

Cover Page



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And that's it. This small booklet is the end of a life adventure. This has been fun and tough, happy and sad, wonderful and some times desperate. All in all it has been a big mess, but I never doubted that it would have been worthy to go all the way through it.

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Curriculum Vitae

I was born on August the 30th, 1984, in Vimercate (Milano), Italy. I attended the primary and the secondary school in my city, Monza. From 1998, I studied at the scientific High School (*Liceo Scientifico*) Paolo Frisi, in Monza, and I obtained my Diploma (*Diploma di Maturità Scientifica*) in 2003, with a mark of 96/100.

In 2003, I started a Bachelor in physics (*Laurea in Fisica*) at Università degli Studi di Milano-Bicocca, in Milano. I graduated in April 2007 (mark: 101/110) with a thesis entitled "Host galaxies and progenitor in Gamma Ray Bursts". My bachelor thesis project was supervised by Prof. Guido Chincarini.

I continued my studies at the University of Milano-Bicocca with a Master in Astrophysics (*Laurea Magistrale in Astrofisica e Fisica dello Spazio*) and I obtained my Master Diploma in 2010 (mark: 109/110). For my Master project, which was supervised by Prof. Monica Colpi and co-supervised by Dr. Anna Wolter, I worked at the Observatory of Brera, in Milano. My Master dissertation was about the X-ray emission from early-type galaxies.

After my Master, I was awarded of a pre-doctoral scholarship (*Borsa di Studio per il proseguimento della formazione dei giovani promettenti*) from the Università degli Studi di Milano. With that funding, I worked from April 2011 until September 2011 at INAF/IASF in Milano on a project of Dr. Fabio Gastaldello, which was published in the Astrophysical Journal.

In September 2011 I started my Ph. D. at SRON Netherlands Institute for Space Research under the supervision of Dr. Elisa Costantini and Prof. Jelle Kaastra. During my Ph.D. I studied the physical properties of the ionized gas in the circumnuclear environment of Active Galactic Nuclei (AGN) using high resolution spectroscopy in the X-ray band and photoionization modeling techniques. The results of my Ph. D. work were published in the journal *Astronomy & Astrophysics* and presented at several international conferences. Since January 2016, I am employed as a postdoctoral researcher at ISDC, Integral Data Center for Astrophysics in Versoix (Genève), Switzerland in the group of Dr. Stéphane Paltani.

Bibliography

- Aalto, S., Garcia-Burillo, S., Muller, S., et al. 2012, A&A, 537, A44
- Anders, E. & Grevesse, N. 1989, Geochim. Cosmochim. Acta, 53, 197
- Antonucci, R. 1993, ARA&A, 31, 473
- Antonucci, R. R. J. & Miller, J. S. 1985, ApJ, 297, 621
- Arabadjis, J. S. & Bregman, J. N. 1999, ApJ, 510, 806
- Arav, N., Chamberlain, C., Kriss, G. A., et al. 2015, A&A, 577, A37
- Arav, N., Edmonds, D., Borguet, B., et al. 2012, A&A, 544, A33
- Arav, N., Gabel, J. R., Korista, K. T., et al. 2007, ApJ, 658, 829
- Arav, N., Korista, K. T., & de Kool, M. 2002, ApJ, 566, 699
- Armentrout, B. K., Kraemer, S. B., & Turner, T. J. 2007, ApJ, 665, 237
- Arnaud, K. A. 1996, in Astronomical Society of the Pacific Conference Series, Vol. 101, Astronomical Data Analysis Software and Systems V, ed. G. H. Jacoby & J. Barnes, 17
- Arnaud, K. A., Branduardi-Raymont, G., Culhane, J. L., et al. 1985, MNRAS, 217, 105
- Asmus, D., Höning, S. F., & Gandhi, P. 2016, ApJ, 822, 109
- Bachev, R., Marziani, P., Sulentic, J. W., et al. 2004, ApJ, 617, 171
- Baldwin, J., Ferland, G., Korista, K., & Verner, D. 1995, ApJ, 455, L119
- Ballantyne, D. R. 2005, MNRAS, 362, 1183
- Ballantyne, D. R. & Fabian, A. C. 2005, ApJ, 622, L97
- Ballantyne, D. R., Ross, R. R., & Fabian, A. C. 2001, MNRAS, 327, 10
- Ballantyne, D. R., Vaughan, S., & Fabian, A. C. 2003, MNRAS, 342, 239
- Bambi, C. 2012, Phys. Rev. D, 85, 043001
- Barvainis, R. 1987, ApJ, 320, 537
- Baskin, A. & Laor, A. 2005, MNRAS, 358, 1043
- Baumgartner, W. H., Tueller, J., Markwardt, C. B., et al. 2013, ApJS, 207, 19
- Bautista, M., Arav, N., Dunn, J., et al. 2009, in Bulletin of the American Astronomical Society, Vol. 41, American Astronomical Society Meeting Abstracts 213, 484.08
- Beckmann, V. & Shrader, C. 2012, in Proceedings of "An INTEGRAL view of the high-energy sky (the first 10 years)" - 9th INTEGRAL Workshop and celebration of the 10th anniversary of the launch (INTEGRAL 2012). 15-19 October 2012. Bibliotheque Nationale de France, Paris, France
- Behar, E., Rasmussen, A. P., Blustin, A. J., et al. 2003, ApJ, 598, 232
- Bianchi, S., Guainazzi, M., & Chiaberge, M. 2006, A&A, 448, 499
- Bianchi, S., Guainazzi, M., Matt, G., Fonseca Bonilla, N., & Ponti, G. 2009, A&A, 495, 421
- Bianchi, S., Maiolino, R., & Risaliti, G. 2012, Advances in Astronomy, 2012, 17
- Blandford, R. D. & Payne, D. G. 1982, MNRAS, 199, 883

