



Universiteit
Leiden

The Netherlands

Turtles all the way down: multiscale simulations connecting star and planet formation

Wilhelm, M.J.C.

Citation

Wilhelm, M. J. C. (2024, February 15). *Turtles all the way down: multiscale simulations connecting star and planet formation*. Retrieved from <https://hdl.handle.net/1887/3717680>

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/1887/3717680>

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

Bibliography

- Adams, F. C., Hollenbach, D., Laughlin, G., & Gorti, U. 2004, *ApJ*, 611, 360
- Alcalá, J. M., Natta, A., Manara, C. F., et al. 2014, *A&A*, 561, A2
- Alessi, M., Pudritz, R. E., & Cridland, A. J. 2017, *MNRAS*, 464, 428
- Alexander, R. D. & Armitage, P. J. 2006, *ApJ*, 639, L83
- Ali, A. A., Bending, T. J. R., & Dobbs, C. L. 2022, *MNRAS*, 510, 5592
- Allen, R. L., Bernstein, G. M., & Malhotra, R. 2001, *ApJ*, 549, L241
- Alzate, J. A., Bruzual, G., Kounkel, M., et al. 2023, *MNRAS*
- Anderson, K. R., Adams, F. C., & Calvet, N. 2013, *ApJ*, 774, 9
- Andrews, S. M., Wilner, D. J., Hughes, A. M., Qi, C., & Dullemond, C. P. 2010, *ApJ*, 723, 1241
- Angerhofer, P. E., Kundu, M. R., Becker, R. H., & Velusamy, T. 1977, *A&A*, 61, 285
- Ansdell, M., Williams, J. P., Manara, C. F., et al. 2017, *AJ*, 153, 240
- Appel, S. M., Burkhardt, B., Semenov, V. A., Federrath, C., & Rosen, A. L. 2022, *ApJ*, 927, 75
- Appelgren, J., Lambrechts, M., & Johansen, A. 2020, *A&A*, 638, A156
- Armitage, P. J. 2020, *Astrophysics of planet formation, Second Edition* (Cambridge University Press)
- Arthur, S. J. 2012, *MNRAS*, 421, 1283
- Arthur, S. J., Henney, W. J., Mellema, G., de Colle, F., & Vázquez-Semadeni, E. 2011, *MNRAS*, 414, 1747
- Arzoumanian, D., Arakawa, S., Kobayashi, M. I. N., et al. 2023, *ApJ*, 947, L29
- Baczynski, C., Glover, S. C. O., & Klessen, R. S. 2015, *MNRAS*, 454, 380
- Bailes, M., Lyne, A. G., & Shemar, S. L. 1991, *Nature*, 352, 311

- Balega, Y. Y., Chentsov, E. L., Rzaev, A. K., & Weigelt, G. 2015, in *Astronomical Society of the Pacific Conference Series*, Vol. 494, *Physics and Evolution of Magnetic and Related Stars*, ed. Y. Y. Balega, I. I. Romanyuk, & D. O. Kudryavtsev, 57
- Bate, M. R. 2012, *MNRAS*, 419, 3115
- Bate, M. R. 2018, *MNRAS*, 475, 5618
- Beccari, G., Petr-Gotzens, M. G., Boffin, H. M. J., et al. 2017, *A&A*, 604, A22
- Beckwith, S. V. W., Sargent, A. I., Chini, R. S., & Guesten, R. 1990, *AJ*, 99, 924
- Birnstiel, T., Klahr, H., & Ercolano, B. 2012, *A&A*, 539, A148
- Bisbas, T. G., Haworth, T. J., Williams, R. J. R., et al. 2015, *MNRAS*, 453, 1324
- Blanchet, L. 2014, *Living Reviews in Relativity*, 17, 2
- Blandford, R. D. & Payne, D. G. 1982, *MNRAS*, 199, 883
- Borgdorff, J., Falcone, J.-L., Lorenz, E., et al. 2013, *Journal of Parallel and Distributed Computing*, 73, 465
- Boss, A. P. 1997, *Science*, 276, 1836
- Bovy, J. 2015, *ApJS*, 216, 29
- Breslau, A., Steinhausen, M., Vincke, K., & Pfalzner, S. 2014, *A&A*, 565, A130
- Bruno, G. 1584, *De l'Infinito Universo e Mondi* (London)
- Cabrit, S., Pety, J., Pesenti, N., & Dougados, C. 2006, *A&A*, 452, 897
- Cai, M. X., Kouwenhoven, M. B. N., Portegies Zwart, S. F., & Spurzem, R. 2017, *MNRAS*, 470, 4337
- Cameron, A. G. W. 1978, *Moon and Planets*, 18, 5
- Carpenter, J. M., Mamajek, E. E., Hillenbrand, L. A., & Meyer, M. R. 2006, *ApJ*, 651, L49
- Carrera, D., Gorti, U., Johansen, A., & Davies, M. B. 2017, *ApJ*, 839, 16
- Casamiquela, L., Carrera, R., Jordi, C., et al. 2016, *MNRAS*, 458, 3150
- Casertano, S. & Hut, P. 1985, *ApJ*, 298, 80
- Chevance, M., Kruijssen, J. M. D., Hygate, A. P. S., et al. 2020, *MNRAS*, 493, 2872
- Chevance, M., Krumholz, M. R., McLeod, A. F., et al. 2023, in *Astronomical Society of the Pacific Conference Series*, Vol. 534, *Protostars and Planets VII*, ed. S. Inutsuka, Y. Aikawa, T. Muto, K. Tomida, & M. Tamura, 1
- Chini, R., Hoffmeister, V. H., Nasserri, A., Stahl, O., & Zinnecker, H. 2012, *MNRAS*, 424, 1925
- Choi, J., Dotter, A., Conroy, C., et al. 2016, *ApJ*, 823, 102

