Australian Astronomy Publication and Facilities Survey

Prepared by Decadal Plan Working Group 3.1

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Methodology

We have undertaken a survey of Australian Astronomers. Astronomers were contacted via the Astronomical Society of Australia email list and asked to fill out a form, ascribing percentages of their papers to various facilities, or to theory. For our analysis we used the Astrophysical Data Service (ADS) database, including publications that were labeled as astronomy papers, and which were published between 1996-2004. Astronomers were asked to exclude papers which were not undertaken while resident in Australia, and those papers which were not theirs (same name). Citations were taken from all sources, as listed by ADS, to the date of 28 April 2005.

This survey does not accurately measure the impact of Australian Astronomy relative to international benchmarks because it is incomplete. However, it is useful in assessing the relative impact of Australian facilities on our publications, because it does sample a significant fraction of Australian astronomical papers over the period. In total, a 130 astronomers participated in the survey, entering information for 2063 distinct papers. It is also apparent that some fields, such as Gravity wave astronomy, publications are largely contained in physics journals, and are not covered by the ADS astronomy database.

In our analysis, we were able to analyse only those publications which people had assigned at least one facility to. If they left the facility as, “not completed”, then the publication was ignored.

In all cases, if more than one astronomer provided a percentage to a publication, we averaged their results, by summing each astronomers results, dividing by the number of responses.

There are different ways (and philosophies) to judge the importance of facilities, and we break these down into 7 separate cases. Although we prefer two of the methods over the others.

Case 1: Measure the total number of publications that are attributable to each facility, weighted by the percentage that each astronomer ascribed to each publication. This provides an estimate of the total number of papers being driven by each facility, independent of quality, and independent of the fraction of Australian authors on the paper (as long as it is not 0!). It is a measure of the relative usage of each facility in producing scientific works.

Case 2: Same as Case 1, but normalized by the fraction of Australian authors on the paper. In this case, if a paper has 20 authors, 3 of which are Australian, the paper is de-

weighted by 3/20, relative to a paper which has only Australian Authors. Australian Authors are defined, in this case, as people who have filled out the survey – not by their affiliation as listed on the paper. While this would be a bad thing to do in measuring absolute impact, because we are measuring relative impact, it should not affect results significantly.

Case 3: Same as Case 1, but normalized by the total number of citations the paper has received. Each paper with an Australian author is treated equally – a paper with 1 out of 20 Australian authors is not de-weighted with respect to a paper which is solely Australian. This is the simplest way of measuring the sum of quantity times quality of a paper.

Case 4: Same as Case 3, but normalized by the average number of citations that papers from around the world have received in that year. Since we are dealing with publications from 1996 (average # of citations 16.7) to 2004 (average # if citations 2.5), papers in 1996 are given 7 times more weight than the youngest papers, and this method removes this bias.

Case 5: Same as Case 3, but normalized by the fraction of Australian authors. This is a citation weighted, Australian fraction weighted quality index, which ignores the bias of younger versus older papers.

Case 6: Same as Case 5, but now weights, as in Case 4, by the average number of citations in a papers year.

Case 7: The average citations for a paper relative to the mean number of citations for the year for each facility. Facilities whose papers were cited at the yearly mean would have a value of 1. The average is weighted by the fraction that each paper is ascribed to each facility. This is a pure quality measure, but has strong biases in this context. Overseas facilities often have higher quality measures because only an elite few proposals are able to get time. We have included, for reference, the fraction of Australian paper output (case 1) that each facility contributes. We will not discuss this quality measure further because we believe it of little use for the decadal plan.

Finally, for each case (except case 7), we have grouped the data into the broad facility areas Theory, Radio/mm/submm, UV-Optical-IR, X-ray-Gamma Ray, Airshower, and Gravity Wave.

Analysis

The choice of the method of analysis does not change the broad conclusions reached by the Survey. It is only if one tries to play league tables between facilities – which this survey is not complete enough to do except in a very rough sense – that one would get different answers between which method is chosen for the analysis. See attached spreadsheet for full rundown and a list of participants in the survey.

