my first taste of teaching, as I related to the struggles of students in the years below me and shared my experiences and insights gleaned during my own similar struggles. Not just sharing the knowledge, but how to change a way of thinking, how to learn. I did a minor thesis with Dr. Peter Katgert on cosmology, focusing on quintessence versus a cosmological constant. My master thesis about galactic bars in edge-on galaxies with boxy bulges, a case study of IC2531, was done under supervision of Prof. dr. Tim de Zeeuw and Dr. Martin Bureau.

Of course, besides also still devouring books, my interests still wandered all over the place, and I immersed myself in tabletop games and the first variants of online games, not only playing, but also developing and writing them. With a group of close friends, we visited the cinema at least once a week and of course several editions of the Leiden Movie Festival. I assisted the astronomy association Kaiser with a few activities over the years and participated in the trip to Northern France to see the solar eclipse of 1999 in Noyon. I joined SKC, the student volleyball club, and over the course of ten years, worked my way from the lowest to the first team, became a licensed referee and joined several committees, such as the social activities committee, the lustrum committee, the bar committee and the monthly club magazine.

Most importantly, I actively participated in De Leidsche Flesch, the student association for physics, astronomy, mathematics and computer science. Besides joining committees for first year students, the yearly almanac, movie nights and games, among others, I spent a year as president. At the time, member engagement was very low and some people wondered if the association still had a purpose, a future. With a fantastic board and a group of creative and enthusiastic first year students, we watched the association bloom with renewed social and scientific activities, planting during this year many seeds that would come to fruition in following years, like the yearly student trip abroad. It was an impressive and privileged experience to be at the front row during that change.

It will come as no surprise that at some point, my studies were taking quite a long time. A student has to eat, and I decided that after my unofficial experiences with teaching, I could dabble in the real thing. It turned out that I could all too well, and before I realized, I had three years experience in teaching almost full time in high school, at a sublocation of the Carmelcollege in Gouda. With the support at home and of Prof. dr. de Zeeuw, I quit a steady income to return home to astronomy – at least that's how it felt.

Fueled by the feeling that I had returned where I belonged, I finished my masters degree. Over the summer, I did a short research project with Dr. Richard McDerimid on M32 using Oasis data in my spare time. At the same time, I applied for a PhD position with Prof. Dr. Koen Kuijken to work on weak gravitational lensing with the Kilo-Degree Survey and was ecstatic when I was accepted. In expectation of the start of KiDS, I started work-

ing on Wide-Field Imager data of nearby galaxy groups found in the 2-degree Field Galaxy Redshift Survey and observations on galaxy supergroup SG1120–1202 from the Advanced Camera for Surveys on the Hubble Space Telescope. As part of the growing lensing group in Leiden, I had the privilege to take part in the ‘Dark side of the Universe through Extragalactic Lensing’ (DUEL) European training network and the collaborations on Canada-France-Hawaii Legacy Survey data, evolving in name and composition from CFHT-CARS, through CFHTLS Systematics to the final CFHT Lensing Survey (CFHTLenS). I attended summer schools and workshops on statistics at Penn State, USA; astronomical image processing in Dubrovnik, Croatia; AstroWISE in Leiden, The Netherlands. I participated in scientific meetings, presented my work and gave talks and colloquia in Leiden, Ameland, and Veldhoven, The Netherlands; State College, USA; Santiago, Chile; London, and Edinburgh, UK; Paris, France; Sydney, Australia; Victoria, Canada.

At the same time, I assisted several years with the courses Introductory Astrophysics and Special Relativity. I was active for several consecutive years in the institute social committee (as chair), the computer committee and the institute council. During the same years, I worked on public outreach and gave popular lectures in, among others, Amsterdam, Leiden, Alkmaar, Hoorn, and Wormer.

During the full second year and part of the third year of my PhD, I went through a divorce that ended a six year relationship. Pursuing many interests and passions at the same time had been a characteristic of my life and that provided escape in many different directions at once. My journey made the softest landing possible, when I soon after met my wife and love of my life, but this newfound happiness occupied my attention more than the tumbleweeds blowing through the silent landscape of my PhD.