- Blustin, A. J., Page, M. J., Fuerst, S. V., Branduardi-Raymont, G., & Ashton, C. E. 2005, *A&A*, 431, 111
- Boissay, R., Ricci, C., & Paltani, S. 2016, *A&A*, 588, A70
- Borguet, B. C. J., Edmonds, D., Arav, N., Dunn, J., & Kriss, G. A. 2012, *ApJ*, 751, 107
- Braito, V., Reeves, J. N., Sambruna, R. M., & Gofford, J. 2011, *MNRAS*, 414, 2739
- Brenneman, L. W., Madejski, G., Fuerst, F., et al. 2014, *ApJ*, 788, 61
- Brinkman, B. C., Gunsing, T., Kaastra, J. S., et al. 2000, in Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, Vol. 4012, X-Ray Optics, Instruments, and Missions III, ed. J. E. Truemper & B. Aschenbach, 81–90
- Brinkmann, W., Otani, C., Wagner, S. J., & Siebert, J. 1998, *A&A*, 330, 67
- Burrows, D. N., Hill, J. E., Nousek, J. A., et al. 2005, *Space Sci. Rev.*, 120, 165
- Burtscher, L., Meisenheimer, K., Tristram, K. R. W., et al. 2013, *A&A*, 558, A149
- Buttiglione, S., Capetti, A., Celotti, A., et al. 2009, *A&A*, 495, 1033
- Cackett, E. M., Fabian, A. C., Zoghbi, A., et al. 2013, *ApJ*, 764, L9
- Canizares, C. R., Davis, J. E., Dewey, D., et al. 2005, *PASP*, 117, 1144
- Cappi, M., Panessa, F., Bassani, L., et al. 2006, *A&A*, 446, 459
- Cardelli, J. A., Clayton, G. C., & Mathis, J. S. 1989, *ApJ*, 345, 245
- Carter, B. 1971, *Physical Review Letters*, 26, 331
- Carter, B. J., Fabricant, D. G., Geller, M. J., Kurtz, M. J., & McLean, B. 2001, *ApJ*, 559, 606
- Cash, W. 1979, *ApJ*, 228, 939
- Cavagnolo, K. W., McNamara, B. R., Nulsen, P. E. J., et al. 2010, *ApJ*, 720, 1066
- Cicone, C., Maiolino, R., Sturm, E., et al. 2014, *A&A*, 562, A21
- Coffey, D., Longinotti, A. L., Rodríguez-Ardila, A., et al. 2014, *MNRAS*, 443, 1788
- Condon, J. J., Cotton, W. D., Greisen, E. W., et al. 1998, *AJ*, 115, 1693
- Corral, A., Page, M. J., Carrera, F. J., et al. 2008, *A&A*, 492, 71
- Costantini, E. 2010, *Space Sci. Rev.*, 157, 265
- Costantini, E., Kaastra, J. S., Arav, N., et al. 2007, *A&A*, 461, 121
- Costantini, E., Kaastra, J. S., Korista, K., et al. 2010, *A&A*, 512, A25
- Crenshaw, D. M., Fischer, T. C., Kraemer, S. B., & Schmitt, H. R. 2015, *ApJ*, 799, 83
- Crenshaw, D. M. & Kraemer, S. B. 1997, in *Bulletin of the American Astronomical Society*, Vol. 29, American Astronomical Society Meeting Abstracts, 1334
- Crenshaw, D. M. & Kraemer, S. B. 1999, *ApJ*, 521, 572
- Crenshaw, D. M. & Kraemer, S. B. 2012, *ApJ*, 753, 75
- Crenshaw, D. M., Kraemer, S. B., Gabel, J. R., et al. 2003a, *ApJ*, 594, 116
- Crenshaw, D. M., Kraemer, S. B., & George, I. M. 2003b, *ARA&A*, 41, 117
- Crummy, J., Fabian, A. C., Gallo, L., & Ross, R. R. 2006, *MNRAS*, 365, 1067
- de Blok, W. J. G., Walter, F., Brinks, E., et al. 2008, *AJ*, 136, 2648
- De Marco, B., Ponti, G., Cappi, M., et al. 2013, *MNRAS*, 431, 2441
- de Vaucouleurs, G., de Vaucouleurs, A., Corwin, J. H. G., et al. 1991, *Third Reference Catalogue of Bright Galaxies*. Volume I: Explanations and references. Volume II: Data for galaxies between 0^h and 12^h . Volume III: Data for galaxies between 12^h and 24^h .

