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Current Comments®

The 1982 Articles Most Cited in 1982 and 1983. 2. Physical Sciences

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We recently identified and discussed the 1982 life-sciences papers that were most cited in 1982 and 1983.[1] In this essay, we present the most-cited 1982 physical-sciences papers. These studies highlight areas of intense activity in current research, as indicated by rapid citation. That is, by identifying the papers that are highly cited soon after publication, we can get a good idea of the topics that have attracted significant attention within the research community. However, we make no claim that these most-cited papers necessarily represent the "best" or "most important" research. Many papers not included here will achieve high impact over the next few years, and they will be recognized as seminal contributions. Nevertheless, the papers presented in this study will continue to be highly cited for many years. These papers are interesting precisely because their recognition was *immediate*—that is, they are "instant" classics.

Table 1 presents full bibliographic information on the 106 papers in this study. They are arranged in alphabetic order by first author. Column A provides the number of citations each paper received in 1982, and 1983 citations are listed in column B. The total number of citations for this two-year period is given in column C. The average paper received 42 citations: 8 in 1982 and 34 in 1983. The most-cited paper received 105 citations. Ten papers were cited 30 times each, the threshold for inclusion in this study. Keep in mind that the average paper or book chapter cited in *Science Citation Index*® (*SCI*®) each year receives no more than one or two citations.

Clearly, the 106 papers in Table 1 were cited at a rate far above that of the average paper. In fact, many of these papers have already become part of the "core" literature of research fronts generated from the *SCI* and *Social Sciences Citation Index*® (*SSCI*®) files in 1982 and 1983. Briefly, a research front consists of current papers that cited any of a group of high-impact articles that were frequently cited *together*, or co-cited. ISI®'s co-citation clustering algorithm has been described previously.[2] What you should remember is that research fronts symbolize individual clusters of subject-related research. By examining the titles of the *citing* articles, we get a very clear and concise definition of what the research cluster is about. That is, the citing authors *themselves* categorize the literature into discrete clusters and describe their cognitive content.

Of the 106 papers, 94 are core papers in 53 separate research fronts. These papers are indicated in Table 1 by code-numbers following the reference. Table 2 provides the names of 19 research fronts that include at least two papers from this study in their cores (column C). The total number of core and citing papers for each research front is shown in column D. For reasons of space, we cannot list the 34 research fronts with only one of the most-cited physical-sciences papers in their cores. That infor-

Table 1: The 1982 physical sciences articles most cited in 1982-1983. Articles are listed in alphabetic order by first author. The authors' addresses follow each citation. Code numbers indicate the 1982 *SCI*® research front specialties for which these are core papers. Code numbers with an asterisk (*) indicate the 1983 *SCI/SSCI*® research fronts for which these are core papers. A = citations received, 1982. B = citations received, 1983. C = total citations received, 1982-1983. D = bibliographic data.