Finding strength and encouragement in each other, I returned to astronomy once more, but without funding. With savings, I could bridge a gap of several months, but to support myself, I needed to return to my secondary passion: teaching. Continuing my PhD one day per week, I completed my masters degrees in education of both mathematics and physics, cum laude. Since then, I have been teaching in high school for ten years, developing an interest and indeed an opinion on teacher education. I am a certified and registered video coach and have participated with great interest in working collaborations on the subjects of education of mathematics and statistics within the Dutch Association of Teachers in Mathematics (NVvW).

This has been a long reflection, but then, I am now finishing my PhD at the age of 44. I still feel that I am where I belong, and am currently living in the most important time of my life, whatever dreams and passions may lie ahead.

*“Wisdom comes from experience. Experience is often a result of lack of wisdom.”*

– Terry Pratchett





---

# Acknowledgements

---

*“Every person you encounter, whom you interact with, is there to teach you something. Sometimes it may be years before you realize what each had to show you.”*

– Raymond E. Feist, *Rise of a Merchant Prince*

When you stick around as long as I have, perhaps the most difficult task is to not forget a single individual who helped, inspired and supported me during my time in Leiden, both as scientists and as friends. If I did, I hope you’ll still accept my apologies and gratitude.

I’ve heard it is not customary to acknowledge directly your promotor. Yet Koen, you have been much more than a regular thesis supervisor. When I applied for the position, I followed the advice I had been given: a good supervisor is more important than an interesting project. How true that advice turned out to be, even though weak lensing has captured my heart. Your patience and availability during the full 16 years that my PhD lasted have been incredible. You never ‘closed the door’, as the saying goes, an example that I have taken to heart and which has in turn made me a better teacher and supervisor to my own students. You have given me an incredible opportunity and during most of our meetings you’d reiterate “go for it!” I may have needed a long time, but I have taken that opportunity. If you remember, I promised to walk back uphill, but sometimes one needs a path to be available.

I have been very fortunate by the support, guidance and friendship of the members of the Leiden lensing group. Tim, Malin, Edo, Hendrik, I fondly remember the times when we, as a small but growing group, would go to meetings and conferences together, and highlights include the hiking trip over the Berg Lake Trail in the Canadian Rocky Mountains, the tour of the New Zealand South Island including all those Lord of the Rings filming locations, the sailing trip from Dubrovnik and the drinks on the steep cliffs just outside the walls. Margot and Andrej, my time of visiting conferences and meetings may not have intersected with yours, but I treasure our talks and exchange of ideas and above all your company, and I consider you amazing persons, friends and scientists.

I have had the privilege of being a part of the DUEL and CFHTLenS groups and have learned more about lensing and what ‘doing science’ really is from those meetings, than any amount of courses or summer schools could offer. Besides some names from the Leiden group, I want to mention Sanaz, Emma, Karianne, Henk, Elisabetta, Barney, Tom, Martin, Liping, Jean. I want to thank especially Ludo and Catherine: I have considered the both of you inspiring scientists, mentors to many in the group, friendly and approachable in person and yet expert scientific leaders by example.

There have been many other members of the lensing group I want to thank for advice and fruitful discussions during the group meetings or over a drink during a ‘borrel’: Marcello, Ricardo, Christopher, Massimo. Of course my ‘roommates’ not yet mentioned, some of whom are also involved in the lensing group: Allesandro, Hugo, Christiaan and Vivianni.

The most constant common denominator in acknowledgements of masters and PhD theses, and rightfully so, is the amazing support at Leiden. The unequalled ‘computer group’, as scientists and programmers crucial to the succes of many research projects, especially

Erik, David and Aart, who have been there since my beginning. The institute management and ‘secretaries’, who have been so much more than that for many at the institute, such as guardian angels and personal support: Jeanne, Kirsten, Evelijn, Marjan, Monica, Alexandra.