- Chopard, B., Borgdorff, J., & Hoekstra, A. 2014, *Philosophical transactions. Series A, Mathematical, physical, and engineering sciences*, 372
- Christlieb, A. J., Liu, Y., & Xu, Z. 2015, *Journal of Computational Physics*, 294, 224
- Churchwell, E. & Felli, M. 1970, *A&A*, 4, 309
- Cieza, L. A., Olofsson, J., Harvey, P. M., et al. 2013, *ApJ*, 762, 100
- Claret, A. 2004, *A&A*, 424, 919
- Clarke, C. J. 2007, *MNRAS*, 376, 1350
- Clarke, C. J., Gendrin, A., & Sotomayor, M. 2001, *MNRAS*, 328, 485
- Clarke, C. J. & Pringle, J. E. 1993, *MNRAS*, 261, 190
- Cleeves, L. I., Öberg, K. I., Wilner, D. J., et al. 2016, *ApJ*, 832, 110
- Close, J. L. & Pittard, J. M. 2017, *MNRAS*, 469, 1117
- Cohen, M. & Kuhl, L. V. 1976, *ApJ*, 210, 365
- Coleman, G. A. L. & Haworth, T. J. 2020, *MNRAS*, 496, L111
- Coleman, G. A. L., Nelson, R. P., & Triaud, A. H. M. J. 2023, *MNRAS*, 522, 4352
- Concha-Ramírez, F., Vaher, E., & Portegies Zwart, S. 2019a, *MNRAS*, 482, 732
- Concha-Ramírez, F., Wilhelm, M. J. C., & Portegies Zwart, S. 2023, *MNRAS*, 520, 6159
- Concha-Ramírez, F., Wilhelm, M. J. C., Portegies Zwart, S., & Haworth, T. J. 2019b, *MNRAS*, 490, 5678
- Concha-Ramírez, F., Wilhelm, M. J. C., Portegies Zwart, S., van Terwisga, S. E., & Hacar, A. 2021, *MNRAS*, 501, 1782
- Copernicus, N. 1543, *De Revolutionibus Orbium Coelestium* (Nuremberg: Johannes Petreius)
- Cournoyer-Cloutier, C., Sills, A., Harris, W. E., et al. 2023, *MNRAS*, 521, 1338
- Crampton, D. & Fisher, W. A. 1974, *Publications of the Dominion Astrophysical Observatory Victoria*, 14, 283
- Cuello, N., Ménard, F., & Price, D. J. 2023, *European Physical Journal Plus*, 138, 11
- Cunningham, A. J., Krumholz, M. R., McKee, C. F., & Klein, R. I. 2018, *MNRAS*, 476, 771
- Cutri, R. M., Wright, E. L., Conrow, T., et al. 2013, *Explanatory Supplement to the AllWISE Data Release Products, Explanatory Supplement to the AllWISE Data Release Products*, by R. M. Cutri et al.
- Dahm, S. E. 2015, *ApJ*, 813, 108
- Dahm, S. E. & Hillenbrand, L. A. 2007, *AJ*, 133, 2072

- Dale, J. E. 2015, *New Astron. Review*, 68, 1
- Dale, J. E., Ercolano, B., & Bonnell, I. A. 2012, *MNRAS*, 424, 377
- Dale, J. E., Ercolano, B., & Bonnell, I. A. 2013, *MNRAS*, 430, 234
- Dale, J. E., Ngoumou, J., Ercolano, B., & Bonnell, I. A. 2014, *MNRAS*, 442, 694
- De Marchi, G., Panagia, N., & Beccari, G. 2017, *ApJ*, 846, 110
- Dias, W. S., Alessi, B. S., Moitinho, A., & Lépine, J. R. D. 2002, *A&A*, 389, 871
- Dong, R., Liu, H. B., Cuello, N., et al. 2022, *Nature Astronomy*, 6, 331
- Downes, D. & Wilson, T. L. 1974, *A&A*, 34, 133
- Draine, B. T. 1978, *ApJS*, 36, 595
- Drazkowska, J., Bitsch, B., Lambrechts, M., et al. 2023, in *Astronomical Society of the Pacific Conference Series*, Vol. 534, *Astronomical Society of the Pacific Conference Series*, ed. S. Inutsuka, Y. Aikawa, T. Muto, K. Tomida, & M. Tamura, 717
- Dunham, M. M., Stutz, A. M., Allen, L. E., et al. 2014, in *Protostars and Planets VI*, ed. H. Beuther, R. S. Klessen, C. P. Dullemond, & T. Henning, 195
- Eggleton, P. P., Kiseleva, L. G., & Hut, P. 1998, *ApJ*, 499, 853
- Eisner, J. A., Arce, H. G., Ballering, N. P., et al. 2018, *ApJ*, 860, 77
- Elmegreen, B. G., Dickinson, D. F., & Lada, C. J. 1978, *ApJ*, 220, 853
- Emsenhuber, A., Mordasini, C., Burn, R., et al. 2021, *A&A*, 656, A69
- Evans, Neal J., I., Heyer, M., Miville-Deschênes, M.-A., Nguyen-Luong, Q., & Merello, M. 2021, *ApJ*, 920, 126
- Facchini, S., Clarke, C. J., & Bisbas, T. G. 2016, *MNRAS*, 457, 3593
- Federrath, C., Banerjee, R., Clark, P. C., & Klessen, R. S. 2010, *ApJ*, 713, 269
- Federrath, C., Schrön, M., Banerjee, R., & Klessen, R. S. 2014, *ApJ*, 790, 128
- Fekel, F. C. 1999, in *Astronomical Society of the Pacific Conference Series*, Vol. 185, *IAU Colloq. 170: Precise Stellar Radial Velocities*, ed. J. B. Hearnshaw & C. D. Scarfe, 378
- Ferrario, L., Pringle, J. E., Tout, C. A., & Wickramasinghe, D. T. 2009, *MNRAS*, 400, L71
- Fich, M., Treffers, R. R., & Dahl, G. P. 1990, *AJ*, 99, 622
- Flaccomio, E., Micela, G., & Sciortino, S. 2012, *A&A*, 548, A85
- Foreman-Mackey, D., Hogg, D. W., Lang, D., & Goodman, J. 2013, *PASP*, 125, 306
- Freyer, T., Hensler, G., & Yorke, H. W. 2003, *ApJ*, 594, 888
- Fryxell, B., Olson, K., Ricker, P., et al. 2000, *ApJS*, 131, 273