A	B	C	D
2	30	32	**Adler S L.** Einstein gravity as a symmetry-breaking effect in quantum field theory. *Rev. Mod. Phys.* 54:729-66, 1982. Inst. Adv. Study, Princeton, NJ.
20	68	88	**Albrecht A & Steinhardt P J.** Cosmology for grand unified theories with radiatively induced symmetry breaking. *Phys. Rev. Lett.* 48:1220-3, 1982. Univ. Pennsylvania, Dept. Phys., Philadelphia, PA. 82-0029; *83-0319
0	36	36	**Alexander S & Orbach R.** Density of states on fractals: 'fractons.' *J. Phys.—Lett.* 43:L625-31, 1982. Hebrew Univ., Racah Inst., Jerusalem, Israel; Inst. Phys. Chem. Ind., Paris, France. *83-0506
11	21	32	**Alvarado S, Campagna M & Hopster H.** Surface magnetism of Ni(100) near the critical region by spin-polarized electron scattering. *Phys. Rev. Lett.* 48:51-4, 1982. Julich Nucl. Res. Ctr., Inst. Solid-State Res., FRG. *83-0683
6	74	80	**Ando T, Fowler A B & Stern F.** Electronic properties of two-dimensional systems. *Rev. Mod. Phys.* 54:437-672, 1982. Univ. Tsukuba, Inst. Appl. Phys., Ibaraki, Japan; IBM, Thomas J. Watson Res. Ctr., Yorktown Heights, NY. *83-0898
2	42	44	**Backer D C, Kulkarni S R, Heiles C, Davis M M & Goss W M.** Letter to editor. (A millisecond pulsar.) *Nature* 300:615-8, 1982. Univ. California, Astron. Dept., Berkeley, CA; Cornell Univ., Natl. Astron. Ionosph. Ctr., Arecibo, PR; Kapteyn Astron. Inst., Groningen, the Netherlands. *83-0638
2	48	50	**Bak P.** Commensurate phases, incommensurate phases and the devil's staircase. *Rep. Progr. Phys.* 45:587-629, 1982. H.C. Oersted Inst., Copenhagen, Denmark. *83-1602
5	55	60	**Barber M, Bordoli R S, Elliot G J, Sedgwick R D & Tyler A N.** Fast atom bombardment mass spectrometry. *Anal. Chem.* 54:645-57A, 1982. Univ. Manchester, Inst. Sci. Technol., UK. *83-0072
7	28	35	**Barbieri R, Ferrara S, Nanopoulos D V & Stelle K S.** Supergravity, R invariance and spontaneous supersymmetry breaking. *Phys. Lett. B* 113:219-22, 1982. Higher Normal Sch.; INFN, Pisa, Italy; CERN, Geneva, Switzerland; Normal Coll., Lab. Theor. Phys., Paris, France.
0	58	58	**Barbieri R, Ferrara S & Savoy C A.** Gauge models with spontaneously broken local supersymmetry. *Phys. Lett. B* 119:343-7, 1982. Higher Normal Sch.; INFN, Pisa, Italy; CERN; Univ. Geneva, Dept. Theor. Phys., Switzerland. *83-1184
6	32	38	**Beall G, Bander M & Soni A.** Constraint on the mass scale of a left-right-symmetric electroweak theory from the K_L-K_S mass difference. *Phys. Rev. Lett.* 48:848-51, 1982. Univ. California, Depts. Phys., Irvine & Los Angeles, CA. *83-2071
7	39	46	**Bhanot G, Heller U M & Neuberger H.** The quenched Eguchi-Kawai model. *Phys. Lett. B* 113:47-50, 1982. Inst. Adv. Study, Princeton, NJ. *83-2705
12	18	30	**Brezin E & Drouffe J M.** Continuum limit of a Z_2 lattice gauge theory. *Nucl. Phys. B* 200:93-106, 1982. CENS, Gif-sur-Yvette, France. *83-0966
8	29	37	**Bridge H S, Bagenal F, Belcher J W, Lazarus A J, McNutt R L, Sullivan J D, Gazis P R, Hartle R E, Ogilvie K W, Scudder J D, Sittler E C, Eviatar A, Siscoe G L, Goertz C K & Vasyliunas V M.** Plasma observations near Saturn: initial results from Voyager 2. *Science* 215:563-70, 1982. MIT, Ctr. Space Res. & Dept. Phys., Cambridge, MA; NASA, Goddard Space Flight Ctr., Greenbelt, MD; Univ. California, Dept. Atmos. Sci., Los Angeles, CA; Univ. Iowa, Dept. Phys. Astron., Iowa City, IA; Max Planck Soc. Adv. Sci., Inst. Aeronom., Katlenburg-Lindau, FRG. *83-3458
12	71	83	**Cabrera B.** First results from a superconductive detector for moving magnetic monopoles. *Phys. Rev. Lett.* 48:1378-81, 1982. Stanford Univ., Phys. Dept., CA. *83-0319
1	44	45	**Callan C G.** Dyon-fermion dynamics. *Phys. Rev. D—Part. Fields* 26:2058-68, 1982. Princeton Univ., Joseph Henry Labs., NJ. *83-0319
2	54	56	**Callan C G.** Disappearing dyons. *Phys. Rev. D—Part. Fields* 25:2141-6, 1982. Princeton Univ., Joseph Henry Labs., NJ. *83-0319
7	25	32	**Cecotti S & Girardello L.** Functional measure, topology and dynamical supersymmetry breaking. *Phys. Lett. B* 110:39-43, 1982. Harvard Univ., Lyman Lab. Phys. & Gordon McKay Lab., Cambridge, MA. *83-1184