- den Herder, J. W., Brinkman, A. C., Kahn, S. M., et al. 2001, *A&A*, 365, L7
- Detmers, R. G., Kaastra, J. S., & McHardy, I. M. 2009, *A&A*, 504, 409
- Detmers, R. G., Kaastra, J. S., Steenbrugge, K. C., et al. 2011, *A&A*, 534, A38
- Di Gesu, L., Costantini, E., Arav, N., et al. 2013, *A&A*, 556, A94 (Paper I)
- Di Gesu, L., Costantini, E., Piconcelli, E., et al. 2014, *A&A*, 563, A95
- Di Matteo, T., Springel, V., & Hernquist, L. 2005, *Nature*, 433, 604
- Dickey, J. M. & Lockman, F. J. 1990, *ARA&A*, 28, 215
- Done, C., Davis, S. W., Jin, C., Blaes, O., & Ward, M. 2012, *MNRAS*, 420, 1848
- Dunn, J. P., Bautista, M., Arav, N., et al. 2010, *ApJ*, 709, 611
- Dunn, J. P., Crenshaw, D. M., Kraemer, S. B., & Gabel, J. R. 2007, *AJ*, 134, 1061
- Dunn, J. P., Crenshaw, D. M., Kraemer, S. B., & Trippe, M. L. 2008, *AJ*, 136, 1201
- Ebrero, J., Costantini, E., Kaastra, J. S., et al. 2010, *A&A*, 520, A36
- Ebrero, J., Kaastra, J. S., Kriss, G. A., de Vries, C. P., & Costantini, E. 2013, *MNRAS*, 435, 3028
- Ebrero, J., Kaastra, J. S., Kriss, G. A., et al. 2016, *A&A*, 587, A129
- Ebrero, J., Kriss, G. A., Kaastra, J. S., et al. 2011, *A&A*, 534, A40
- Ebrero, J., Mateos, S., Stewart, G. C., Carrera, F. J., & Watson, M. G. 2009, *A&A*, 500, 749
- Edmonds, D., Borguet, B., Arav, N., et al. 2011, *ApJ*, 739, 7
- Elitzur, M. 2012, *ApJ*, 747, L33
- Elitzur, M. & Shlosman, I. 2006, *ApJ*, 648, L101
- Elvis, M. 2012, *Journal of Physics Conference Series*, 372, 012032
- Elvis, M., Risaliti, G., Nicastro, F., et al. 2004, *ApJ*, 615, L25
- Everett, J. E. 2005, *ApJ*, 631, 689
- Fabian, A. C. 2006, *Astronomische Nachrichten*, 327, 943
- Fabian, A. C., Miniutti, G., Iwasawa, K., & Ross, R. R. 2005, *MNRAS*, 361, 795
- Fabian, A. C., Zoghbi, A., Ross, R. R., et al. 2009, *Nature*, 459, 540
- Faucher-Giguère, C.-A. & Quataert, E. 2012, *MNRAS*, 425, 605
- Ferguson, J. W., Korista, K. T., Baldwin, J. A., & Ferland, G. J. 1997, *ApJ*, 487, 122
- Ferland, G. J., Korista, K. T., Verner, D. A., et al. 1998, *PASP*, 110, 761
- Ferland, G. J., Martin, P. G., van Hoof, P. A. M., & Weingartner, J. C. 2003, ArXiv Astrophysics e-prints
- Ferland, G. J., Porter, R. L., van Hoof, P. A. M., et al. 2013, *Rev. Mexicana Astron. Astrofis.*, 49, 137
- Feruglio, C., Fiore, F., Carniani, S., et al. 2015, ArXiv e-prints
- Feruglio, C., Maiolino, R., Piconcelli, E., et al. 2010, *A&A*, 518, L155
- Fiore, F., Elvis, M., Mathur, S., Wilkes, B. J., & McDowell, J. C. 1993, *ApJ*, 415, 129
- Fischer, J., Sturm, E., González-Alfonso, E., et al. 2010, *A&A*, 518, L41
- Gabel, J. R., Kraemer, S. B., Crenshaw, D. M., et al. 2005, *ApJ*, 631, 741
- Gehrels, N., Chincarini, G., Giommi, P., et al. 2004, *ApJ*, 611, 1005
- Giacchè, S., Gilli, R., & Titarchuk, L. 2014, *A&A*, 562, A44
- Giustini, M., Turner, T. J., Reeves, J. N., et al. 2015, *A&A*, 577, A8