- Fujii, M., Iwasawa, M., Funato, Y., & Makino, J. 2007, PASJ, 59, 1095
- Fujii, M. S., Saitoh, T. R., Hirai, Y., & Wang, L. 2021, PASJ, 73, 1074
- Gaburov, E., Gualandris, A., & Portegies Zwart, S. 2008, MNRAS, 384, 376
- Gahm, G. F., Carlqvist, P., Johansson, L. E. B., & Nikolić, S. 2006, A&A, 454, 201
- Gaia Collaboration, Brown, A. G. A., Vallenari, A., et al. 2018, A&A, 616, A1
- Gaia Collaboration, Brown, A. G. A., Vallenari, A., et al. 2021, A&A, 649, A1
- Gaia Collaboration, Brown, A. G. A., Vallenari, A., et al. 2016, A&A, 595, A2
- Galilei, G. 1610, Sidereus Nuncius (Thomas Baglioni)
- Galilei, G. 1632, Dialogo Sopra i Due Massimi Sistemi del Mondo
- Garmany, C. D., Glaspey, J. W., Bragança, G. A., et al. 2015, AJ, 150, 41
- Geen, S. & de Koter, A. 2022, MNRAS, 509, 4498
- Geen, S., Pellegrini, E., Bieri, R., & Klessen, R. 2020, MNRAS, 492, 915
- Georgelin, Y. P. & Georgelin, Y. M. 1970, A&A, 6, 349
- Gerritsen, J. P. E. & Icke, V. 1997, A&A, 325, 972
- Getman, K. V., Broos, P. S., Kuhn, M. A., et al. 2017, ApJS, 229, 28
- Getman, K. V., Feigelson, E. D., Kuhn, M. A., et al. 2018a, MNRAS, 476, 1213
- Getman, K. V., Kuhn, M. A., Feigelson, E. D., et al. 2018b, MNRAS, 477, 298
- Gillon, M., Jehin, E., Lederer, S. M., et al. 2016, Nature, 533, 221
- Gillon, M., Triaud, A. H. M. J., Demory, B.-O., et al. 2017, Nature, 542, 456
- Girichidis, P., Offner, S. S. R., Kritsuk, A. G., et al. 2020, Space Sci. Rev., 216, 68
- Gossage, S., Conroy, C., Dotter, A., et al. 2018, ApJ, 863, 67
- Götberg, Y., de Mink, S. E., & Groh, J. H. 2017, A&A, 608, A11
- GRAVITY Collaboration, Karl, M., Pfuhl, O., et al. 2018, A&A, 620, A116
- Gray, R. O. & Corbally, Christopher, J. 2009, Stellar Spectral Classification (Princeton University Press)
- Gregory, S. G., Adams, F. C., & Davies, C. L. 2016, MNRAS, 457, 3836
- Grudić, M. Y., Guszejnov, D., Hopkins, P. F., Offner, S. S. R., & Faucher-Giguère, C.-A. 2021, MNRAS, 506, 2199
- Grunhut, J. H., Wade, G. A., Neiner, C., et al. 2017, MNRAS, 465, 2432
- Gupta, A., Miotello, A., Manara, C. F., et al. 2023, A&A, 670, L8
- Guszejnov, D., Grudić, M. Y., Offner, S. S. R., et al. 2022, MNRAS, 515, 4929

- Habing, H. J. 1968, *Bul. Astron. Inst. Neth.* , 19, 421
- Hacar, A., Clark, S., Heitsch, F., et al. 2022, arXiv e-prints, arXiv:2203.09562
- Haisch, Karl E., J., Lada, E. A., & Lada, C. J. 2001, *ApJ*, 553, L153
- Hamers, A. S., Rantala, A., Neunteufel, P., Preece, H., & Vynatheya, P. 2021, *MNRAS*, 502, 4479
- Hardy, A., Caceres, C., Schreiber, M. R., et al. 2015, *A&A*, 583, A66
- Harris, C. R., Millman, K. J., van der Walt, S. J., et al. 2020, *Nature*, 585, 357
- Harten, R. H., Goss, W. M., Matthews, H. E., & Israel, F. P. 1981, *A&A*, 103, 50
- Haworth, T. J. 2021, *MNRAS*, 503, 4172
- Haworth, T. J., Cadman, J., Meru, F., et al. 2020, *MNRAS*, 494, 4130
- Haworth, T. J. & Clarke, C. J. 2019, *MNRAS*, 485, 3895
- Haworth, T. J., Clarke, C. J., & Owen, J. E. 2016, *MNRAS*, 457, 1905
- Haworth, T. J., Clarke, C. J., Rahman, W., Winter, A. J., & Facchini, S. 2018a, *MNRAS*, 481, 452
- Haworth, T. J., Facchini, S., Clarke, C. J., & Mohanty, S. 2018b, *MNRAS*, 475, 5460
- Haworth, T. J., Glover, S. C. O., Koepferl, C. M., Bisbas, T. G., & Dale, J. E. 2018c, *New Astron. Review* , 82, 1
- Haworth, T. J., Kim, J. S., Winter, A. J., et al. 2021, *MNRAS*, 501, 3502
- Hendler, N., Pascucci, I., Pinilla, P., et al. 2020, *ApJ*, 895, 126
- Henney, W. J. 2007, in *Astrophysics and Space Science Proceedings*, Vol. 1, *Diffuse Matter from Star Forming Regions to Active Galaxies - A Volume Honouring John Dyson*, 103
- Henney, W. J. & Arthur, S. J. 1998, *AJ*, 116, 322
- Henney, W. J. & O'Dell, C. R. 1999, *AJ*, 118, 2350
- Henney, W. J., O'Dell, C. R., Meaburn, J., Garrington, S. T., & Lopez, J. A. 2002, *ApJ*, 566, 315
- Hernquist, L. & Katz, N. 1989, *ApJS*, 70, 419
- Hildebrand, R. H. 1983, *QJRAS*, 24, 267
- Hillenbrand, L. A. & Hartmann, L. W. 1998, *ApJ*, 492, 540
- Høg, E., Fabricius, C., Makarov, V. V., et al. 2000, *A&A*, 355, L27
- Hopkins, P. F. 2015, *MNRAS*, 450, 53
- Hosokawa, T. & Inutsuka, S.-i. 2006, *ApJ*, 646, 240