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0	33	33	**Chamseddine A H, Arnowitt R & Nath P.** Locally supersymmetric grand unification. *Phys. Rev. Lett.* 49:970-4, 1982. Northeastern Univ., Dept. Phys., Boston, MA. *83-1184
10	24	34	**Condon J J, Condon M A, Gisler G & Puschell J J.** Strong radio sources in bright spiral galaxies. II. Rapid star formation and galaxy-galaxy interactions. *Astrophys. J.* 252:102-24, 1982. Natl. Radio Astron. Observ., Charlottesville; Virginia Polytech. Inst. State Univ., Blacksburg, VA. *83-4681
12	21	33	**Crabtree R H, Mellea M F, Mihelcic J M & Quirk J M.** Alkane dehydrogenation by iridium complexes. *J. Amer. Chem Soc.* 104:107-13, 1982. Yale Univ., Dept. Chem., New Haven, CT. *83-3652
1	51	52	**Cremmer E, Ferrara S, Girardello L & Van Proeyen A.** Coupling supersymmetric Yang-Mills theories to supergravity. *Phys. Lett. B* 116:231-7, 1982. Normal Coll., Lab. Theor. Phys., Paris, France; CERN, Geneva, Switzerland; Univ. Milan, Inst. Phys.; INFN, Milan, Italy. *83-1184
11	27	38	**Davis M, Huchra J, Latham D W & Tonry J.** A survey of galaxy redshifts. II. The large scale space distribution. *Astrophys. J.* 253:423-45, 1982. Harvard Univ., Harvard-Smithsonian Ctr. Astrophys., Cambridge, MA. *83-1720
5	27	32	**De Marzo C, De Palma M, Distante A, Favuzzi C, Germinario G, Lavopa P, Maggi G, Posa F, Ranieri A, Selvaggi G, Spinelli P, Waldner F, Bialas A, Czyz W, Coghen T, Eskreys A, Eskreys K, Fialkowski K, Kisielewska D, Madeysky B, Malecki P, Olkiewicz K, Pawlik D, Evans W H, Fry J R, Grant C, Houlden M, Morton A, Muirhead H, Shiers J, Antic M, Baker W, Bechteler H, Derado I, Eckardt V, Fent J, Freund P, Gebauer H J, Kahl T, Kalbach R, Manz A, Meinke R, Polakos P, Pretzl K P, Schmitz N, Seyboth P, Seyerlein J, Stopa P, Vranic D, Wolf G, Crijns F, Metzger W J, Pols C, Spuijbroek T, Schouten T & Sarma N.** A study of deep inelastic hadron-hadron collisions with a large acceptance calorimeter trigger. *Phys. Lett. B* 112:173-7, 1982. Univ. Bari, Inst. Phys.; INFN, Bari, Italy; Stanislaw Staszic Univ. Min. Met., Inst. Nucl. Phys. & Inst. Phys. Nucl. Tech.; Jagiellonian Univ., Kracow, Poland; Univ. Liverpool, UK; Max Planck Soc. Adv. Sci., Inst. Phys. Astrophys., Munich, FRG; Univ. Nijmegen; NIKHEE, the Netherlands; CERN, Geneva, Switzerland. *83-1757
10	28	38	**Dine M & Fischler W.** A phenomenological model of particle physics based on supersymmetry. *Phys. Lett. B* 110:227-31, 1982. Inst. Adv. Stud., Princeton, NJ; Univ. Pennsylvania, Dept. Phys., Philadelphia, PA.
1	34	35	**Dine M & Fischler W.** A supersymmetric GUT. *Nucl. Phys. B* 204:346-64, 1982. Inst. Adv. Stud., Princeton, NJ; Univ. Pennsylvania, Dept. Phys., Philadelphia, PA. *83-1184
1	34	35	**Doddrell D M, Pegg D T & Bendall M R.** Distortionless enhancement of NMR signals by polarization transfer. *J. Magn. Resonance* 48:323-7, 1982. Griffith Univ., Sch. Sci., Nathan, Australia. *83-1380
8	33	41	**Edwards C, Partridge R, Peck C, Porter F C, Antreasyan D, Gu Y E, Kollmann W, Richardson M, Strauch K, Wacker K, Weinstein A, Aschman D, Burnett T, Cavalli-Sforza M, Coyne D, Newman C, Sadrozinski H F W, Gelphman D, Hofstadter R, Horisberger R, Kirkbride I, Kalanoski H, Konigsmann K, Lee R, Liberman A, O'Reilly J, Osterheld A, Pollock B, Tompkins J, Bloom E, Bulos F, Chestnut R, Gaiser J, Godfrey G, Kiesling C, Lockman W, Oreglia M & Scharre D L.** Evidence for 77 resonance in *J/4* radiative decays. *Phys. Rev. Lett.* 48:458-61, 1982. CalTech, Phys. Dept., Pasadena, CA; Harvard Univ., Phys. Dept., Cambridge, MA; Princeton Univ., Phys. Dept., NJ; Stanford Univ., Phys. Dept. & Stanford Linear Accel. Ctr., CA. *83-1583
14	50	64	**Eguchi T & Kawai H.** Reduction of dynamical degrees of freedom in the large-*N* gauge theory. *Phys. Rev. Lett.* 48:1063-6, 1982. Univ. Tokyo, Fac. Sci., Japan. *83-2705
17	24	41	**Einhorn M B & Jones D R T.** The weak mixing angle and unification mass in supersymmetric SU(5). *Nucl. Phys. B* 196:475-88, 1982. Univ. Michigan, Randall Lab. Phys., Ann Arbor, MI. 82-0885
8	54	62	**Ellis J, Ibanez L & Ross G G.** Grand unification with large supersymmetry breaking. *Phys. Lett. B* 113:283-7, 1982. Univ. Oxford, All Souls Coll., Dept. Theor. Phys. & Pembroke Coll.; SERC, Rutherford Appleton Lab., Chilton, UK; Madrid Autonom. Univ., Dept. Theor. Phys., Spain. *83-1184
14	28	42	**Ellis J & Nanopoulos D V.** Flavour-changing neutral interactions in broken supersymmetric theories. *Phys. Lett. B* 110:44-8, 1982. CERN, Geneva, Switzerland. *83-1184
7	26	33	**Emery V J, Bruinsma R & Barisic S.** Electron-electron umklapp scattering in organic superconductors. *Phys. Rev. Lett.* 48:1039-43, 1982. Brookhaven Natl. Lab., Upton, NY; Univ. Paris XI, Lab. Phys. Solid-State, Orsay, France. 82-2192