I have experienced the same inspiration, support and inclusive environment from the observatory community as a whole. Inspiring lectures, exchange of ideas during coffee, personal advice in the ‘wandelgangen’, support from the PBC, or as TA. During my 16 years as PhD, I have become convinced that the better I became at teaching, the better I became at science, and vice versa. I take away a mixture of personal gratitude and inspiring teaching and science examples from: Paul, Jarle, Peter, Xander, Antony, Ignas, Tim, Joop, George, Vincent, Frank, Rudolf, and the always optimistic Jan; Gé Nienhuis, Pierre van Baal, and Robert Terwiel from the physics department; and Jo Hermans, honorary member of my student association De Leidsche Flesch.

The same goes for some memorable teachers in high school: Jos, Leo, Harry, René, Joop, Anton, en Jos. I hope I can in my own modest way contribute to students’ developments in learning and science, the way you did for me. I enjoy a great group of colleagues at school and take inspiration from working together, with a special mention for the colleagues math and natural sciences. I’m grateful for being a member of the ‘havo-vwo’ and statistics groups of the NVvW and our group of IO’s and SO’s of 4OLS, both allowing me to see education in new and refreshing ways.

I’ve made friends at the student association De Leidsche Flesch, with whom I love to debate science, society and ethics, between tasting delicious wines, whiskies, cheese and dinners: Jasper, Marinus, Jacob, Erwin, Pim, Frédérique, Ellen, Erik, and Vera. In fact, I want to thank Jasper explicitly, for bringing the recent article from Norris & Norris (2021) to my attention, when he was writing a column about it (*Financieel Dagblad*, 23 januari 2021).

Volleyball has been a source of friendship, special moments and the much needed release, after which I loved to enjoy beer and ‘bitterballen’ or sometimes a fine whisky, with Fonz, Daaf, Yannick, Wouter, and Timon, among others. Another great way to restock on much needed energy was playing tabletop games, D&D, or ‘klaverjassen’: Arno, Roy, Frank, Jochem, George, Maarten, Jan-Pieter, Nathan.

Steven, no matter how long we haven’t spoken, as soon as we sit down for a beer, we pick up right where we left off. Paul and Daphne have not only been the best neighbours you can imagine, but also amazing friends, companions during skiing and sailing and trying to beat *Pandemic Legacy* together. Jelle and Hanne have been our partners in crime for tabletop escape rooms and *Chronicles of Crime*, but most of all friends and confidants. Rot and Lisette, we may be journeying through Middle Earth at the moment, but we’re not done exploring Terrinoth, Golarion, the House on the Hill or battling zombie hordes or mad cultists. Rot, you’re my longest and best friend and I’m grateful to have you as witness to my marriage.

Natuurlijk ben ik wie ik ben, dankzij de rest van mijn familie en schoonfamilie. Anneke en Alois, voor hun steun en warmte. Mijn grootouders, voor aan de ene kant de vele dagjes uit en aan de andere kant voor misschien iets van de Wortelgenen. Mijn zus Arwen, die altijd aan mijn kant heeft gestaan, haar man Sjoerd en hun kinderen in wie ik zoveel herken. Bovenal mijn ouders, die ons altijd geleerd hebben zelf na te denken, ons de gelegenheid hebben gegeven te studeren en onze nieuwsgierigheid in onze kinderjaren altijd hebben geprikkeld. Hun nuchterheid en hun humor. Het je kunnen verliezen in verhalen en het met beide benen op de grond staan.

En tenslotte mijn eigen gezinnetje. Annelie, je bent het grootste wonder dat ik in mijn

leven heb mogen meemaken. Ik zou niet weten hoe de wereld zonder jou had kunnen bestaan. Ik gun je eindeloze nieuwsgierigheid en ontdekkingen.

Marije, je hebt alles in je wat ik nodig heb. Zorgzaamheid, liefde, een uitdagende gesprekspartner, sportiviteit en enthousiasme, veiligheid en steun, en de moeder van onze klauwterkabouter. De laatste meer-dan-11 jaar heb ik dit als hobby en als passie naast een betaalde baan kunnen afmaken en dat was zonder jouw geduld en steun niet mogelijk geweest.