- Huang, J., Ginski, C., Benisty, M., et al. 2022, *ApJ*, 930, 171
- Hubble, E. P. 1925, *The Observatory*, 48, 139
- Hunter, J. D. 2007, *Computing in Science & Engineering*, 9, 90
- Hurley, J. R., Tout, C. A., & Pols, O. R. 2002, *MNRAS*, 329, 897
- Hut, P. 1981, *A&A*, 99, 126
- Iorio, G., Mapelli, M., Costa, G., et al. 2023, *MNRAS*[[arXiv:2211.11774](https://arxiv.org/abs/2211.11774)]
- Jänes, J., Pelupessy, I., & Portegies Zwart, S. 2014, *A&A*, 570, A20
- J Jeans, J. H. 1902, *Philosophical Transactions of the Royal Society of London Series A*, 199, 1
- Jia, H. & Li, K. 2011, *Mathematical and Computer Modelling*, 53, 387
- Johnstone, C. P., Bartel, M., & Güdel, M. 2020, *arXiv e-prints*, [arXiv:2009.07695](https://arxiv.org/abs/2009.07695)
- Johnstone, D., Hollenbach, D., & Bally, J. 1998, *ApJ*, 499, 758
- Kant, I. 1755, *Allgemeine Naturgeschichte und Theorie des Himmels*
- Keszthelyi, Z. 2023, *Galaxies*, 11, 40
- Keszthelyi, Z., Meynet, G., Martins, F., de Koter, A., & David-Uraz, A. 2021, *MNRAS*, 504, 2474
- Kharchenko, N. V., Piskunov, A. E., Röser, S., Schilbach, E., & Scholz, R. D. 2005, *A&A*, 438, 1163
- Kim, D., Lu, J. R., Konopacky, Q., et al. 2019, *AJ*, 157, 109
- Kim, J., Chevance, M., Kruijssen, J. M. D., et al. 2022, *MNRAS*, 516, 3006
- Kim, J. S., Clarke, C. J., Fang, M., & Facchini, S. 2016, *ApJ*, 826, L15
- Kiseleva, L. G., Eggleton, P. P., & Mikkola, S. 1998, *MNRAS*, 300, 292
- Koornneef, J. 1983, *A&A*, 128, 84
- Krapp, L., Benítez-Llambay, P., Gressel, O., & Pessah, M. E. 2019, *ApJ*, 878, L30
- Krause, M. G. H., Offner, S. S. R., Charbonnel, C., et al. 2020, *Space Sci. Rev.*, 216, 64
- Kroupa, P. 2001, *MNRAS*, 322, 231
- Kroupa, P., Jeřábková, T., Dinnbier, F., Beccari, G., & Yan, Z. 2018, *A&A*, 612, A74
- Kruijjer, T. S., Touboul, M., Fischer-Gödde, M., et al. 2014, *Science*, 344, 1150
- Kruijssen, J. M. D., Longmore, S. N., Chevance, M., et al. 2021, *arXiv e-prints*, [arXiv:2109.06182](https://arxiv.org/abs/2109.06182)
- Krumholz, M. R. 2014, *Phys. Rep.*, 539, 49

- Krumholz, M. R., Bate, M. R., Arce, H. G., et al. 2014, in *Protostars and Planets VI*, ed. H. Beuther, R. S. Klessen, C. P. Dullemond, & T. Henning, 243
- Krumholz, M. R. & Forbes, J. C. 2015, *Astronomy and Computing*, 11, 1
- Krumholz, M. R., McKee, C. F., & Bland-Hawthorn, J. 2019, *ARA&A*, 57, 227
- Kuchner, M. J., Silverberg, S. M., Bans, A. S., et al. 2016, *ApJ*, 830, 84
- Kudritzki, R.-P. & Puls, J. 2000, *ARA&A*, 38, 613
- Kuffmeier, M., Zhao, B., & Caselli, P. 2020, *A&A*, 639, A86
- Kuhn, M. A., Hillenbrand, L. A., Sills, A., Feigelson, E. D., & Getman, K. V. 2019, *ApJ*, 870, 32
- Kuiper, G. P. 1951, *Proceedings of the National Academy of Science*, 37, 1
- Kun, M., Kiss, Z. T., & Balog, Z. 2008, in *Handbook of Star Forming Regions, Volume I*, ed. B. Reipurth, Vol. 4 (*Astronomical Society of the Pacific Conference Series*), 136
- Kurtovic, N. T., Pérez, L. M., Benisty, M., et al. 2018, *ApJ*, 869, L44
- Kuznetsova, A., Bae, J., Hartmann, L., & Mac Low, M.-M. 2022, *ApJ*, 928, 92
- Lada, C. J. & Lada, E. A. 2003, *ARA&A*, 41, 57
- Lambrechts, M. & Johansen, A. 2012, *A&A*, 544, A32
- Lancaster, L., Ostriker, E. C., Kim, J.-G., & Kim, C.-G. 2021a, *ApJ*, 914, 89
- Lancaster, L., Ostriker, E. C., Kim, J.-G., & Kim, C.-G. 2021b, *ApJ*, 914, 90
- Lanz, T. & Hubeny, I. 2003, *ApJS*, 146, 417
- Laplace, P.-S. 1796, *Exposition du Système du Monde*
- Lata, S., Pandey, A. K., Maheswar, G., Mondal, S., & Kumar, B. 2011, *MNRAS*, 418, 1346
- Lebreuilly, U., Hennebelle, P., Maury, A., et al. 2023, *arXiv e-prints*, arXiv:2309.05397
- Lee, J., Song, I., & Murphy, S. 2020, *MNRAS*, 494, 62
- Lehmann, H., Vitrichenko, E., Bychkov, V., Bychkova, L., & Klochkova, V. 2010, *A&A*, 514, A34
- Leisawitz, D., Bash, F. N., & Thaddeus, P. 1989, *ApJS*, 70, 731
- Lesur, G., Ercolano, B., Flock, M., et al. 2022, *arXiv e-prints*, arXiv:2203.09821
- Lewis, S., McMillan, S., Mac Low, M.-M., et al. 2023a, in *American Astronomical Society Meeting Abstracts*, Vol. 55, *American Astronomical Society Meeting Abstracts*, 109.03D
- Lewis, S. C., McMillan, S. L. W., Mac Low, M.-M., et al. 2023b, *ApJ*, 944, 211

