"Current Comments"

Journal Citation Studies. XII.
Astrophysical Journal and its *Supplements*

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Recently we listed heavily cited geology and geophysics journals,[1] and then showed the citing/cited relationships of the most heavily cited of them, the *Journal of Geophysical Research.*[2]

In those studies, astronomy and astrophysics journals intruded upon any attempt to keep one's feet on the ground. In fact, of the geology, geophysics and astrophysics journals that rank among the 1000 most cited journals in science, we found that the journal with the greatest number of highly cited articles (70 or more times during the period 1961-73) was *Astrophysical Journal.* It ranked 179th in terms of total citations and 49th in terms of impact among all journals of science. It ranked fourth in terms of total citations among geology/geophysics/astrophysics journals, and fifth in terms of impact.

I must point out, before going further, that in this study the *Astrophysical Journal (AJ)* includes *Astrophysical Journal Supplements (AJS)* as well. There were two reasons for combining the titles. First, however issued, they form a single overall publication. Thus, from a subject viewpoint, there is justification for treating them as one. Second, citation practices in astrophysics leave something to be desired. By combining them we could more readily resolve the ambiguities resulting from these practices.

The journal title abbreviations used in astrophysics are dreadful. The field has adopted the bothersome practice common to Soviet journals--the use of acronyms or near-acronyms for journal titles. At ISI® we have had to learn to live with *ZHOKH*, long since no joke at all, and its many counterparts in the Soviet literature. *ZHOKH* means *Zhurnal Obshchei Khimii.*

The practice is unfortunately peculiarly widespread in astronomical and astrophysical journals in English. I hope that concerned readers will do what they can to stifle it. For example, we have *AJ, AFP, AA, BAN, ZAP, AJS, ASTRAP, MEMRAS*--all abbreviations of journal titles you will find in the lists in Figures 1a and 1b. The cost of any space saved by this sort of thing (and I doubt that any really is) is repaid untold times by the cost of confusion it produces in bibliography, data processing, and research references. It also bespeaks a provinciality that is incredible for people with a 'cosmic connection'. Do astrophysicists believe no one else ever uses their literature? Will the astrophysicist who wrote me about this very problem a few years ago please note. Over 125 different journals cited *Astrophysical Journal.* This indicates a much broader interest than the use of these in-group acronyms assumes.

In Figure 1a we list the journals that were cited by *Astrophysical Journal* and its *Supplements.* The thirty journals account for about 70% of the total citations by *AJ* and *AJS.* The self-citing rate is about 37%. In Figure 1b we list the journals that cited *AJ* and *AJS* most frequently. These thirty journals account for about 92% of citations made in reference to them. The self-cited rate is almost the same, 35%. This is by no means true for all journals.

Eighteen journals are common to the two lists. Excluding themselves, the third journal most frequently cited by *AJ* and *AJS* is *Nature.* Even more astonishing, of the journals that cite them most frequently, *Nature* is second, immediately after *Mon. Not. Roy. Astron. Soc. Science* also occurs on both lists, ranking 13th on the first and 25th on the second.

If, in Figure 1a, we had treated *Theses* as a journal, such a collection would have ranked at least 10th. Almost 200 citations to theses from seven universities turned up. More could have been identified. The frequency with which theses are cited by established journals is a phenomenon that needs further study. Boyer paid special attention to this problem in his own dissertation.[3,4]

Observe that *AJ* and *AJS* cited *Astron. Zh.* 160 times. However, it was cited by this Soviet journal 496 times. The *Proc. Acad. Sci. USSR (Doklady)* does not appear on either list. According to several astrophysicists this may reflect the fact that the Soviets