Total Impact of Facilities based on Number of Publications:

This idea is encapsulated in case 1 and 2. We believe that the impact to Australian Astronomy is best measured by case 2, which weights large international collaborations by the number of Australian participants. Whether you like case 1 or 2, we see that the

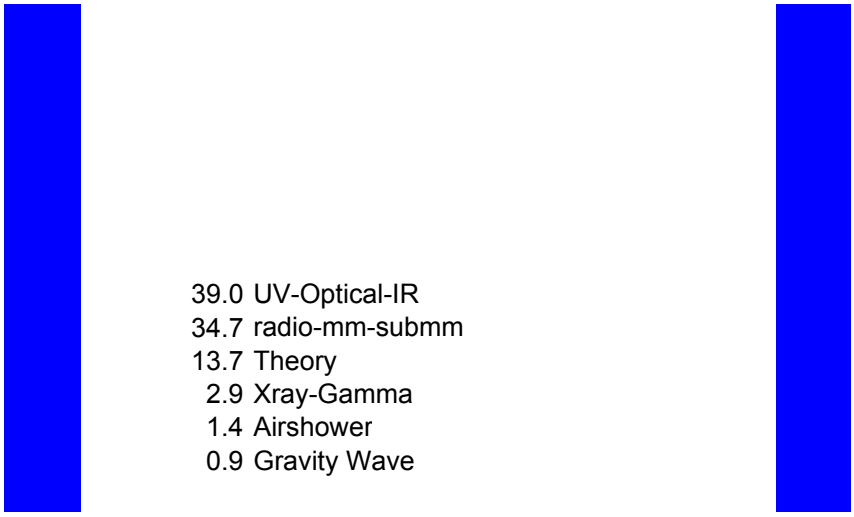
numbers of Australian astronomy publications are dominated by research which uses the two ATNF radio facilities, The AAT, ANU Optical Facilities, and Theory. If we look across broad facility areas, Australian publications are more than 70% made up of facilities covering from the UV through to the Radio, with an approximately even split between the radio and optical regimes. There are significant number of theory papers, and smaller numbers of papers in the High-Energy areas of airshower astronomy, X-ray/Gamma Ray Astronomy, and Gravity Wave Astronomy.

Total Impact of Facilities based on Citations Rates:

This idea is encapsulated in cases 3-6. We believe that the impact to Australian Astronomy is best measured by case 6, which tries to take into account the age of the paper, and weights papers by the fraction of Australian contributors. Once again, The broadbrush details are the same, regardless of the method. Facilities run by the AAT ATNF are the most influential, with important contributions by the ANU optical facilities, and theory. International facilities which Australia does not make a financial contribution towards are also well represented, with HST heading the list, but also other large optical facilities, the VLA, and space-based telescopes such as Chandra.

If we look across broad facility areas, Australian citations are once again dominated by the Optical through Radio faciltities, with an UV/Optical/IR facilities producing nearly ½ of all of Australia's citations, and Radio/mm/sub-mm more than a quarter. There are significant impacts in theory, as well non-negligible impact in areas of airshower astronomy, X-ray/Gamma Ray Astronomy, and Gravity Wave Astronomy.