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15	32	47	**Fincher C R, Chen C-E, Heeger A J, MacDiarmid A G & Hastings J B.** Structural determination of the symmetry-breaking parameter in *trans*-$(CH)_x$. *Phys. Rev. Lett.* 48:100-4, 1982. Univ. Pennsylvania, Lab. Res. Struct. Mat., Philadelphia, PA; Brookhaven Natl. Lab., Upton, NY. *83-3402
5	25	30	**Fyfe C A, Gobbi G C, Klinowski J, Thomas J M & Ramdas S.** Resolving crystallographically distinct tetrahedral sites in silicalite and ZSM-5 by solid-state NMR. *Nature* 296:530-3, 1982. Univ. Guelph, Dept. Chem., Ontario, Canada; Univ. Cambridge, Dept. Phys. Chem., UK. *83-3408
9	27	36	**Garoche P, Brusetti R, Jerome D & Bechgaard K.** Specific heat measurements of organic superconductivity in $(TMTSF)_2C10_4$. *J. Phys.—Lett.* 43:L147-52, 1982. Univ. Paris XI, Lab. Phys. Solid-State, Orsay, France; H.C. Oersted Inst., Copenhagen, Denmark. *83-2192
4	30	34	**Giallorenzi T G, Bucaro J A, Dandridge A, Sigel G H, Cole J H, Rashleigh S C & Priest R G.** Optical fiber sensor technology. *IEEE J. Quantum Electron.* 18:626-65, 1982. USN, Naval Res. Lab., Washington, DC. *83-2512
15	41	56	**Girardello L & Grisaru M T.** Soft breaking of supersymmetry. *Nucl. Phys. B* 194:65-76, 1982. Harvard Univ., Gordon McKay Lab., Cambridge, MA; Brandeis Univ., Dept. Phys., Waltham, MA. *83-1184
6	27	33	**Gordon M S, Binkley J S, Pople J A, Pietro W J & Hehre W J.** Self-consistent molecular-orbital methods. 22. Small split-valence basis sets for second-row elements. *J. Amer. Chem. Soc.* 104:2797-803, 1982. N. Dakota State Univ., Dept. Chem., Fargo, ND; Carnegie-Mellon Univ., Dept. Chem., Pittsburgh, PA; Univ. California, Dept. Chem., Irvine, CA. *83-2634
1	29	30	**Grinstein G & Ma S.** Roughening and lower critical dimension in the random-field Ising model. *Phys. Rev. Lett.* 49:685-8, 1982. IBM, Thomas J. Watson Res. Ctr., Yorktown Heights, NY; Univ. California, Dept. Phys. & Inst. Pure Appl. Phys. Sci., San Diego, CA. *83-0316
0	32	32	**Guth A H & Pi S-Y.** Fluctuations in the new inflationary universe. *Phys. Rev. Lett.* 49:1110-3, 1982. MIT, Dept. Phys.; Harvard Univ., Lyman Lab. Phys., Cambridge, MA; Univ. New Hampshire, Lab. Mech., Durham, NH. *83-0319
4	39	43	**Halperin B I.** Quantized Hall conductance, current-carrying edge states, and the existence of extended states in a two-dimensional disordered potential. *Phys. Rev. B—Condensed Matter* 25:2185-90, 1982. Harvard Univ., Lyman Lab. Phys., Cambridge, MA. *83-0897
11	27	38	**Hamber H, Marinari E, Parisi G & Rebbi C.** Spectroscopy in a lattice gauge theory. *Phys. Lett. B* 108:314-6, 1982. Brookhaven Natl. Lab., Upton, NY; Rome Univ., Inst. Phys.; INFN, Rome & Frascati, Italy. *83-0966
14	31	45	**Hasenfratz A, Kunszt Z, Hasenfratz P & Lang C B.** Hopping parameter expansion for the meson spectrum in SU(3) lattice QCD. *Phys. Lett. B* 110:289-94, 1982. Hungarian Acad. Sci., Cent. Res. Inst. Phys.; Eotvos Lorand Univ., Budapest, Hungary; CERN, Geneva, Switzerland. *83-0966
1	33	34	**Hawking S W.** The development of irregularities in a single bubble inflationary universe. *Phys. Lett. B* 115:295-7, 1982. Univ. Cambridge, Dept. Appl. Math. Theor. Phys., UK. *83-0319
22	39	61	**Hawking S W & Moss I G.** Supercooled phase transitions in the very early universe. *Phys. Lett B* 110:35-8, 1982. Univ. Cambridge, Dept. Appl. Math. Theor. Phys., UK. 82-0029; *83-0319
9	31	40	**Heiney P A, Birgeneau R J, Brown G S, Horn P M, Moncton D E & Stephens P W.** Freezing transition of monolayer xenon on graphite. *Phys. Rev. Lett.* 48:104-8, 1982. MIT, Dept. Phys., Cambridge, MA; Stanford Univ., Synchrotr. Radiat. Lab., CA; IBM, Thomas J. Watson Res. Ctr., Yorktown Heights; SUNY, Dept. Phys., Stony Brook, NY; Bell Labs., Murray Hill, NJ. *83-0707
5	30	35	**Henry C H.** Theory of the linewidth of semiconductor lasers. *IEEE J. Quantum Electron.* 18:259-64, 1982. Bell Labs., Murray Hill, NJ. *83-6088
10	25	35	**Hepburn J W, Northrup F J, Ogram G L, Polanyi J C & Williamson J M.** Rotationally inelastic scattering from surfaces $CO_{(g)}$+LiF(001). *Chem. Phys. Lett.* 85:127-30, 1982. Univ. Toronto, Dept. Chem., Canada.
4	35	39	**Herrmann W A.** The methylene bridge. *Advan. Organometal. Chem.* 20:159-263, 1982. Univ. Regensburg, Inst. Inorg. Chem., FRG. *83-1064
12	38	50	**Herrmann W A.** Organometallic aspects of the Fischer-Tropsch synthesis. *Angew. Chem. Int. Ed.* 21:117-30, 1982. Univ. Regensburg, Inst. Inorg. Chem., FRG. *83-1064