- Gliozzi, M., Papadakis, I. E., Grupe, D., Brinkmann, W. P., & Räth, C. 2013, MNRAS, 433, 1709
- Gofford, J., Reeves, J. N., Tombesi, F., et al. 2013, MNRAS, 430, 60
- González-Alfonso, E., Fischer, J., Isaak, K., et al. 2010, A&A, 518, L43
- Guainazzi, M., Comastri, A., Stirpe, G. M., et al. 1998, A&A, 339, 327
- Haardt, F. & Maraschi, L. 1991, ApJ, 380, L51
- Hamann, F. & Sabra, B. 2004, in Astronomical Society of the Pacific Conference Series, Vol. 311, AGN Physics with the Sloan Digital Sky Survey, ed. G. T. Richards & P. B. Hall, 203
- Hamann, F. W., Barlow, T. A., Chaffee, F. C., Foltz, C. B., & Weymann, R. J. 2001, ApJ, 550, 142
- Hardee, P. 2008, Journal of Physics Conference Series, 131, 012052
- Harrison, C. M., Alexander, D. M., Mullaney, J. R., & Swinbank, A. M. 2014, MNRAS, 441, 3306
- Harrison, F. A., Craig, W. W., Christensen, F. E., et al. 2013, ApJ, 770, 103
- Hasenkopf, C. A., Sambruna, R. M., & Eracleous, M. 2002, ApJ, 575, 127
- Ho, L. C., Filippenko, A. V., & Sargent, W. L. W. 1997, ApJ, 487, 568
- Hönig, S. F. & Kishimoto, M. 2010, A&A, 523, A27
- Hönig, S. F., Kishimoto, M., Antonucci, R., et al. 2012, ApJ, 755, 149
- Hönig, S. F., Kishimoto, M., Tristram, K. R. W., et al. 2013, ApJ, 771, 87
- Hopkins, P. F. & Elvis, M. 2010, MNRAS, 401, 7
- Hopkins, P. F., Hernquist, L., Cox, T. J., & Kereš, D. 2008, ApJS, 175, 356
- Hutsemékers, D., Hall, P. B., & Brinkmann, J. 2004, A&A, 415, 77
- Immler, S., Brandt, W. N., Vignali, C., et al. 2003, AJ, 126, 153
- Israel, F. P. 1998, A&A Rev., 8, 237
- Iwasawa, K., Fabian, A. C., & Nandra, K. 1999, MNRAS, 307, 611
- Jaffe, W., Meisenheimer, K., Röttgering, H. J. A., et al. 2004, Nature, 429, 47
- Jiménez-Bailón, E., Piconcelli, E., Guainazzi, M., et al. 2005, A&A, 435, 449
- Jin, C., Ward, M., Done, C., & Gelbord, J. 2012, MNRAS, 420, 1825
- Kaastra, J. S. & Barr, P. 1989, A&A, 226, 59
- Kaastra, J. S., Detmers, R. G., Mehdipour, M., et al. 2012, A&A, 539, A117
- Kaastra, J. S., Kriss, G. A., Cappi, M., et al. 2014, Science, 345, 64
- Kaastra, J. S., Mewe, R., Liedahl, D. A., Komossa, S., & Brinkman, A. C. 2000, A&A, 354, L83
- Kaastra, J. S., Mewe, R., & Nieuwenhuijzen, H. 1996, in UV and X-ray Spectroscopy of Astrophysical and Laboratory Plasmas, ed. K. Yamashita & T. Watanabe, 411–414
- Kaastra, J. S., Petrucci, P.-O., Cappi, M., et al. 2011, A&A, 534, A36
- Kaastra, J. S., Raassen, A. J. J., Mewe, R., et al. 2004, A&A, 428, 57
- Kaastra, J. S., Steenbrugge, K. C., Raassen, A. J. J., et al. 2002, A&A, 386, 427
- Kalberla, P. M. W., Burton, W. B., Hartmann, D., et al. 2005, A&A, 440, 775
- Kallman, T. 1999, XSTAR: A program for calculating conditions and spectra of photoionized gases, Astrophysics Source Code Library
- Kaspi, S., Brandt, W. N., George, I. M., et al. 2002a, ApJ, 574, 643
- Kaspi, S., Brandt, W. N., George, I. M., et al. 2002b, ApJ, 574, 643