- Li, Z. Y., Banerjee, R., Pudritz, R. E., et al. 2014, in *Protostars and Planets VI*, ed. H. Beuther, R. S. Klessen, C. P. Dullemond, & T. Henning, 173–194
- Lindblad, P. O., Grape, K., Sandqvist, A., & Schober, J. 1973, *A&A*, 24, 309
- Liu, L. & Pang, X. 2019, *ApJS*, 245, 32
- Liu, T., Janes, K. A., & Bania, T. M. 1989, *AJ*, 98, 626
- Lozinskaya, T. A., Sitnik, T. G., & Toropova, M. S. 1987, *SvA*, 31, 493
- Lucas, W. E., Bonnell, I. A., & Dale, J. E. 2020, *MNRAS*, 493, 4700
- Lynden-Bell, D. & Pringle, J. E. 1974, *MNRAS*, 168, 603
- Lynds, B. T. 1962, *ApJS*, 7, 1
- MacConnell, D. J. 1968, *ApJS*, 16, 275
- Maíz Apellániz, J., Trigueros Páez, E., Negueruela, I., et al. 2019, *A&A*, 626, A20
- Majaess, D. J., Turner, D. G., Lane, D. J., & Moncrieff, K. E. 2008, *The Journal of the American Association of Variable Star Observers*, 36, 90
- Mamajek, E. E. 2009, in *American Institute of Physics Conference Series*, Vol. 1158, *Exoplanets and Disks: Their Formation and Diversity*, ed. T. Usuda, M. Tamura, & M. Ishii, 3–10
- Manara, C. F., Ansdell, M., Rosotti, G. P., et al. 2022, *arXiv e-prints*, arXiv:2203.09930
- Mann, R. K., Di Francesco, J., Johnstone, D., et al. 2014, *ApJ*, 784, 82
- Marchington, B. & Parker, R. J. 2022, *MNRAS*, 515, 5449
- Marois, C., Macintosh, B., Barman, T., et al. 2008, *Science*, 322, 1348
- Marois, C., Zuckerman, B., Konopacky, Q. M., Macintosh, B., & Barman, T. 2010, *Nature*, 468, 1080
- Martins, F., Escolano, C., Wade, G. A., et al. 2012, *A&A*, 538, A29
- Matzner, C. D. & McKee, C. F. 2000, *ApJ*, 545, 364
- Mayor, M. & Queloz, D. 1995, *Nature*, 378, 355
- McKee, C. F., van Buren, D., & Lazareff, B. 1984, *ApJ*, 278, L115
- McMillan, S., Portegies Zwart, S., van Elteren, A., & Whitehead, A. 2012, in *Astronomical Society of the Pacific Conference Series*, Vol. 453, *Advances in Computational Astrophysics: Methods, Tools, and Outcome*, ed. R. Capuzzo-Dolcetta, M. Limongi, & A. Tornambè, 129
- McMillan, S. L. W. 1986, in *The Use of Supercomputers in Stellar Dynamics*, ed. P. Hut & S. L. W. McMillan, Vol. 267 (Springer), 156
- McMillan, S. L. W. & Hut, P. 1996, *ApJ*, 467, 348
- Mestel, L. 1968, *MNRAS*, 138, 359

- Michel, A., van der Marel, N., & Matthews, B. C. 2021, *ApJ*, 921, 72
- Miller, R. H. 1964, *ApJ*, 140, 250
- Milson, N., Barton, C., & Bennett, P. D. 2020, arXiv e-prints, arXiv:2011.13914
- Mintz, A., Hora, J. L., & Winston, E. 2021, *AJ*, 162, 236
- Mitchell, T. R. & Stewart, G. R. 2010, *ApJ*, 722, 1115
- Miyamoto, M. & Nagai, R. 1975, *PASJ*, 27, 533
- Murphy, S. J., Mamajek, E. E., & Bell, C. P. M. 2018, *MNRAS*, 476, 3290
- Naoz, S. & Fabrycky, D. C. 2014, *ApJ*, 793, 137
- Navarro, J. F., Frenk, C. S., & White, S. D. M. 1996, *ApJ*, 462, 563
- Ndugu, N., Abedigamba, O. P., & Andama, G. 2022, *MNRAS*, 512, 861
- Ndugu, N., Bitsch, B., & Jurua, E. 2018, *MNRAS*, 474, 886
- Nicholson, R. B., Parker, R. J., Church, R. P., et al. 2019, *MNRAS*, 485, 4893
- Nielsen, M. B., Gizon, L., Schunker, H., & Karoff, C. 2013, *A&A*, 557, L10
- Nikolić, S., Kiss, C., Johansson, L. E. B., Wouterloot, J. G. A., & Tóth, L. V. 2001, *A&A*, 367, 694
- O'Dell, C. R., Kollatschny, W., & Ferland, G. J. 2017, *ApJ*, 837, 151
- O'Dell, C. R. & Wen, Z. 1994, *ApJ*, 436, 194
- O'Dell, C. R., Wen, Z., & Hu, X. 1993, *ApJ*, 410, 696
- Offner, S. S. R., Moe, M., Kratter, K. M., et al. 2022, arXiv e-prints, arXiv:2203.10066
- Ormel, C. W. & Klahr, H. H. 2010, *A&A*, 520, A43
- Ostriker, E. C., McKee, C. F., & Leroy, A. K. 2010, *ApJ*, 721, 975
- Ostriker, J. P. & McKee, C. F. 1988, *Reviews of Modern Physics*, 60, 1
- Owen, J. E. & Clarke, C. J. 2012, *MNRAS*, 426, L96
- Owen, J. E., Clarke, C. J., & Ercolano, B. 2012, *MNRAS*, 422, 1880
- Pabst, C., Higgins, R., Goicoechea, J. R., et al. 2019, *Nature*, 565, 618
- Pabst, C. H. M., Goicoechea, J. R., Teyssier, D., et al. 2020, *A&A*, 639, A2
- Pandey, A. K., Sharma, S., Ogura, K., et al. 2008, *MNRAS*, 383, 1241
- Panwar, N., Pandey, A. K., Samal, M. R., et al. 2018, *AJ*, 155, 44
- Parker, R. J., Alcock, H. L., Nicholson, R. B., Panić, O., & Goodwin, S. P. 2021a, *ApJ*, 913, 95
- Parker, R. J., Nicholson, R. B., & Alcock, H. L. 2021b, *MNRAS*, 502, 2665