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11	24	35	**Hirsch J E, Huberman B A & Scalapino D J.** Theory of intermittency. *Phys. Rev. A—Gen. Phys.* 25:519-32, 1982. Univ. California, Inst. Theor. Phys. & Dept. Phys., Santa Barbara; Xerox Palo Alto Res. Ctr., CA. *83-0321
6	24	30	**Hofmann A W & White W M.** Mantle plumes from ancient oceanic crust. *Earth Planet. Sci. Lett.* 57:421-36, 1982. Carnegie Inst. Washington, Dept. Terr. Magnet., Washington, DC.
13	31	44	**Holmes D E, Chen R T, Elliot K R & Kirkpatrick C G.** Stoichiometry-controlled compensation in liquid encapsulated Czochralski GaAs. *Appl. Phys. Lett.* 40:46-8, 1982. Rockwell Intl. Microelectron. Res. Dev. Ctr., Thousand Oaks, CA. *83-0019
0	43	43	**Ibanez L.** Locally supersymmetric SU(5) grand unification. *Phys. Lett. B* 118:73-8, 1982. CERN, Geneva, Switzerland. *83-1184
13	27	40	**Ibanez L & Ross G G.** $SU(2)_L \times U(1)$ symmetry breaking as a radiative effect of supersymmetry breaking in GUTs. *Phys. Lett. B* 110:215-20, 1982. Univ. Oxford, Dept. Theor. Phys., UK.
8	26	34	**Ishikawa K, Teper M & Schierholz G.** The glueball mass spectrum in QCD: first results of a lattice Monte Carlo calculation. *Phys. Lett. B* 110:399-405, 1982. DESY; Hamburg Univ., Inst. Theor. Phys. II, FRG. *83-0966
12	36	48	**Janowicz A H & Bergman R G.** C-H activation in completely saturated hydrocarbons: direct observation of M+R-H→M(R)(H). *J. Amer. Chem. Soc.* 104:352-4, 1982. Univ. California, Dept. Chem. & Lawrence Berkeley Lab., Berkeley, CA. *83-3652
0	44	44	**Jerome D & Schulz H J.** Organic conductors and superconductors. *Advan. Phys.* 31:299-490, 1982. Univ. Paris XI, Lab. Phys. Solid-State, Orsay; Max Von Laue-Paul Langevin Inst., Grenoble, France. *83-2192
7	25	32	**Kobayashi S, Yamamoto Y, Ito M & Kimura T.** Direct frequency modulation in AlGaAs semiconductor lasers. *IEEE J. Quantum Electron.* 18:582-95, 1982. Nippon Telegr. Tel. Publ. Corp., Musashino Elect. Commun. Lab., Tokyo & Ibaraki Elect. Commun. Lab., Japan. *83-0358
8	23	31	**Kroemer H.** Heterostructure bipolar transistors and integrated circuits. *Proc. IEEE* 70:13-25, 1982. Univ. California, Dept. Elect. Comput. Eng., Santa Barbara, CA. *83-0973
9	44	53	**Lagowski J, Gatos H C, Parsey J M, Wada K, Kaminska M & Walukiewicz W.** Origin of the 0.82-eV electron trap in GaAs and its annihilation by shallow donors. *Appl. Phys. Lett.* 40:342-4, 1982. MIT, Dept. Elect. Eng. Comput. Sci., Cambridge, MA. *83-0019
12	28	40	**Lane A L, Hord C W, West R A, Esposito L W, Coffeen D L, Sato M, Simmons K E, Pomphrey R B & Morris R B.** Photopolarimetry from Voyager 2: preliminary results on Saturn, Titan, and the rings. *Science* 215:537-43, 1982. CalTech, Jet Prop. Lab., Pasadena, CA; Univ. Colorado, Lab. Atmos. Space Phys., Boulder, CO; Goddard Inst. Space Stud., New York, NY. *83-3458
10	22	32	**Larson B C, White C W, Noggle T S & Mills D.** Synchrotron X-ray diffraction study of silicon during pulsed-laser annealing. *Phys. Rev. Lett.* 48:337-40, 1982. Oak Ridge Natl. Lab., Solid-State Div., TN; Cornell Univ., High Energy Synchrotr. Source & Sch. Appl. Eng. Phys., Ithaca, NY. *83-1053
33	72	105	**Linde A D.** A new inflationary universe scenario: a possible solution of the horizon, flatness, homogeneity, isotropy and primordial monopole problems. *Phys. Lett. B* 108:389-93, 1982. Acad. Sci. USSR, P.H. Lebedev Phys. Inst., Moscow, USSR. 82-0029; *83-0319
12	20	32	**Masamune S, Hanzawa Y, Murakami S, Bally T & Blount J H.** Cyclotrisilane $(R_2Si)_3$ and disilene $(R_2Si{=}SiR_2)$ systems: synthesis and characterization. *J. Amer. Chem. Soc.* 104:1150-3, 1982. MIT, Dept. Chem., Cambridge, MA; Hoffmann-La Roche, Inc., Nutley, NJ. *83-1039
11	23	34	**Matsuoka T, Nagai H, Itaya Y, Noguchi Y, Suzuki Y & Ikegami T.** CW operation of DFB-BH GaInAsP/InP lasers in 1.5 μm wavelength region. *Electron. Lett.* 18:27-8, 1982. Nippon Telegr. Tel. Publ. Corp., Musashino Elect. Commun. Lab., Tokyo, Japan. *83-0409
7	28	35	**Mayer-Hasselwander H A, Bennett K, Bignami G F, Buccheri R, Caraveo P A, Hermsen W, Kanbach G, Lebrun F, Lichti G G, Masnou J L, Paul J A, Pinkau K, Sacco B, Scarsi L, Swanenburg B N & Wills R D.** Large-scale distribution of galactic gamma radiation observed by COS-B. *Astron. Astrophys.* 105:164-75, 1982. Huygens Lab., Cosm.-Ray Work. Grp., Leiden; Eur. Space Agcy., ESTEC, Noordwijk, the Netherlands; CNR, Cosm. Phys. Inst., Milan & Cosm. Phys. Data Inst., Palermo, Italy; Max Planck Soc. Adv. Sci., Inst. Phys. Astrophys. & Inst. Extraterr. Phys., Munich, FRG; CENS, Serv. Electron. Phys., Gif-sur-Yvette, France. *83-0638