Figure 1a.
Journals Cited by *Astrophysical Journal* and its *Supplements*

RANK	Times Cited 1969**	Journal
1.	5912	*Astrophys. J.
2.	600	*Mon. Not. Roy. Astr. Soc.
3.	596	*Astron. J.
4.	576	*Nature
5.	340	Phys. Rev.
6.	300	*Phys. Rev. Lett.
7.	296	*Pub. Astr. Soc. Pacific
8.	284	Annu. Rev. Astron. Astrophys.
9.	192	*Astron. & Astrophys.
10.	160	*Astron. Zh. (Sov. Astron. AJ USSR)
11.	160	Bull. Astr. Inst. Netherlands
12.	144	*Canad. J. Phys.
13.	144	*Science
14.	120	*Astrophys. Lett.
15.	120	*J. Astrophys. Res.
16.	112	*Proc. Roy. Soc. A
17.	108	Ann. Astrophysique
18.	108	*Aust. J. Phys.
19.	88	Phys. Fluids
20.	76	*J. Chem. Phys.
21.	64	J. Physics
22.	64	Lowell Obs. Bull.
23.	60	*Proc. Nat. Acad. Sci. USA
24.	56	*Observatory
25.	56	Zschr. Astrophys.
26.	52	Ann. Physics
27.	52	Planet. Space Sci.
28.	52	Rev. Mod. Phys.
29.	48	J. Opt. Soc. Amer.
30.	48	*J. Quant. Spectrosc.
	5060	Other
	16048	Total

Figure 1b.
Journals that Cited *Astrophysical Journal* and its *Supplements*

RANK	Times Citing 1969**	Journal
1.	5912	*Astrophys. J.
2.	1444	*Mon. Not. Roy. Astr. Soc.
3.	684	*Nature
4.	676	Solar Phys.
5.	660	*Astron. & Astrophys.
6.	612	*Astron. J.
7.	588	*Proc. Roy. Soc. A.
8.	568	Space Sci. Rev.
9.	552	*Astrophys. Lett.
10.	532	J. Atmospheric Sci.
11.	496	*Astron. Zh. (Sov. Astron. AJ USSR)
12.	484	Astrophys. Space Sci.
13.	372	*Pub. Astr. Soc. Pacific
14.	244	Icarus
15.	240	Quart. J. Roy. Astr. Soc.
16.	184	*J. Geophys. Res.
17.	180	Progr. Theoret. Phys.
18.	176	Naturwissenschaften
19.	140	Ann. New York Acad. Sci.
20.	128	*Aust. J. Phys.
21.	104	*J. Quant. Spectrosc.
22.	96	Appl. Optics
23.	96	Radio Science
24.	84	*J. Chem. Phys.
25.	84	*Science
26.	80	*Phys. Rev. Lett.
27.	76	*Proc. Nat. Acad. Sci. USA
28.	68	Bull. Cl. Sci. Acad. Roy. Belg.
29.	60	*Canad. J. Phys.
30.	56	*Observatory
	1356	Other
	17032	Total

* Journals common to the two lists
** Figures are an annual extrapolation from a quarterly sample. See reference 7.

have been followers in astrophysics, especially where observational work is concerned. This has been due to a lack of adequate equipment. The brilliance of several Soviet astrophysical theoreticians is not disputed.[5] You will note that in *Current Contents*® the *Doklady* does not feature a section for astronomy.

On the other hand, the *Proc. Nat. Acad. Sci. USA* ranks low on both lists (23rd and 27th). The *Comptes Rendus*, etc., does not appear at all.

In Figure 2 we list the articles from *AJ* and *AJS* most frequently cited during the period 1961 through 1973. Of the 75 papers listed, all but six were published during the 1960s. Five were published during the 50s (items 1, 4, 8, 65, 73), and one in 1970 (item 38). The most cited paper overall is the 1953 Johnson and Morgan paper on photoelectric photometry for spectral standards. With four exceptions (items 13, 14, 27, 38), it continued as the most cited in 1973, a remarkable record after 20 years of heavy citation.

The reader will note that several authors appear frequently, sometimes as first, sometimes as secondary authors. In compiling the list, I was reminded of the desirability of getting authors to use the same form of their names on all papers.[6] If not, the author does himself a disservice. However, the situation isn't as simple as it appears. Some years ago Prof. A.R. Sandage decided to stick with *A. Sandage*—a bibliographically unwise decision. His conscientious colleagues, however, regularly undo his decision to be merely *A. Sandage*. Even when he now signs himself

A. Sandage colleagues continue to cite him from memory as *A.R. Sandage*. These 'trivialities' have not prevented us from appreciating the significance of his work in this field through citation analysis.

Our readers with a deeper understanding may wish to think about our success in identifying the key papers in this field. Keep in mind that the listing in Figure 2 has been limited to one journal. Very possibly, the highly cited papers published in *Nature*, etc., may be of equal or greater historical significance for astrophysics.