- Kaspi, S., Smith, P. S., Netzer, H., et al. 2000, *ApJ*, 533, 631
- Kellermann, K. I., Sramek, R., Schmidt, M., Shaffer, D. B., & Green, R. 1989, *AJ*, 98, 1195
- King, A. & Pounds, K. 2015, *ARA&A*, 53, 115
- King, A. R. 2010, *MNRAS*, 402, 1516
- Kishimoto, M., Höning, S. F., Beckert, T., & Weigelt, G. 2007, *A&A*, 476, 713
- Königl, A. 2006, *Mem. Soc. Astron. Italiana*, 77, 598
- Korista, K., Baldwin, J., Ferland, G., & Verner, D. 1997, *ApJS*, 108, 401
- Korista, K. T. & Goad, M. R. 2000, *ApJ*, 536, 284
- Koshida, S., Minezaki, T., Yoshii, Y., et al. 2014, *ApJ*, 788, 159
- Kraemer, S. B., Crenshaw, D. M., Dunn, J. P., et al. 2012, *ApJ*, 751, 84
- Kraemer, S. B., Crenshaw, D. M., Gabel, J. R., et al. 2006, *ApJS*, 167, 161
- Kraemer, S. B., Crenshaw, D. M., George, I. M., Gabel, J. R., & NGC 4151 Team. 2005, in *Bulletin of the American Astronomical Society*, Vol. 37, American Astronomical Society Meeting Abstracts, 1190
- Kraemer, S. B., Crenshaw, D. M., Hutchings, J. B., et al. 2001, *ApJ*, 551, 671
- Kriss, G. A., Arav, N., Kaastra, J. S., et al. 2011, *A&A*, 534, A41
- Krolik, J. H. & Kriss, G. A. 2001, *ApJ*, 561, 684
- Krongold, Y., Elvis, M., Andrade-Velazquez, M., et al. 2010, *ApJ*, 710, 360
- Krongold, Y., Nicastro, F., Brickhouse, N. S., Elvis, M., & Mathur, S. 2005, *ApJ*, 622, 842
- Krongold, Y., Nicastro, F., Elvis, M., et al. 2007, *ApJ*, 659, 1022
- Landt, H., Ward, M. J., Elvis, M., & Karovska, M. 2014, *MNRAS*, 439, 1051
- Laor, A. 1991, *ApJ*, 376, 90
- Larsson, J., Fabian, A. C., Ballantyne, D. R., & Miniutti, G. 2008, *MNRAS*, 388, 1037
- Longinotti, A. L., Bianchi, S., Ballo, L., de La Calle, I., & Guainazzi, M. 2009, *MNRAS*, 394, L1
- Longinotti, A. L., Costantini, E., Petrucci, P. O., et al. 2010, *A&A*, 510, A92
- Longinotti, A. L., Krongold, Y., Kriss, G. A., et al. 2013, *ApJ*, 766, 104
- Magdziarz, P., Blaes, O. M., Zdziarski, A. A., Johnson, W. N., & Smith, D. A. 1998, *MNRAS*, 301, 179
- Magdziarz, P. & Zdziarski, A. A. 1995, *MNRAS*, 273, 837
- Maiolino, R. & Rieke, G. H. 1995, *ApJ*, 454, 95
- Malizia, A., Molina, M., Bassani, L., et al. 2014, *ApJ*, 782, L25
- Malzac, J., Beloborodov, A. M., & Poutanen, J. 2001, in *American Institute of Physics Conference Series*, Vol. 587, Gamma 2001: Gamma-Ray Astrophysics, ed. S. Ritz, N. Gehrels, & C. R. Shrader, 111–115
- Marchese, E., Braito, V., Della Ceca, R., Caccianiga, A., & Severgnini, P. 2012, *MNRAS*, 421, 1803
- Marinucci, A., Matt, G., Kara, E., et al. 2014a, *MNRAS*, 440, 2347
- Marinucci, A., Matt, G., Miniutti, G., et al. 2014b, *ApJ*, 787, 83
- Markowitz, A. G., Krumpe, M., & Nikutta, R. 2014, *MNRAS*, 439, 1403
- Mason, K. O., Breeveld, A., Much, R., et al. 2001, *A&A*, 365, L36
- Mathur, S. 1994, *ApJ*, 431, L75