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10	20	30	**McNeal C J.** Symposium on fast atom and ion induced mass spectrometry of nonvolatile organic solids. *Anal. Chem.* 54:A43-50, 1982. Texas A&M Univ., Dept. Chem., College Station, TX. *83-0072
5	32	37	**Monceau P, Richard J & Renard M.** Charge-density-wave motion in $NbSe_3$. I. Studies of the differential resistance *dV/dI*. *Phys. Rev. B—Condensed Matter* 25:931-47, 1982. CNRS, Very Low Temp. Res. Ctr., Grenoble, France. *83-1805
11	31	42	**Monod P & Bouchiat H.** Equilibrium magnetization of a spin glass: is mean-field theory valid? *J. Phys.—Lett.* 43:L45-53, 1982. Univ. Paris XI, Lab. Phys. Solid-State, Orsay, France. *83-1782
14	17	31	**Nanopoulos D V & Tamvakis K.** Super cosmology. *Phys. Lett. B* 110:449-55, 1982. CERN, Geneva, Switzerland.
11	21	32	**Ness N F, Acuna M H, Behannon K W, Burlaga L F, Connerney J E P, Lepping R P & Neubauer F M.** Magnetic field studies by Voyager 2: preliminary results at Saturn. *Science* 215:558-63, 1982. NASA, Goddard Space Flight Ctr., Greenbelt, MD; Tech. Univ., Braunschweig, FRG.
5	27	32	**Oset E, Toki H & Weise W.** Pionic modes of excitation in nuclei. *Phys. Rep.* 83:281-380, 1982. Univ. Salamanca, Dept. Atom. Nucl. Phys., Spain; Michigan State Univ., Dept. Phys., East Lansing, MI; Univ. Regensburg, Inst. Theor. Phys., FRG. *83-2664
3	27	30	**Paalanen M A, Tsui D C & Gossard A C.** Quantized Hall effect at low temperatures. *Phys. Rev. B—Condensed Matter* 25:5566-9, 1982. Bell Labs., Murray Hill, NJ. *83-0897
14	17	31	**Pagels H & Primack J R.** Supersymmetry, cosmology, and new physics at teraelectronvolt energies. *Phys. Rev. Lett.* 48:223-6, 1982. Rockefeller Univ., New York, NY; Univ. California, Dept. Phys., Santa Cruz, CA.
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1	32	33	**Pandit R, Schick M & Wortis M.** Systematics of multilayer adsorption phenomena on attractive substrates. *Phys. Rev. B—Condensed Matter* 26:5112-40, 1982. Univ. Illinois, Dept. Phys. & Mat. Res. Lab., Urbana, IL; Univ. Washington, Dept. Phys., Seattle, WA. *83-0683
8	35	43	**Parisi G.** A simple expression for planar field theories. *Phys. Lett. B* 112:463-4, 1982. INFN, Natl. Lab., Frascati; Rome Univ., Italy. *83-2705
9	23	32	**Pouget J P, Moret R, Comes R, Bechgaard K, Fabre J M & Giral L.** X-ray diffuse scattering study of some $(TMTSF)_2X$ and $(TMTTF)_2X$ salts. *Mol. Cryst. Liquid Cryst.* 79:129-43, 1982. Univ. Paris XI, Lab. Phys. Solid-State, Orsay; USTL, Lab. Chem. Organ. Struct., Montpellier, France; H.C. Oersted Inst., Copenhagen, Denmark. *83-2192
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1	43	44	**Salam A & Strathdee J.** On Kaluza-Klein theory. *Ann. Phys. NY* 141:316-52, 1982. Intl. Ctr. Theor. Phys., Trieste, Italy; Univ. London, Imperial Coll. Sci. Technol., UK.*83-2796
10	29	39	**Sandage A.** The Oosterhoff period groups and the age of globular clusters. III. The age of the globular cluster system. *Astrophys. J.* 252:553-73, 1982. Carnegie Inst. Washington, Mount Wilson Las Campanas Observs., Pasadena, CA. *83-7090
12	25	37	**Sandel B R, Shemansky D E, Broadfoot A L, Holberg J B, Smith G R, McConnell J C, Strobel D F, Atreya S K, Donahue T M, Moos H W, Hunten D M, Pomphrey R B & Linick S.** Extreme ultraviolet observations from the Voyager 2 encounter with Saturn. *Science* 215:548-53, 1982. USC, Earth Space Sci. Inst.; Univ. Arizona, Lunar Planet.