1. Garfield, E. Journal citation studies. X. Geology and geophysics. *Current Contents (CC®)* No. 30, 24 July 1974, p. 5-9.
2. ————. Journal citation studies. XI. *Journal of Geophysical Research*. *CC* No. 33, 14 August 1974, p. 5-8.
3. Boyer, C.J. *The Ph.D. dissertation: an analysis of the doctoral dissertation as an information source*. Dissertation presented to the Faculty of the Graduate School of the University of Texas at Austin, August 1972, 123 pp.
4. Garfield, E. Should ISI adopt an author fee to promote better dissemination of dissertations and other non-journal material. *CC* No. 7, 14 February 1973, p. 5-6.
5. For example, the names of L.M. Ozernoi and S.B. Pikelner appear in our lists of highly cited authors for the period 1961-73.
6. Garfield, E. A suggestion for improving the information content of authors' names. *CC* No. 6, 11 February 1970, p. 4-5.
7. ————. Citation analysis as a tool in journal evaluation. *Science* 178:471-79, 1972.

Figure 2. Highly Cited Articles 1961-1973 from *Astrophysical Journal* and its *Supplements*.

Item	Times Cited	Bibliographical Data
1.	346	**Johnson H L & Morgan W W.** Fundamental stellar photometry for standards of spectral type on the revised system of the Yerkes spectral *Atlas*. *Astrophys. J.* 117:313-52, 1953.
2.	248	**Penzias A A & Wilson R W.** A measurement of excess antenna temperature at 40 80 mc/s. *Astrophys. J.* 142:419-21, 1965.
3.	247	**Goldberg L, Muller E A & Aller L H.** The abundances of the elements in the solar atmosphere. *Astrophys. J. Suppl.* 5:1-37, 1960.
4.	207	**Parker E N.** Dynamics of the interplanetary gas and magnetic fields. *Astrophys. J.* 128:664-76, 1958.
5.	174	**Mihalas D.** Model atmospheres and line profiles for early-type stars. *Astrophys. J. Suppl.* 9:321-437, 1964.
6.	185	**Matthews T A & Sandage A.** Optical identification of 3C 48, 3C 196, and 3C 286 with stellar objects. *Astrophys. J.* 138:30-56, 1963.
7.	174	**Oke J B.** Photoelectric spectrophotometry of stars suitable for standards. *Astrophys. J.* 140:689-93, 1964.
8.	173	**Hiltner W A.** Photometric, polarization, and spectrographic observations of O and B stars. *Astrophys. J. Suppl.* 2:329-462, 1956.
9.	166	**Colgate S A & White R H.** The hydrodynamic behavior of supernovae explosions. *Astrophys. J.* 143:626-81, 1966.
10.	162	**Wagoner R V, Fowler W A & Hoyle F.** On the synthesis of elements at very high temperatures. *Astrophys. J.* 148:3-49, 1967.
11.	159	**Dicke R H, Peebles P J E, Roll P G & Wilkinson D T.** Cosmic black-body radiation. *Astrophys. J.* 142:414-19, 1965.
12.	159	**Sandage A R.** The ability of the 200-inch telescope to discriminate between selected world models. *Astrophys. J.* 133:355-92, 1961.
13.	156	**Field G B, Goldsmith D W & Habing H J.** Cosmic-ray heating of the interstellar gas. *Astrophys. J.* 155:L149-54, 1969.
14.	153	**Kellermann K I & Williams P J S.** The spectra of radio sources in the revised 3C catalogue. *Astrophys. J.* 157:1-34, 1969.
15.	143	**Johnson H L.** Interstellar extinction in the galaxy. *Astrophys. J.* 141:923-42, 1965.
16.	141	**Greenstein J L & Schmidt M.** The quasi-stellar radio sources of 3C 48 and 3C 273. *Astrophys. J.* 140:1-34, 1964.
17.	138	**Sandage A R.** The existence of a major new constituent of the universe: the quasi-stellar galaxies. *Astrophys. J.* 141:1560-78, 1965.
18.	136	**Ostriker J P & Gunn J E.** On the nature of pulsars. I. Theory. *Astrophys. J.* 157:1395-1418, 1969.

19. 135 Leighton R B, Noyes R W & Simon G W. Velocity fields in the solar atmosphere. I. Preliminary report. *Astrophys. J.* 135:474, 1962.

20. 134 Felten J E & Morrison P. Omnidirectional inverse Compton and synchrotron radiation from cosmic distributions of fast electrons and thermal photons. *Astrophys. J.* 146:686-708, 1966.

21. 133. Christy R F. A study of pulsation in RR Lyrae models. *Astrophys. J.* 144:108-79, 1966.