Case 1		Case 2	
12.0	ATNF ATCA	14.3	ATNF ATCA
10.8	Australian ANU Optical	11.7	ATNF Parkes
10.4	ATNF Parkes	9.9	Theory Analytic
9.8	AAO AAT	9.4	Australian ANU Optical
6.0	Theory Analytic	9.2	AAO AAT
5.7	Space HST	3.8	Other
3.6	International OIR ESO	3.6	Space HST
3.6	Other	3.1	AAT UKSchmidt
3.3	International OIR Other	3.0	International OIR ESO
2.6	AAT UKSchmidt	2.5	Australian Swinburne Computational
2.0	International Radio VLA	2.5	International OIR Other
1.8	International OIR NOAO (KPNO+CTIO)	2.0	Australian UNSW Antarctic
1.7	International OIR La_Palma	1.8	Australian University Other
1.6	ATNF VLBI	1.7	Australian USyd MOST
1.5	Australian Swinburne Computational	1.7	International Radio VLA
1.4	Australian USyd MOST	1.3	Space X-ray other
1.2	Space X-ray other	1.2	International OIR NOAO (KPNO+CTIO)
1.2	International OIR KECK	1.1	International OIR La_Palma
1.2	International Radio-mm-submm Other	1.1	ATNF VLBI
1.1	Australian UNSW Antarctic	0.9	International Radio-mm-submm Other
1.1	Australian University Other	0.9	Australian UWA Gravitational
1.0	Space Chandra	0.8	ATNF Mopra
0.8	Space ROSAT	0.8	International OIR US Optical Other
0.8	International OIR US Optical Other	0.7	Australian VPAC
0.8	Australian UWA Gravitational	0.7	International OIR KECK
0.8	International OIR UKIRT	0.7	Space ROSAT
0.7	ATNF Mopra	0.7	International High Performance Computing
0.6	International Cosmic Ray HiRes	0.7	International Cosmic Ray Pierre Auget
0.6	Space Gamma Rays	0.6	International OIR UKIRT
0.6	International Radio European mm-submm	0.6	International Radio European mm-submm
0.6	International Radio U.S. mm-submm	0.6	Australian APAC
0.5	Australian Perth Observatory	0.6	Australian Perth Observatory
0.5	Space Optical-UV-IR Other	0.5	Space Chandra
0.5	International Cosmic Ray Pierre Auget	0.5	Space Other
0.5	Space Other	0.5	Australian Adelaide Cosmic Ray
0.4	Australian Adelaide Cosmic Ray	0.4	Space Optical-UV-IR Other
0.4	International Radio Jodrell Bank	0.3	Australian UTas Radio
0.4	Australian APAC	0.3	International Radio Jodrell Bank
0.4	Space VSOP	0.3	International Radio U.S. mm-submm
0.4	Australian UNSW APT/ROTSE	0.3	Australian Gemini
0.4	International Radio VLBA	0.2	Australian UNSW APT/ROTSE
0.4	Australian VPAC	0.2	Space Gamma Rays
0.4	International OIR Subaru	0.2	International Radio Westerbork
0.4	International OIR Palomar	0.2	International OIR Subaru
0.3	International High Performance Computing	0.2	International Radio VLBA
0.3	International OIR CFHT	0.2	International OIR Europe Optical Other
0.3	Australian Adelaide Airshower	0.2	International Radio Bonn
0.3	Australian Gemini	0.2	International Radio JCMT
0.3	International Radio JCMT	0.2	Australian UTas Optical
0.3	Australian UTas Radio	0.2	International OIR Palomar
0.2	International Radio Bonn	0.1	Space VSOP
0.2	Australian UTas Optical	0.1	Space XMM-Newton
0.2	International OIR Europe Optical Other	0.1	Australian UNSW Mopra
0.2	International Radio Westerbork	0.1	International OIR MMT
0.2	Space XMM-Newton	0.1	International Radio GBT
0.1	International Gravity Other	0.1	International OIR CFHT
0.1	International Radio GBT	0.1	International Cosmic Ray HiRes