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			Lab., Tucson, AZ; York Univ., Ontario, Canada; USN, Naval Res. Lab., Washington, DC; Univ. Michigan, Dept. Atmos. Ocean. Sci., Ann Arbor, MI; Johns Hopkins Univ., Baltimore, MD; CalTech, Jet Prop. Lab., Pasadena, CA.
7	23	30	**Schuetzle D, Riley T L, Prater T J, Harvey T M & Hunt D F.** Analysis of nitrated polycyclic aromatic hydrocarbons in diesel particulates. *Anal. Chem.* 54:265-71, 1982. Ford Motor Co., Analyt. Sci. Dept., Dearborn, MI; Univ. Virginia, Chem. Dept., Charlottesville, VA. *83-4244
9	35	44	**Sikivie P.** Axions, domain walls, and the early universe. *Phys. Rev. Lett.* 48:1156-9, 1982. Univ. Florida, Dept. Phys., Gainesville, FL. *83-1236
7	28	35	**Sinha S K, Crabtree G W, Hinks D G & Mook H.** Study of coexistence of ferromagnetism and superconductivity in single-crystal $ErRh_4B_4$. *Phys. Rev. Lett.* 48:950-3, 1982. Argonne Natl. Lab., IL; Oak Ridge Natl. Lab., TN. *83-0140
23	63	86	**Smith B A, Soderblom L, Batson R, Bridges P, Inge J, Masursky H, Shoemaker E, Beebe R, Boyce J, Briggs G, Bunker A, Collins S A, Hansen C J, Johnson T V, Mitchell J L, Terrile R J, Cook A F, Cuzzi J, Pollack J B, Danielson G E, Ingersoll A P, Davies M E, Hunt G E, Morrison D, Owen T, Sagan C, Veverka J, Strom R & Suomi V E.** A new look at the Saturn system: the Voyager 2 images. *Science* 215:504-37, 1982. Univ. Arizona, Dept. Planet. Sci. & Lunar Planet. Lab., Tucson; US Geol. Survey, Flagstaff, AZ; New Mexico State Univ., Dept. Astron., Las Cruces, NM; NASA Headquarters, Washington, DC & Ames Res. Ctr., Moffett Field; CalTech, Jet Prop. Lab. & Div. Geol. Planet. Sci., Pasadena; Rand Corp., Santa Monica, CA; Univ. London, Univ. Coll., UK; Univ. Hawaii, Inst. Astron., Honolulu, HI; SUNY, Dept. Earth Space Sci., Stony Brook; Cornell Univ., Lab. Planet. Stud., Ithaca, NY; Univ. Wisconsin, Madison, WI. 82-1234; *83-3458
13	23	36	**Swiatecki W J.** The dynamics of the fusion of two nuclei. *Nucl. Phys. A* 376:275-91, 1982. Univ. California, Lawrence Berkeley Lab., Berkeley, CA. *83-2007
3	33	36	**Takahashi T, Jerome D & Bechgaard K.** Observation of a magnetic state in the organic superconductor $(TMTSF)_2ClO_4$: influence of the cooling rate. *J. Phys.—Lett.* 43:L565-73, 1982. Univ. Paris XI, Lab. Phys. Solid-State, Orsay, France. *83-2192
12	27	39	**Testa J, Perez J & Jeffries C.** Evidence for universal chaotic behavior of a driven nonlinear oscillator. *Phys. Rev. Lett.* 48:714-7, 1982. Univ. California, Lawrence Berkeley Lab. & Dept. Phys., Berkeley, CA. *83-0321
6	25	31	**Tsui D C, Gossard A C, Field B F, Cage M E & Dziuba R F.** Determination of the fine-structure constant using $GaAs\text{-}Al_xGa_{1-x}As$ heterostructures. *Phys. Rev. Lett.* 48:3-6, 1982. Bell Labs., Murray Hill, NJ; NBS, Ctr. Absolute Phys. Quants., Washington, DC. *83-0897
1	44	45	**Tsui D C, Stormer H L & Gossard A C.** Two-dimensional magnetotransport in the extreme quantum limit. *Phys. Rev. Lett.* 48:1559-62, 1982. Bell Labs., Murray Hill, NJ. *83-0897
7	26	33	**Uhrberg R I G, Hansson G V, Nicholls J M & Flodstrom S A.** Experimental evidence for one highly dispersive dangling-bond band on *Si(111) 2 × 1*. *Phys. Rev. Lett.* 48:1032-5, 1982. Linkoping Inst. Technol., Dept. Phys. Measur. Technol., Sweden. *83-2788
12	24	36	**Weinberg S.** Cosmological constraints on the scale of supersymmetry breaking. *Phys. Rev. Lett.* 48:1303-6, 1982. Univ. Texas, Dept. Phys., Austin, TX.
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21	51	72	**Weingarten D.** Monte Carlo evaluation of hadron masses in lattice gauge theories with fermions. *Phys. Lett. B* 109:57-62, 1982. Indiana Univ., Phys. Dept., Bloomington, IN. 82-0032; *83-0966
8	38	46	**Wilczek F.** Remarks on dyons. *Phys. Rev. Lett.* 48:1146-9, 1982. Univ. California, Inst. Theor. Phys., Santa Barbara, CA. *83-0319
3	41	44	**Witten E.** Constraints on supersymmetry breaking. *Nucl. Phys B* 202:253-316, 1982. Princeton Univ., Joseph Henry Labs., NJ. *83-1184
22	53	75	**Wu F Y.** The Potts model. *Rev. Mod. Phys.* 54:235-68, 1982. Julich Nucl. Res. Ctr., Inst. Solid-State Phys., FRG. 82-0376; *83-0506
10	35	45	**Yoshizawa H, Cowley R A, Shirane G, Birgeneau R J, Guggenheim H J & Ikeda H.** Random-field effects in two- and three-dimensional Ising antiferromagnets. *Phys. Rev. Lett.* 48:438-41, 1982. Brookhaven Natl. Lab., Upton, NY; MIT, Dept. Phys., Cambridge, MA; Bell Labs., Murray Hill, NJ; Ochanomizu Univ., Dept. Phys., Tokyo, Japan. *83-0316
8	22	30	**Young A P & Kirkpatrick S.** Low-temperature behavior of the infinite-range Ising spin-glass. Exact statistical mechanics for small samples. *Phys. Rev. B—Condensed Matter* 25:440-51, 1982. Univ. London, Imperial Coll. Sci. Technol., UK; IBM, Thomas J. Watson Res. Ctr., Yorktown Heights, NY. *83-1782