22. 132 Morton D C & Adams T F. Effective temperatures and bolometric corrections of early-type stars. *Astrophys. J.* 151:611-21, 1968.

23. 131 Wyndham J D. Optical identification of radio sources in the 3C revised catalogue. *Astrophys. J.* 144:459-82, 1966.

24. 128 Mezger P G & Hoglund B. Galactic H/II regions. II. Observations on their hydrogen 109a recombination-line radiation at the frequency 5009 MHz. *Astrophys. J.* 147:490-518, 1967.

25. 128 Osterbrock D E. The heating of the solar chromasphere, plages, and corona by magnetohydrodynamic waves. *Astrophys. J.* 134:347-88, 1961.

26. 127 Sandage A, Westphal J A & Strittmatter P A. On the optical identification of SCO X-1. *Astrophys. J.* 146:316-75, 1966.

27. 126 Goldreich P & Julian W H. Pulsar electrodynamics. *Astrophys. J.* 157:

27. 126 Goldreich P & Julian W H. Pulsar electrodynamics. *Astrophys. J.* 157:869-80, 1969.

28. 126 Mihalas D. Balmer-line-blanketed model atmospheres for A-type stars. *Astrophys. J. Suppl.* 13:1-29, 1966.

29. 125 Iben I. Stellar evolution. I. The approach of the main sequence. *Astrophys. J.* 141:993-1018, 1965.

30. 121 Eggen O J, Leyden-Bell D & Sandage A R. Evidence from the motions of old stars that the galaxy collapsed. *Astrophys. J.* 136:748-66, 1962.

31. 120 VanRegemorter H. Rate of collisional excitation in stellar atmospheres. *Astrophys. J.* 136:906-15, 1962.

32. 120 Madden R P & Codling K. Two electron excitation states in helium. *Astrophys. J.* 141:364-75, 1965.

33. 117 Schmidt M. Space distribution and luminosity functions of quasi-stellar radio sources. *Astrophys. J.* 151:393-409, 1968.

34. 117 Eggen O J, Greenstein J L. Spectra, colours, luminosities, and motions of the white dwarfs. *Astrophys. J.* 141:83-108, 1965.

35. 116 Corliss C H & Warner B. Absolute oscillator strengths for Fe I. *Astrophys. J. Suppl.* 8:395-438, 1964.

36. 112 Karzas W J & Latter R. Electron radiative transitions in the Coulomb field. *Astrophys. J. Suppl.* 6:167-212, 1961.

37. 111 Schraml J & Mezger P G. Galactic H/II Regions. IV. 1.95-CM observations with high angular resolution and high positional accuracy. *Astrophys. J.* 156:269-307, 1969.

38. 109 Oke J B & Schild R E. The absolute spectral energy distribution of Alpha Lyrae. *Astrophys. J.* 161:1015-24, 1970.

39. 105 Spitzer L & Tomasko M G. Heating of H/I regions by energetic particles. *Astrophys. J.* 152:971-86, 1968.

40. 105 Field G B. Thermal instability. *Astrophys. J.* 142:531-67, 1965.

41. 105 Toomre A. On the gravitational stability of a disk of stars. *Astrophys. J.* 139:1217-38, 1964.

42. 103 Mezger P G & Henderson A P. Galactic H/II Regions. I. Observations of their continuum radiation at the frequency 5 GHz. *Astrophys. J.* 147:471-89, 1967.

43. 103 Iben I. Stellar evolution. III. The evolution of a $5M_{\odot}$ star from the main sequence through core helium burning. *Astrophys. J.* 143:483-504, 1966.

44. 101 Weber E J & Davis L. The angular momentum of the solar wind. *Astrophys. J.* 148:217-27, 1967.

45. 101 Kaplan L D, Munch G & Spinrad H. An analysis of the spectrum of Mars. *Astrophys. J.* 139:1-15, 1964.

46. 101 **Pauliny-Toth I I K, Wade C M & Heeschen D S.** Positions and flux densities of radio sources. *Astrophys. J. Suppl.* 13:65-123, 1966.

47. 100 **Kellermann K I.** The spectra of non-thermal radio sources. *Astrophys. J.* 140:969-91, 1964.

48. 100 **Clark B.G.** An interferrometer investigation of the 21-centimeter hydrogen-line absorption. *Astrophys. J.* 142:1398-1427, 1965.