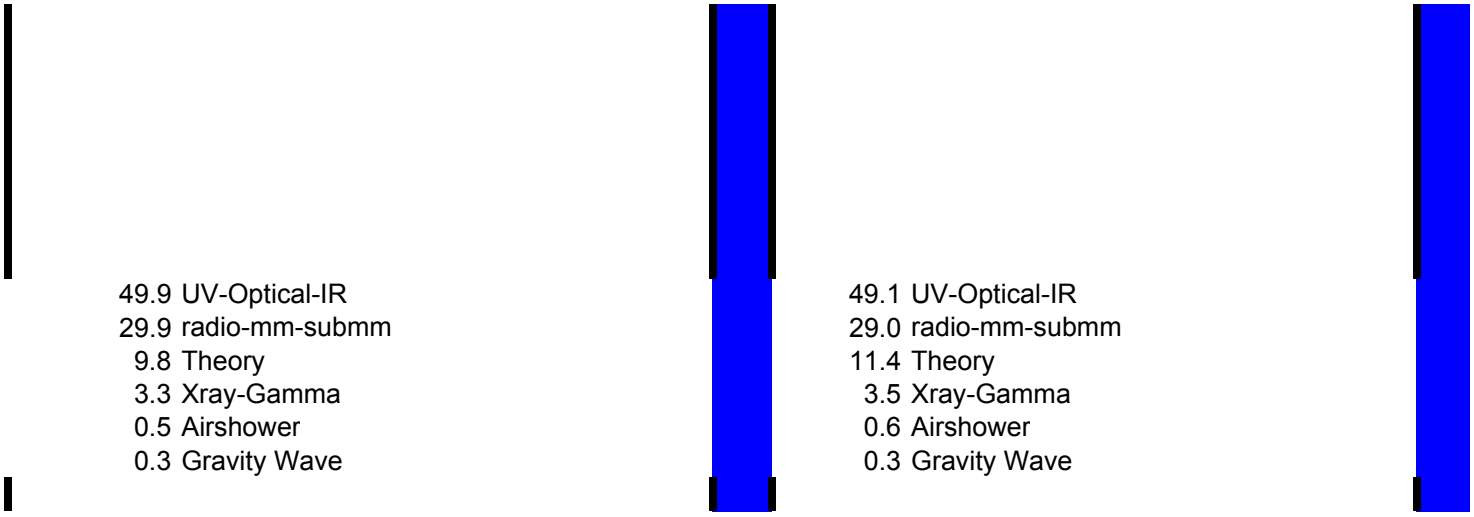

0.1 Australian UNSW Mopra
0.1 Space FUSE
0.1 International OIR MMT
0.1 Australian National Facility Other
0.1 International Radio GMRT
46.2 UV-Optical-IR
32.9 radio-mm-submm
8.3 Theory
3.7 Xray-Gamma
1.9 Airshower
0.9 Gravity Wave
39.0 UV-Optical-IR
34.7 radio-mm-submm
13.7 Theory
2.9 Xray-Gamma
1.4 Airshower
0.9 Gravity Wave

Case 3		Case 4	
14.0	AAO AAT	15.1	AAO AAT
10.8	Space HST	9.4	Australian ANU Optical
10.5	Australian ANU Optical	9.2	Space HST
7.7	ATNF Parkes	8.3	ATNF Parkes
7.4	ATNF ATCA	6.8	ATNF ATCA
6.3	International OIR NOAO (KPNO+CTIO)	5.0	International OIR NOAO (KPNO+CTIO)
5.1	International OIR KECK	4.8	International OIR KECK
4.5	Theory Analytic	4.6	Theory Analytic
3.9	Other	3.7	Other
3.3	International OIR ESO	3.4	International OIR ESO
2.4	International OIR Other	2.9	International OIR Other
2.2	Space Gamma Rays	2.5	International OIR La_Palma
2.1	International OIR La_Palma	2.3	Space Chandra
1.9	International OIR CFHT	2.1	International OIR CFHT
1.9	Space Chandra	2.0	International Radio VLA
1.8	AAT UKSchmidt	1.8	AAT UKSchmidt
1.6	International Radio VLA	1.6	Space Gamma Rays
0.9	Australian USyd MOST	0.9	International OIR Palomar
0.9	ATNF VLBI	0.8	Space X-ray other
0.9	International OIR Palomar	0.8	International OIR US Optical Other
0.8	International OIR US Optical Other	0.8	ATNF VLBI
0.8	Australian University Other	0.8	Australian Swinburne Computational
0.7	Space ROSAT	0.8	Australian USyd MOST
0.7	Space X-ray other	0.7	International OIR Subaru
0.6	International OIR UKIRT	0.6	Space ROSAT
0.4	International Radio U.S. mm-submm	0.6	Australian University Other
0.4	International Radio-mm-submm Other	0.5	International OIR UKIRT
0.4	International OIR Subaru	0.5	Space Other
0.4	Australian UNSW Antarctic	0.5	International Radio U.S. mm-submm
0.4	Space Other	0.5	International Cosmic Ray HiRes
0.3	Space VSOP	0.5	Australian UNSW Antarctic
0.3	International Radio European mm-submm	0.4	International Radio-mm-submm Other
0.3	Australian Swinburne Computational	0.3	Australian APAC
0.3	International Cosmic Ray HiRes	0.3	International Radio Jodrell Bank
0.3	International OIR Europe Optical Other	0.3	International Radio European mm-submm
0.2	International Radio Jodrell Bank	0.3	International Radio JCMT
0.2	International Radio JCMT	0.3	Australian Gemini
0.2	Space Optical-UV-IR Other	0.3	International High Performance Computing
0.2	Australian APAC	0.3	Australian VPAC
0.2	Australian UWA Gravitational	0.3	Australian Adelaide Airshower
0.2	Australian UTas Radio	0.3	International OIR Europe Optical Other
0.2	International Radio Bonn	0.2	Australian UWA Gravitational
0.1	Space XMM-Newton	0.2	Space VSOP
0.1	Australian Perth Observatory	0.2	International Radio Bonn
0.1	Australian Adelaide Cosmic Ray	0.2	Space Optical-UV-IR Other
0.1	Australian Adelaide Airshower	0.2	International Radio GBT
0.1	Australian Gemini	0.1	International Radio VLBA
0.1	Australian UNSW APT/ROTSE	0.1	Australian National Facility Other
0.1	International Radio VLBA	0.1	Space XMM-Newton
0.1	International High Performance Computing	0.1	Australian Adelaide Cosmic Ray
0.1	ATNF Mopra	0.1	International Cosmic Ray Pierre Auget
0.1	International Radio GBT	0.1	International Gravity Other
0.1	Australian VPAC	0.1	ATNF Mopra
0.1	International Cosmic Ray Pierre Auget	0.1	Australian UNSW APT/ROTSE
0.1	International Gravity Other	0.1	Australian UTas Radio
0.1	International Radio Westerbork	0.1	Australian Perth Observatory
		0.1	International Radio Westerbork