- Mathur, S., Wilkes, B., Elvis, M., & Fiore, F. 1994, *ApJ*, 434, 493
- Matt, G., Guainazzi, M., & Maiolino, R. 2003, *MNRAS*, 342, 422
- Matt, G., Perola, G. C., & Piro, L. 1991, *A&A*, 247, 25
- Mauch, T., Murphy, T., Buttery, H. J., et al. 2003, *MNRAS*, 342, 1117
- McHardy, I. M., Koerding, E., Knigge, C., Uttley, P., & Fender, R. P. 2006, *Nature*, 444, 730
- McKernan, B., Yaqoob, T., & Reynolds, C. S. 2007, *MNRAS*, 379, 1359
- McNamara, B. R. & Nulsen, P. E. J. 2012, *New Journal of Physics*, 14, 055023
- Mehdipour, M., Branduardi-Raymont, G., Kaastra, J. S., et al. 2011, *A&A*, 534, A39
- Mehdipour, M., Kaastra, J. S., Kriss, G. A., et al. 2015, *ArXiv e-prints*
- Merritt, D. & Ferrarese, L. 2001, *ApJ*, 547, 140
- Middleton, M., Done, C., & Gierliński, M. 2007, *MNRAS*, 381, 1426
- Miller, C. J., Nichol, R. C., Gómez, P. L., Hopkins, A. M., & Bernardi, M. 2003, *ApJ*, 597, 142
- Miller, J. M. 2007, *ARA&A*, 45, 441
- Miller, L., Turner, T. J., & Reeves, J. N. 2008, *A&A*, 483, 437
- Miniutti, G. & Fabian, A. C. 2004, *MNRAS*, 349, 1435
- Miniutti, G., Sanfrutos, M., Beuchert, T., et al. 2014, *MNRAS*, 437, 1776
- Moe, M., Arav, N., Bautista, M. A., & Korista, K. T. 2009, *ApJ*, 706, 525
- Molina, M., Venturi, T., Malizia, A., et al. 2015, *MNRAS*, 451, 2370
- Morgan, C. W., Kochanek, C. S., Dai, X., Morgan, N. D., & Falco, E. E. 2008, *ApJ*, 689, 755
- Morganti, R. 2015, in *IAU Symposium*, Vol. 313, *IAU Symposium*, ed. F. Massaro, C. C. Cheung, E. Lopez, & A. Siemiginowska, 283–288
- Morganti, R., Fogasy, J., Paragi, Z., Oosterloo, T., & Orienti, M. 2013, *Science*, 341, 1082
- Murphy, K. D. & Yaqoob, T. 2009, *MNRAS*, 397, 1549
- Nandra, K., Fabian, A. C., George, I. M., et al. 1993, *MNRAS*, 260, 504
- Nandra, K., O'Neill, P. M., George, I. M., & Reeves, J. N. 2007, *MNRAS*, 382, 194
- Nardini, E., Reeves, J. N., Gofford, J., et al. 2015, *Science*, 347, 860
- Nenkova, M., Ivezić, Ž., & Elitzur, M. 2002, *ApJ*, 570, L9
- Nenkova, M., Sirocky, M. M., Nikutta, R., Ivezić, v., & Elitzur, M. 2008, *ApJ*, 685, 160
- Netzer, H. 1990, in *Active Galactic Nuclei*, ed. R. D. Blandford, H. Netzer, L. Woltjer, T. J.-L. Courvoisier, & M. Mayor, 57–160
- Netzer, H. 2004, *ApJ*, 604, 551
- Netzer, H. 2008, *New A Rev.*, 52, 257
- Netzer, H. 2015, *ARA&A*, 53, 365
- Netzer, H., Kaspi, S., Behar, E., et al. 2003, *ApJ*, 599, 933
- Noda, H., Makishima, K., Nakazawa, K., et al. 2013, *PASJ*, 65
- Noda, H., Makishima, K., Yamada, S., et al. 2011, *PASJ*, 63, S925
- Novikov, I. D. & Thorne, K. S. 1973, in *Black Holes (Les Astres Occlus)*, ed. C. Dewitt & B. S. Dewitt, 343–450
- Nucita, A. A., Guainazzi, M., Longinotti, A. L., et al. 2010, *A&A*, 515, A47

- O'Neill, P. M., Nandra, K., Papadakis, I. E., & Turner, T. J. 2005, MNRAS, 358, 1405
- Osterbrock, D. E. 1989, *Astrophysics of Gaseous Nebulae and Active Galactic Nuclei*, University Science Books, Mill Valley
- Page, K. L., Pounds, K. A., Reeves, J. N., & O'Brien, P. T. 2002, MNRAS, 330, L1
- Page, M. J., Symeonidis, M., Vieira, J. D., et al. 2012, Nature, 485, 213
- Pal, M. & Dewangan, G. C. 2013, MNRAS, 435, 1287
- Pancoast, A., Brewer, B. J., Treu, T., et al. 2014, MNRAS, 445, 3073
- Panessa, F., Bassani, L., Bazzano, A., et al. 2014, in *Proceedings of the 12th European VLBI Network Symposium and Users Meeting (EVN 2014)*. 7-10 October 2014. Cagliari, Italy., 4
- Panessa, F., Bassani, L., de Rosa, A., et al. 2008, A&A, 483, 151
- Pearson, T. J., Blundell, K. M., Riley, J. M., & Warner, P. J. 1992, MNRAS, 259, 13P
- Perola, G. C., Matt, G., Cappi, M., et al. 2002, A&A, 389, 802
- Peterson, B. M. 1997, *An Introduction to Active Galactic Nuclei*
- Peterson, B. M., Ferrarese, L., Gilbert, K. M., et al. 2004, ApJ, 613, 682
- Peterson, B. M. & Horne, K. 2004, Astronomische Nachrichten, 325, 248
- Peterson, B. M. & Wandel, A. 1999, ApJ, 521, L95
- Petrucci, P.-O., Paltani, S., Malzac, J., et al. 2013, A&A, 549, A73
- Piconcelli, E., Bianchi, S., Guainazzi, M., Fiore, F., & Chiaberge, M. 2007, A&A, 466, 855
- Piconcelli, E., Jimenez-Bailón, E., Guainazzi, M., et al. 2005, A&A, 432, 15
- Pinto, C., Kriss, G. A., Kaastra, J. S., et al. 2012, A&A, 541, A147
- Piro, L., Matt, G., & Ricci, R. 1997, A&AS, 126, 525
- Pogge, R. W. 1988, ApJ, 332, 702
- Ponti, G., Miniutti, G., Cappi, M., et al. 2006, MNRAS, 368, 903
- Ponti, G., Papadakis, I., Bianchi, S., et al. 2012, A&A, 542, A83
- Porquet, D. & Dubau, J. 2000, A&AS, 143, 495
- Pounds, K. A., Reeves, J. N., Page, K. L., & O'Brien, P. T. 2004a, ApJ, 605, 670
- Pounds, K. A., Reeves, J. N., Page, K. L., & O'Brien, P. T. 2004b, ApJ, 616, 696
- Pozo Nuñez, F., Haas, M., Chini, R., et al. 2014, A&A, 561, L8
- Predehl, P. & Schmitt, J. H. M. M. 1995, A&A, 293, 889
- Proga, D. 2007, in *Astronomical Society of the Pacific Conference Series*, Vol. 373, *The Central Engine of Active Galactic Nuclei*, ed. L. C. Ho & J.-W. Wang, 267
- Proga, D., Stone, J. M., & Kallman, T. R. 2000, ApJ, 543, 686
- Protassov, R., van Dyk, D. A., Connors, A., Kashyap, V. L., & Siemiginowska, A. 2002, ApJ, 571, 545
- Puccetti, S., Fiore, F., Risaliti, G., et al. 2007, MNRAS, 377, 607
- Raban, D., Jaffe, W., Röttgering, H., Meisenheimer, K., & Tristram, K. R. W. 2009, MNRAS, 394, 1325
- Reeves, J. N., Gofford, J., Braito, V., & Sambruna, R. 2010, ApJ, 725, 803
- Reeves, J. N., Sambruna, R. M., Braito, V., & Eracleous, M. 2009, ApJ, 702, L187
- Reeves, J. N. & Turner, M. J. L. 2000, MNRAS, 316, 234
- Reis, R. C. & Miller, J. M. 2013, ApJ, 769, L7