49. 99 **Henry R C, Fritz G, Meekins J F, Friedman H & Byram E T.** Possible detection of a dense intergalactic plasma. *Astrophys. J.* 153:L11, 1968.

50. 97 **Clark G W, Garmire G P, & Kraushaar W L.** Observation on high energy cosmic gamma rays. *Astrophys. J.* 153:L203, 1968.

51. 96 **Sandage A.** A new determination of the Hubble constant from globular clusters in M87. *Astrophys. J.* 152:L149-54, 1968.

52. 96 **Cox D P & Tucker W H.** Ionization equilibrium and radiative cooling of a low-density plasma. *Astrophys. J.* 157:1157-68, 1969.

53. 94 **Salpeter E E.** Energy and pressure of a zero-temperature plasma. *Astrophys. J.* 134:669-82, 1961.

54. 93 **Odell C R.** A distance scale for planetary nebulae based on emission-like fluxes. *Astrophys. J.* 135:371, 1962.

55. 93 **Iben I.** Stellar evolution. V. The evolution of a 15 $M_\odot$ star from the main sequence through core helium burning. *Astrophys. J.* 143:516-76, 1966.

56. 91 **Iben I.** Stellar evolution. VI. Evolution from the main sequence to the red-giant branch for stars of mass 1 $M_\odot$, 1, 25 $M_\odot$, and 1.5 $M_\odot$. *Astrophys. J.* 147:624-63, 1967.

57. 89 **Schwarzschild M & Harm R.** Thermal instability in non-degenerate stars. *Astrophys. J.* 142:855-89, 1965.

58. 89 **Burbidge G R, Gould R J & Pottasch S R.** Excitation conditions in H/II regions in spiral and irregular galaxies. *Astrophys. J.* 138:945-68, 1963.

59. 88 **Chandrasekhar S.** The dynamical instability of gaseous masses approaching the Schwarzschild limit in general relativity. *Astrophys. J.* 140:417-33, 1964.

60. 86 **Goss W M.** OH absorption in the galaxy. *Astrophys. J. Suppl.* 15:131-202, 1968.

61. 86 **Oke J B & Conti P S.** Absolute photoelectric spectrophotometry of stars in the Hyades. *Astrophys. J.* 143:134-45, 1966.

62. 85 **Iben I.** Stellar evolution. II. The evolution of a 3 $M_\odot$ star from the main sequence through core helium burning. *Astrophys. J.* 142:1447-67, 1965.

63. 84 **Misner C W.** The isotropy of the universe. *Astrophys. J.* 151:431-57, 1968.

64. 82 **Becklin E E, Neugebauer .** Infrared observations of the galactic center. *Astrophys. J.* 151:145-61, 1968.

65. 80 **Sharpless S.** A catalogue of H/II regions. *Astrophys. J. Suppl.* 4:257-79, 1959.

66. 79 **Thorne K S.** Primordial element formation, primordial magnetic fields, and the isotropy of the universe. *Astrophys. J.* 148:51-68, 1967.

67 77 **Newkirk G.** The solar corona in active regions and the thermal origin of the slowly varying component of solar radio radiation. *Astrophys. J.* 133:983-1013, 1961.

68. 77 **Goldreich P & Schubert G.** Differential rotation in stars. *Astrophys. J.* 150:571-87, 1967.

69. 75 **Fish R A & Coles C C.** The record in the Meteorites. III. On the development of meteorites in asteroidal bodies. *Astrophys. J.* 132:243-58, 1960.

70. 75 **Schmidt M.** Large redshifts of 5 quasi-stellar sources. *Astrophys. J.* 141:1295-1300, 1965.

71. 75 **Iben I.** Stellar evolution. IV. The evolution of a 9 $M_\odot$ star from the main sequence through core helium burning. *Astrophys. J.* 143:505-15, 1966.

72. 75 **Lin C C & Shu F H.** On the spiral structure of disk galaxies. *Astrophys. J.* 140:646-55, 1964.

73. 74 **Wilson O C & Vainu Bappu M K.** H and K emission in late-type stars: dependence of line width on luminosity and related topics. *Astrophys. J.* 125:661-83, 1957.

74. 72 **Cohen M H, Gundermann E J, Hardebeck H E & Sharp L E.** Interplanetary scintillations. II. Observations. *Astrophys. J.* 147:449-66, 1967.

75. 70 **Peebles P J E.** The black-body radiation content of the universe and the formation of galaxies. *Astrophys. J.* 142:1317-26, 1965.