62.1 UV-Optical-IR
21.0 radio-mm-submm
5.5 Xray-Gamma
5.1 Theory
0.6 Airshower
0.3 Gravity Wave

60.7 UV-Optical-IR
21.4 radio-mm-submm
6.1 Theory
5.3 Xray-Gamma
1.1 Airshower
0.3 Gravity Wave

Case 5		Case 6	
13.0	AAO AAT	13.0	AAO AAT
12.5	ATNF ATCA	11.2	ATNF ATCA
10.8	Australian ANU Optical	11.0	ATNF Parkes
10.7	ATNF Parkes	9.7	Australian ANU Optical
8.2	Theory Analytic	7.8	Theory Analytic
6.5	Space HST	5.6	Space HST
3.5	International OIR ESO	3.5	International OIR ESO
3.2	International OIR NOAO (KPNO+CTIO)	3.0	International OIR NOAO (KPNO+CTIO)
2.9	Other	2.8	Other
2.2	AAT UKSchmidt	2.5	International OIR KECK
2.2	International OIR KECK	2.5	International OIR Other
2.1	Australian University Other	2.1	Australian Swinburne Computational
2.0	International OIR Other	2.0	International OIR La_Palma
1.8	International OIR La_Palma	2.0	International Radio VLA
1.8	International Radio VLA	1.9	AAT UKSchmidt
1.6	Australian USyd MOST	1.5	Australian University Other
1.0	Space ROSAT	1.2	Space Chandra
1.0	Australian UNSW Antarctic	1.2	Australian USyd MOST
0.9	Space Chandra	1.1	Australian UNSW Antarctic
0.9	International OIR US Optical Other	1.0	International High Performance Computing
0.9	Australian Swinburne Computational	0.9	International OIR US Optical Other
0.9	Space X-ray other	0.9	Space X-ray other
0.7	Space Other	0.8	Space Other
0.7	ATNF VLBI	0.8	Australian APAC
0.6	International OIR Palomar	0.8	Space ROSAT
0.6	International OIR UKIRT	0.7	ATNF VLBI
0.6	Space Gamma Rays	0.7	Australian VPAC
0.5	International High Performance Computing	0.6	International OIR Europe Optical Other
0.5	International Radio-mm-submm Other	0.5	International OIR Palomar
0.5	International OIR Europe Optical Other	0.5	International OIR UKIRT
0.5	International OIR CFHT	0.5	International Radio-mm-submm Other
0.4	International Radio European mm-submm	0.5	International OIR CFHT
0.4	Australian VPAC	0.5	Space Gamma Rays
0.3	International Radio Jodrell Bank	0.3	International Radio U.S. mm-submm
0.3	International Radio JCMT	0.3	International Radio JCMT
0.3	International Radio U.S. mm-submm	0.3	International Radio Jodrell Bank
0.3	Australian UWA Gravitational	0.3	International Radio European mm-submm
0.3	Australian APAC	0.3	Space Optical-UV-IR Other
0.2	Space Optical-UV-IR Other	0.3	International OIR Subaru
0.2	ATNF Mopra	0.3	Australian UWA Gravitational
0.2	Australian UTas Radio	0.2	ATNF Mopra
0.2	International OIR Subaru	0.2	International Radio Westerbork
0.2	International Radio Bonn	0.2	International Cosmic Ray Pierre Auget
0.1	Space XMM-Newton	0.2	Australian Gemini
0.1	Australian UTas Optical	0.2	Australian Adelaide Cosmic Ray
0.1	Australian Adelaide Cosmic Ray	0.2	International Radio Bonn
0.1	Australian Gemini	0.1	Australian UNSW APT/ROTSE
0.1	Australian UNSW APT/ROTSE	0.1	International Radio GBT
0.1	International Cosmic Ray Pierre Auget	0.1	Space XMM-Newton
0.1	International Radio Westerbork	0.1	International Radio VLBA
0.1	International Radio GBT	0.1	International Cosmic Ray HiRes
0.1	Australian Perth Observatory	0.1	Australian Perth Observatory
0.1	International Cosmic Ray AGASA	0.1	Australian UTas Radio
0.1	International Cosmic Ray HiRes	0.1	Australian UTas Optical