- Reynolds, C. S. & Nowak, M. A. 2003, Phys. Rep., 377, 389
- Riley, J. M. & Warner, P. J. 1990, MNRAS, 246, 1P
- Riley, J. M., Warner, P. J., Rawlings, S., et al. 1989, MNRAS, 236, 13P
- Risaliti, G., Elvis, M., Bianchi, S., & Matt, G. 2010, MNRAS, 406, L20
- Risaliti, G., Elvis, M., Fabbiano, G., Baldi, A., & Zezas, A. 2005, ApJ, 623, L93
- Risaliti, G., Elvis, M., Fabbiano, G., et al. 2007, ApJ, 659, L111
- Risaliti, G., Harrison, F. A., Madsen, K. K., et al. 2013, Nature, 494, 449
- Risaliti, G., Nardini, E., Salvati, M., et al. 2011, MNRAS, 410, 1027
- Risaliti, G., Salvati, M., Elvis, M., et al. 2009, MNRAS, 393, L1
- Rivers, E., Markowitz, A., Duro, R., & Rothschild, R. 2012, ApJ, 759, 63
- Robinson, A., Corbett, E. A., Axon, D. J., & Young, S. 1999, MNRAS, 305, 97
- Roming, P. W. A., Kennedy, T. E., Mason, K. O., et al. 2005, Space Sci. Rev., 120, 95
- Ross, R. R. & Fabian, A. C. 2005, MNRAS, 358, 211
- Rupke, D. S. N. & Veilleux, S. 2013, ApJ, 768, 75
- Sambruna, R. M., Eracleous, M., & Mushotzky, R. F. 1999, ApJ, 526, 60
- Sanfrutos, M., Miniutti, G., Agís-González, B., et al. 2013, MNRAS
- Scannapieco, E. & Oh, S. P. 2004, ApJ, 608, 62
- Schlafly, E. F. & Finkbeiner, D. P. 2011, ApJ, 737, 103
- Scott, J., Kriss, G., Brotherton, M., et al. 2004, in Astronomical Society of the Pacific Conference Series, Vol. 311, AGN Physics with the Sloan Digital Sky Survey, ed. G. T. Richards & P. B. Hall, 31
- Scott, J. E., Kriss, G. A., Lee, J. C., et al. 2005, ApJ, 634, 193
- Shakura, N. I. 1973, Soviet Ast., 16, 756
- Shih, D. C., Iwasawa, K., & Fabian, A. C. 2002, MNRAS, 333, 687
- Sijacki, D., Springel, V., Di Matteo, T., & Hernquist, L. 2007, MNRAS, 380, 877
- Singh, K. P., Garmire, G. P., & Nousek, J. 1985, ApJ, 297, 633
- Sobolewska, M. A., Siemiginowska, A., & Źycki, P. T. 2004, ApJ, 608, 80
- Somerville, R. S., Hopkins, P. F., Cox, T. J., Robertson, B. E., & Hernquist, L. 2008, MNRAS, 391, 481
- Steenbrugge, K. C., Fenovčík, M., Kaastra, J. S., Costantini, E., & Verbunt, F. 2009, A&A, 496, 107
- Steenbrugge, K. C., Kaastra, J. S., Crenshaw, D. M., et al. 2005, A&A, 434, 569
- Steenbrugge, K. C., Kaastra, J. S., de Vries, C. P., & Edelson, R. 2003, A&A, 402, 477
- Strüder, L., Briel, U., Dennerl, K., et al. 2001, A&A, 365, L18
- Sturm, E., González-Alfonso, E., Veilleux, S., et al. 2011, ApJ, 733, L16
- Suganuma, M., Yoshii, Y., Kobayashi, Y., et al. 2006, ApJ, 639, 46
- Sulentic, J. W., Marziani, P., & Dultzin-Hacyan, D. 2000, ARA&A, 38, 521
- Tanaka, Y., Nandra, K., Fabian, A. C., et al. 1995, Nature, 375, 659
- Tarter, C. B., Tucker, W. H., & Salpeter, E. E. 1969, ApJ, 156, 943
- Titarchuk, L. 1994, ApJ, 434, 570
- Tombesi, F., Cappi, M., Reeves, J. N., & Braito, V. 2012, MNRAS, 422, 1