- Patat, F. & Carraro, G. 1995, *A&AS*, 114, 281
- Paxton, B., Bildsten, L., Dotter, A., et al. 2011, *ApJS*, 192, 3
- Paxton, B., Smolec, R., Schwab, J., et al. 2019, *ApJS*, 243, 10
- Pecaut, M. J. & Mamajek, E. E. 2016, *MNRAS*, 461, 794
- Pedlar, A. 1980, *MNRAS*, 192, 179
- Pelupessy, F. I., Jänes, J., & Portegies Zwart, S. 2012, *New Astron.* , 17, 711
- Pelupessy, F. I. & Portegies Zwart, S. 2012, *MNRAS*, 420, 1503
- Pelupessy, F. I., van der Werf, P. P., & Icke, V. 2004, *A&A*, 422, 55
- Pelupessy, F. I., van Elteren, A., de Vries, N., et al. 2013, *A&A*, 557, A84
- Pfalzner, S. 2003, *ApJ*, 592, 986
- Pfalzner, S., Dehghani, S., & Michel, A. 2022, arXiv e-prints, arXiv:2210.02420
- Pfalzner, S., Tackenberg, J., & Steinhausen, M. 2008, *A&A*, 487, L45
- Picogna, G., Ercolano, B., Owen, J. E., & Weber, M. L. 2019, *MNRAS*, 487, 691
- Pineda, J. E., Segura-Cox, D., Caselli, P., et al. 2020, *Nature Astronomy*, 4, 1158
- Plummer, H. C. 1911, *MNRAS*, 71, 460
- Pollack, J. B., Hubickyj, O., Bodenheimer, P., et al. 1996, *ICARUS*, 124, 62
- Portegies Zwart, S. 2018, *Science*, 361, 979
- Portegies Zwart, S. 2019, *A&A*, 622, A69
- Portegies Zwart, S. & McMillan, S. 2018, *Astrophysical Recipes; The art of AMUSE* (Institute of Physics Publishing)
- Portegies Zwart, S., McMillan, S., Harfst, S., et al. 2009, *New Astron.* , 14, 369
- Portegies Zwart, S., McMillan, S. L. W., van Elteren, E., Pelupessy, I., & de Vries, N. 2013, *Computer Physics Communications*, 184, 456
- Portegies Zwart, S., Pelupessy, I., Martínez-Barbosa, C., van Elteren, A., & McMillan, S. 2020, *Communications in Nonlinear Science and Numerical Simulations*, 85, 105240
- Portegies Zwart, S., Pelupessy, I., van Elteren, A., Wijnen, T. P. G., & Lugaro, M. 2018, *A&A*, 616, A85
- Portegies Zwart, S. F. 2016, *MNRAS*, 457, 313
- Portegies Zwart, S. F. & van den Heuvel, E. P. J. 2016, *MNRAS*, 456, 3401
- Portegies Zwart, S. F. & Verbunt, F. 1996, *A&A*, 309, 179
- Portegies Zwart, S. F. & Verbunt, F. 2012, *SeBa: Stellar and binary evolution*, *Astrophysics Source Code Library*, record ascl:1201.003