49.9 UV-Optical-IR
29.9 radio-mm-submm
9.8 Theory
3.3 Xray-Gamma
0.5 Airshower
0.3 Gravity Wave
49.1 UV-Optical-IR
29.0 radio-mm-submm
11.4 Theory
3.5 Xray-Gamma
0.6 Airshower
0.3 Gravity Wave

Case 7

15.1 AAO AAT
9.4 Australian ANU Optical
9.2 Space HST
8.3 ATNF Parkes
6.8 ATNF ATCA
5.0 International OIR NOAO (KPNO+CTIO)
4.8 International OIR KECK
4.6 Theory Analytic
3.7 Other
3.4 International OIR ESO
2.9 International OIR Other
2.5 International OIR La_Palma
2.3 Space Chandra
2.1 International OIR CFHT
2.0 International Radio VLA
1.8 AAT UKSchmidt
1.6 Space Gamma Rays
0.9 International OIR Palomar
0.8 Space X-ray other
0.8 International OIR US Optical Other
0.8 ATNF VLBI
0.8 Australian Swinburne Computational
0.8 Australian USyd MOST
0.7 International OIR Subaru
0.6 Space ROSAT
0.6 Australian University Other
0.5 International OIR UKIRT
0.5 Space Other
0.5 International Radio U.S. mm-submm
0.5 International Cosmic Ray HiRes
0.5 Australian UNSW Antarctic
0.4 International Radio-mm-submm Other
0.3 Australian APAC
0.3 International Radio Jodrell Bank
0.3 International Radio European mm-submm
0.3 International Radio JCMT
0.3 Australian Gemini
0.3 International High Performance Computing
0.3 Australian VPAC
0.3 Australian Adelaide Airshower
0.3 International OIR Europe Optical Other
0.2 Australian UWA Gravitational
0.2 Space VSOP
0.2 International Radio Bonn
0.2 Space Optical-UV-IR Other
0.2 International Radio GBT
0.1 International Radio VLBA
0.1 Australian National Facility Other
0.1 Space XMM-Newton
0.1 Australian Adelaide Cosmic Ray
0.1 International Cosmic Ray Pierre Auget
0.1 International Gravity Other
0.1 ATNF Mopra
0.1 Australian UNSW APT/ROTSE
0.1 Australian UTas Radio
0.1 Australian Perth Observatory
0.1 International Radio Westerbork

60.7 UV-Optical-IR
21.4 radio-mm-submm
6.1 Theory
5.3 Xray-Gamma
1.1 Airshower
0.3 Gravity Wave

Appendix 1: List of Top 1% Papers with Australian Authors

We have identified the top Australian papers, 1996-2004, by listing all papers that have citations equal to or more than 99% of the papers in their year. These identifications are necessarily a little uncertain for the 2003-4 papers, due to the short time after publications. This is not a complete list, it only represents those papers included in the survey.