- Tombesi, F., Cappi, M., Reeves, J. N., et al. 2011, *ApJ*, 742, 44
- Tombesi, F., Cappi, M., Reeves, J. N., et al. 2010, *A&A*, 521, A57
- Tombesi, F., Meléndez, M., Veilleux, S., et al. 2015, *Nature*, 519, 436
- Tombesi, F., Tazaki, F., Mushotzky, R. F., et al. 2014, *MNRAS*, 443, 2154
- Toomre, A. 1964, *ApJ*, 139, 1217
- Torresi, E., Grandi, P., Costantini, E., & Palumbo, G. G. C. 2012, *MNRAS*, 419, 321
- Torresi, E., Grandi, P., Longinotti, A. L., et al. 2010, *MNRAS*, 401, L10
- Tristram, K. R. W., Burtscher, L., Jaffe, W., et al. 2014, *A&A*, 563, A82
- Turner, M. J. L., Abbey, A., Arnaud, M., et al. 2001, *A&A*, 365, L27
- Turner, T. J., Miller, L., Kraemer, S. B., Reeves, J. N., & Pounds, K. A. 2009, *ApJ*, 698, 99
- Urry, C. M. & Padovani, P. 1995, *PASP*, 107, 803
- Ursini, F., Boissay, R., Petrucci, P.-O., et al. 2015, *A&A*, 577, A38
- Véron-Cetty, M.-P. & Véron, P. 2006, *A&A*, 455, 773
- Wagner, A. Y. & Bicknell, G. V. 2011, *ApJ*, 728, 29
- Wagner, A. Y., Bicknell, G. V., & Umemura, M. 2012, *ApJ*, 757, 136
- Wakker, B. P., Lockman, F. J., & Brown, J. M. 2011, *ApJ*, 728, 159
- Wakker, B. P. & Savage, B. D. 2009, *ApJS*, 182, 378
- Walton, D. J., Reis, R. C., & Fabian, A. C. 2010, *MNRAS*, 408, 601
- Walton, D. J., Risaliti, G., Harrison, F. A., et al. 2014, *ApJ*, 788, 76
- Wandel, A. 2002, *ApJ*, 565, 762
- Weigelt, G., Hofmann, K.-H., Kishimoto, M., et al. 2012, *A&A*, 541, L9
- Weymann, R. J., Morris, S. L., Foltz, C. B., & Hewett, P. C. 1991, *ApJ*, 373, 23
- Whewell, M., Branduardi-Raymont, G., Kaastra, J. S., et al. 2015, *A&A*, 581, A79
- Wilkins, D. R. & Fabian, A. C. 2013, *MNRAS*, 430, 247
- Wilkins, D. R. & Gallo, L. C. 2015, *MNRAS*, 449, 129
- Willingale, R., Starling, R. L. C., Beardmore, A. P., Tanvir, N. R., & O'Brien, P. T. 2013, *MNRAS*, 431, 394
- Wilson, A. S., Shopbell, P. L., Simpson, C., et al. 2000, *AJ*, 120, 1325
- Winter, L. M., Lewis, K. T., Koss, M., et al. 2010, *ApJ*, 710, 503
- Winter, L. M., Veilleux, S., McKernan, B., & Kallman, T. R. 2012, *ApJ*, 745, 107
- Yao, Y. & Wang, Q. D. 2005, *ApJ*, 624, 751
- Yaqoob, T. & Murphy, K. D. 2011, *MNRAS*, 412, 277
- Yaqoob, T. & Padmanabhan, U. 2004, *ApJ*, 604, 63
- Yuan, Q., Green, R. F., Brotherton, M., et al. 2002, *ApJ*, 575, 687
- Zycki, P. T. & Czerny, B. 1994, *MNRAS*, 266, 653