- Preibisch, T. & Feigelson, E. D. 2005, *ApJS*, 160, 390
- Ptolemy, C. 150, *Almagest*
- Qiao, L., Coleman, G. A. L., & Haworth, T. J. 2023, *MNRAS*, 522, 1939
- Qiao, L., Haworth, T. J., Sellek, A. D., & Ali, A. A. 2022, *MNRAS*, 512, 3788
- Ribas, Á., Bouy, H., & Merín, B. 2015, *A&A*, 576, A52
- Ribas, Á., Merín, B., Bouy, H., & Maud, L. T. 2014, *A&A*, 561, A54
- Richert, A. J. W., Getman, K. V., Feigelson, E. D., et al. 2018, *MNRAS*, 477, 5191
- Rodriguez, J. E., Loomis, R., Cabrit, S., et al. 2018, *ApJ*, 859, 150
- Rosano, G. S., Angerhofer, P. E., & Grayzeck, E. J. 1980, *AJ*, 85, 716
- Rosotti, G. P. 2023, *New Astron. Review*, 96, 101674
- Rosotti, G. P., Dale, J. E., de Juan Ovelar, M., et al. 2014, *MNRAS*, 441, 2094
- Rosotti, G. P., Ercolano, B., & Owen, J. E. 2015, *MNRAS*, 454, 2173
- Rosotti, G. P., Ercolano, B., Owen, J. E., & Armitage, P. J. 2013, *MNRAS*, 430, 1392
- Rossano, G. S., Grayzeck, E. J., & Angerhofer, P. E. 1983, *AJ*, 88, 1835
- Rosvick, J. M. & Majaess, D. 2013, *AJ*, 146, 142
- Rucska, J. & Wadsley, J. 2023, *arXiv e-prints*, arXiv:2305.11297
- Rzaev, A. K., Shimansky, V. V., & Kolbin, A. I. 2021, *MNRAS*, 504, 3787
- Safronov, V. S. 1960, *Annales d'Astrophysique*, 23, 979
- Salas, J. M., Naoz, S., Morris, M. R., & Stephan, A. P. 2019, *MNRAS*, 487, 3029
- Salyk, C., Pontoppidan, K., Corder, S., et al. 2014, *ApJ*, 792, 68
- Schaller, M., Gonnet, P., Chalk, A. B. G., & Draper, P. W. 2016, in *Proceedings of the Platform for Advanced Scientific Computing Conference*, 2
- Schaye, J., Crain, R. A., Bower, R. G., et al. 2015, *MNRAS*, 446, 521
- Schneider, F. R. N., Ohlmann, S. T., Podsiadlowski, P., et al. 2019, *Nature*, 574, 211
- Schneider, J., Dedieu, C., Le Sidaner, P., Savalle, R., & Zolotukhin, I. 2011, *A&A*, 532, A79
- Scoville, N. Z., Yun, M. S., Clemens, D. P., Sanders, D. B., & Waller, W. H. 1987, *ApJS*, 63, 821
- Sellek, A. D., Booth, R. A., & Clarke, C. J. 2020a, *MNRAS*, 498, 2845
- Sellek, A. D., Booth, R. A., & Clarke, C. J. 2020b, *MNRAS*, 492, 1279
- Shakura, N. I. & Sunyaev, R. A. 1973, *A&A*, 24, 337

- Shapley, H. & Curtis, H. D. 1921, *Bulletin of the National Research Council*, 2, 171
- Sharma, S., Ogura, K., Pandey, A. K., Ojha, D. K., & Bhatt, B. C. 2007, *Bulletin of the Astronomical Society of India*, 35, 1
- Sharpless, S. 1959, *ApJS*, 4, 257
- Sheehan, P. D. & Eisner, J. A. 2018, *ApJ*, 857, 18
- Silverberg, S. M., Kuchner, M. J., Wisniewski, J. P., et al. 2016, *ApJ*, 830, L28
- Silverberg, S. M., Wisniewski, J. P., Kuchner, M. J., et al. 2020, *ApJ*, 890, 106
- Simón-Díaz, S. & Herrero, A. 2007, *A&A*, 468, 1063
- Simón-Díaz, S., Herrero, A., Esteban, C., & Najarro, F. 2006, *A&A*, 448, 351
- Solomon, P. M., Rivolo, A. R., Barrett, J., & Yahil, A. 1987, *ApJ*, 319, 730
- Speedie, J., Pudritz, R. E., Cridland, A. J., Meru, F., & Booth, R. A. 2022, *MNRAS*, 510, 6059
- Stahl, O., Kaufer, A., Rivinius, T., et al. 1996, *A&A*, 312, 539
- Stempels, E. 2005, *FIES Automatic Data Reduction Software, NOT User Manual*
- Sternberg, A., Hoffmann, T. L., & Pauldrach, A. W. A. 2003, *ApJ*, 599, 1333
- Störzer, H. & Hollenbach, D. 1999, *ApJ*, 515, 669
- Strang, G. 1968, *SIAM Journal on Numerical Analysis*, 5, 506
- Strömgren, B. 1939, *ApJ*, 89, 526
- Tabone, B., Rosotti, G. P., Cridland, A. J., Armitage, P. J., & Lodato, G. 2022a, *MNRAS*, 512, 2290
- Tabone, B., Rosotti, G. P., Lodato, G., et al. 2022b, *MNRAS*, 512, L74
- Tanaka, H., Himeno, Y., & Ida, S. 2005, *ApJ*, 625, 414
- Tazzari, M., Testi, L., Ercolano, B., et al. 2016, *A&A*, 588, A53
- Telting, J. H., Avila, G., Buchhave, L., et al. 2014, *Astronomische Nachrichten*, 335, 41
- Terlevich, E. 1987, *MNRAS*, 224, 193
- Toci, C., Lodato, G., Livio, F. G., Rosotti, G., & Trapman, L. 2023, *MNRAS*, 518, L69
- Tokovinin, A. & Moe, M. 2020, *MNRAS*, 491, 5158
- Toomre, A. 1964, *ApJ*, 139, 1217
- Toonen, S., Nelemans, G., & Portegies Zwart, S. 2012, *A&A*, 546, A70
- Trani, A. A. & Spera, M. 2023, *IAU Symposium*, 362, 404
- Trapman, L., Facchini, S., Hogerheijde, M. R., van Dishoeck, E. F., & Bruderer, S. 2019, *A&A*, 629, A79