1. 1996 Colless, Matthew; Dunn, Andrew M.; Structure and Dynamics of the Coma Cluster 1996ApJ...458..435C
2. 1996 Ellis, Richard S.; Colless, Matthew;Broadhurst, Tom;Heyl, Jeremy;Glazebrook, Karl ; Autofib Redshift Survey - I. Evolution of the galaxy luminosity function 1996MNRAS.280..235E
3. 1996 Kneib, J.-P.; Ellis, R. S.;Smail, I.;Couch, W. J.;Sharples, R. M.; Hubble Space Telescope Observations of the Lensing Cluster Abell 2218 1996ApJ...471..643K
4. 1996 Ryan, Sean G.; Norris, John E.;Beers, Timothy C.; Extremely Metal-poor Stars. II. Elemental Abundances and the Early Chemical Enrichment of the Galaxy 1996ApJ...471..254R
5. 1997 Alcock, C.; Allsman, R. A.;Alves, D.;Axelrod, T. S.;Becker, A. C.;Bennett, D. P.;Cook, K. H.;Freeman, K. C.;Griest, K.;Guern, J.;Lehner, M. J.;Marshall, S. L.;Peterson, B. A.;Pratt, M. R.;Quinn, P. J.;Rodgers, A. W.;Stubbs, C. W.;Sutherland, W.;Welch, D. L.;The MACHO Collaboration; The MACHO Project Large Magellanic Cloud Microlensing Results from the First Two Years and the Nature of the Galactic Dark Halo 1997ApJ...486..697A
6. 1997 Alcock, C.; Allsman, R. A.;Alves, D.;Axelrod, T. S.;Bennett, D. P.;Cook, K. H.;Freeman, K. C.;Griest, K.;Guern, J.;Lehner, M. J.;Marshall, S. L.;Park, H.-S.;Perlmutter, S.;Peterson, B. A.;Pratt, M. R.;Quinn, P. J.;Rodgers, A. W.;Stubbs, C. W.;Sutherland, W.; The MACHO Project: 45 Candidate Microlensing Events from the First-Year Galactic Bulge Data 1997ApJ...479..119A
7. 1997 Donati, J.-F.; Semel, M.;Carter, B. D.;Rees, D. E.;Collier Cameron, A.; Spectropolarimetric observations of active stars 1997MNRAS.291..658D
8. 1997 Dressler, Alan; Oemler, Augustus, Jr.;Couch, Warrick J.;Smail, Ian;Ellis, Richard S.;Barger, Amy;Butcher, Harvey;Poggianti, Bianca M.;Sharples, Ray M.; Evolution since Z = 0.5 of the Morphology-Density Relation for Clusters of Galaxies 1997ApJ...490..577D
9. 1997 Ellis, Richard S.; Smail, Ian;Dressler, Alan;Couch, Warrick J.;Oemler, Augustus, Jr.;Butcher, Harvey;Sharples, Ray M.; The Homogeneity of Spheroidal Populations in Distant Clusters 1997ApJ...483..582E
10. 1997 Perlmutter, S.; Gabi, S.;Goldhaber, G.;Goobar, A.;Groom, D. E.;Hook, I. M.;Kim, A. G.;Kim, M. Y.;Lee, J. C.;Pain, R.;Pennypacker, C. R.;Small, I. A.;Ellis, R. S.;McMahon, R. G.;Boyle, B. J.;Bunclark, P. S.;Carter, D.;Irwin, M. J.;Glazebrook, K.;Newberg, H. J. M.;Filippenko, A. V.;Matheson, T.;Dopita, M.;Couch, W. J.;The Supernova Cosmology Project; Measurements of the Cosmological Parameters Omega and Lambda from the First Seven Supernovae at Z >= 0.35 1997ApJ...483..565P
11. 1997 Pettini, Max; Smith, Linda J.;King, David L.;Hunstead, Richard W.; The Metallicity of High-Redshift Galaxies: The Abundance of Zinc in 34 Damped Ly alpha Systems from z = 0.7 to 3.4 1997ApJ...486..665P
12. 1998 Couch, Warrick J.; Barger, Amy J.;Smail, Ian;Ellis, Richard S.;Sharples, Ray M. ; Morphological Studies of the Galaxy Populations in Distant ``Butcher-Oemler'' Clusters with the Hubble Space Telescope. II. AC 103, AC 118, and AC 114 at Z = 0.31 1998ApJ...497..188C
13. 1998 Galama, T. J.; Vreeswijk, P. M.;van Paradijs, J.;Kouveliotou, C.;Augusteijn, T.;Bohnhardt, H.;Brewer, J. P.;Doublier, V.;Gonzalez, J.-F.;Leibundgut, B.;Lidman, C.;Hainaut, O. R.;Patat, F.;Heise, J.;in 't Zand, J.;Hurley, K.;Groot, P. J.;Strom, R. G.;Mazzali, P. A.;Iwamoto, K.;Nomoto, K.;Umeda, H.;Nakamura, T.;Young, T. R.;Suzuki, T.;Shigeyama, T.;Koshut, T.;Kippen, M.;Robinson, C.;de Wildt, P.;Wijers, R. A. M.

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