- Trapman, L., Tabone, B., Rosotti, G., & Zhang, K. 2022, *ApJ*, 926, 61
- Tremblin, P., Audit, E., Minier, V., Schmidt, W., & Schneider, N. 2012a, *A&A*, 546, A33
- Tremblin, P., Audit, E., Minier, V., & Schneider, N. 2012b, *A&A*, 538, A31
- Tremblin, P., Minier, V., Schneider, N., et al. 2013, *A&A*, 560, A19
- Trigueros Páez, E., Barbá, R. H., Negueruela, I., et al. 2021, *A&A*, 655, A4
- Tsukamoto, Y., Maury, A., Commerçon, B., et al. 2022, arXiv e-prints, arXiv:2209.13765
- Turk, M. J., Smith, B. D., Oishi, J. S., et al. 2011, *The Astrophysical Journal Supplement Series*, 192, 9
- Tychoniec, Ł., Manara, C. F., Rosotti, G. P., et al. 2020, *A&A*, 640, A19
- Tychoniec, Ł., Tobin, J. J., Karska, A., et al. 2018, *ApJS*, 238, 19
- van der Helm, E., Saladino, M. I., Portegies Zwart, S., & Pols, O. 2019, *A&A*, 625, A85
- van der Marel, N. & Mulders, G. D. 2021, *AJ*, 162, 28
- van Elteren, A., Portegies Zwart, S., Pelupessy, I., Cai, M. X., & McMillan, S. L. W. 2019, *A&A*, 624, A120
- Van Rossum, G. & Drake Jr, F. L. 1995, *Python reference manual* (Centrum voor Wiskunde en Informatica Amsterdam)
- van Terwisga, S. E., Hacar, A., & van Dishoeck, E. F. 2019, *A&A*, 628, A85
- van Terwisga, S. E., van Dishoeck, E. F., Mann, R. K., et al. 2020, *A&A*, 640, A27
- Veen, L. E. & Hoekstra, A. G. 2020, in *Computational Science – ICCS 2020*, ed. V. V. Krzhizhanovskaya, G. Závodszy, M. H. Lees, J. J. Dongarra, P. M. A. Sloot, S. Brissos, & J. Teixeira (Cham: Springer International Publishing), 425–438
- Vincke, K., Breslau, A., & Pfalzner, S. 2015, *A&A*, 577, A115
- Vincke, K. & Pfalzner, S. 2016, *ApJ*, 828, 48
- Vincke, K. & Pfalzner, S. 2018, *ApJ*, 868, 1
- Virtanen, P., Gommers, R., Oliphant, T. E., et al. 2020, *Nature Methods*, 17, 261
- Vitrichenko, E. A. 2002, *Astronomy Letters*, 28, 324
- Vynatheya, P., Hamers, A. S., Mardling, R. A., & Bellinger, E. P. 2022, *MNRAS*, 516, 4146
- Walborn, N. R. 2009, In: *Stellar Spectral Classification*, ed. by Gray, R. O & Corbally, C. J., Princeton University Press
- Wall, J. E., Mac Low, M.-M., McMillan, S. L. W., et al. 2020, *ApJ*, 904, 192
- Wall, J. E., McMillan, S. L. W., Mac Low, M.-M., Klessen, R. S., & Portegies Zwart, S. 2019, *ApJ*, 887, 62

- Weaver, R., McCray, R., Castor, J., Shapiro, P., & Moore, R. 1977, *ApJ*, 218, 377
- Wegner, W. 2006, *MNRAS*, 371, 185
- Weidenschilling, S. J. 1977, *MNRAS*, 180, 57
- Wielen, R. 1967, *Veroeffentlichungen des Astronomischen Rechen-Instituts Heidelberg*, 19, 1
- Wijnen, T. P. G., Pelupessy, F. I., Pols, O. R., & Portegies Zwart, S. 2017a, *A&A*, 604, A88
- Wijnen, T. P. G., Pols, O. R., Pelupessy, F. I., & Portegies Zwart, S. 2017b, *A&A*, 602, A52
- Wijnen, T. P. G., Pols, O. R., Pelupessy, F. I., & Portegies Zwart, S. 2017c, *A&A*, 604, A91
- Wilhelm, M. J. C. & Portegies Zwart, S. 2022, *MNRAS*, 509, 44
- Wilhelm, M. J. C., Portegies Zwart, S., Cournoyer-Cloutier, C., et al. 2023, *MNRAS*, 520, 5331
- Williams, J. P. & Cieza, L. A. 2011, *ARA&A*, 49, 67
- Winter, A. J., Clarke, C. J., Rosotti, G., et al. 2018, *MNRAS*, 478, 2700
- Winter, A. J., Clarke, C. J., Rosotti, G. P., Hacar, A., & Alexander, R. 2019, *MNRAS*, 490, 5478
- Winter, A. J. & Haworth, T. J. 2022, *European Physical Journal Plus*, 137, 1132
- Winter, A. J., Haworth, T. J., Coleman, G. A. L., & Nayakshin, S. 2022, *MNRAS*, 515, 4287
- Wolfire, M. G., Hollenbach, D., McKee, C. F., Tielens, A. G. G. M., & Bakes, E. L. O. 1995, *ApJ*, 443, 152
- Wolszczan, A. & Frail, D. A. 1992, *Nature*, 355, 145
- Woodsley, S. E., Heger, A., & Weaver, T. A. 2002, *Reviews of Modern Physics*, 74, 1015
- Wootten, A., Sargent, A., Knapp, G., & Huggins, P. J. 1983, *ApJ*, 269, 147
- Wright, E. L., Eisenhardt, P. R. M., Mainzer, A. K., et al. 2010, *AJ*, 140, 1868
- Wu, Y., Chen, Y.-X., Jiang, H., et al. 2023, *MNRAS*, 523, 2630
- Wurster, J., Bate, M. R., & Price, D. J. 2019, *MNRAS*, 489, 1719
- Yang, J. & Fukui, Y. 1992, *ApJ*, 386, 618
- Yepes, G., Kates, R., Khokhlov, A., & Klypin, A. 1997, *MNRAS*, 284, 235
- Yonekura, Y., Dobashi, K., Mizuno, A., Ogawa, H., & Fukui, Y. 1997, *ApJS*, 110, 21
- Youdin, A. N. & Goodman, J. 2005, *ApJ*, 620, 459

Yuan, H. B., Liu, X. W., & Xiang, M. S. 2013, MNRAS, 430, 2188

Zahn, J. P. 1975, A&A, 41, 329

Zapata, L. A., Rodríguez, L. F., Fernández-López, M., et al. 2020, ApJ, 896, 132

Zhu, Z. & Yang, C.-C. 2021, MNRAS, 501, 467

Zucker, C., Goodman, A. A., Alves, J., et al. 2022, Nature, 601, 334

Zucker, C., Speagle, J. S., Schlafly, E. F., et al. 2019, ApJ, 879, 125