mation can be obtained by contacting ISI®. Many of the 12 papers in this study that are *not* in any research front will undoubtedly be incorporated into the core literature of research fronts generated in the next few years.

Research front #83-1184, "Yang-Mills and Other Supersymmetric Grand Unification Theories with Supergravity Effects," includes 12 papers from this study in its core, more than any other research front. The goal of grand unification theories (GUTs) is to devise a single theoretical framework that accounts for the four fundamental forces of nature—weak nuclear, strong nuclear, electromagnetism, and gravity. Scientists have been successful in proposing a "common denominator" for the electromagnetic and weak nuclear forces, the so-called "electroweak" force. Steven Weinberg, Sheldon Glashow, and Abdus Salam shared the 1979 Nobel prize for physics in recognition of their development of the electroweak theory. However, the strong nuclear force and gravity have yet to be described in a comprehensive GUT.

Ten papers in this study are in the core of a closely related research front

Table 2: The 1982 *SCI*® and 1983 *SCI/SSCI*® research fronts that contain at least two of the 1982 most-cited physical sciences papers as core documents. A=research front number. B=research front name. C=number of 1982 most-cited physical sciences papers included in the core of each research front. D=total number of cited/citing documents.

A	B	C	D
82-0029	Phase transitions in the early universe and the inflationary universe scenario	3	39/NA
83-0019	Electronic structure and other properties of EL2 deep level defects in GaAs, metal-doped silicon and other semiconductors	2	37/342
83-0072	Techniques and applications of fast atom bombardment in desorption and secondary ion mass spectrometry	2	38/379
83-0316	Anisotropy, magnetic and random field effects on the critical behavior of Ising systems in amorphous alloys	2	54/383
83-0319	Magnetic monopoles in a supersymmetric inflationary universe; quantum model of grand unification theory and cosmology	10	49/584
83-0321	Transitions to chaos and dynamic models of bifurcations and convection patterns of maps in nonlinear systems	2	54/594
83-0506	Renormalization group approach in Potts models of percolation and critical behavior in fractal lattices	2	19/314
83-0638	High-energy radio emissions and gamma-ray observation from pulsars and supernovas	2	29/321
83-0683	Models of critical wetting transitions at surfaces	2	17/164
83-0897	Theory and analysis of the two-dimensional quantum Hall effect	4	27/297
83-0966	Monte Carlo methods for lattice gauge theory approaches to quantum chromodynamics	5	53/575
83-1064	Fischer-Tropsch syntheses of hydrocarbons and alcohols via the hydrogenation of carbon monoxide on supported iron catalysts	2	35/376
83-1184	Yang-Mills and other supersymmetric grand unification theories with supergravity effects	12	52/516
83-1782	Critical behavior, magnetic order and dynamical properties of Ising spin glasses	2	34/335
83-2192	Organic metals and superconductors based on tetramethyltetraselenafulvalenium salts	4	26/205
83-2705	Twisted Eguchi-Kawai and other reduced models for large-N lattice gauge theory	3	11/108
83-2788	Determination of electronic structure and surface reconstruction of silicon(111) and other semiconductor surfaces	2	14/167
83-3458	Voyager observations of Saturn's ring, magnetosphere and ice rich satellites with emphasis on Titan and its atmosphere	3	23/265
83-3652	Synthesis via the activation of oxygen and carbon-hydrogen bonds using metalloporphyrins and related compounds as catalysts	2	23/223

(#83-0319) entitled "Magnetic Monopoles in a Supersymmetric Inflationary Universe; Quantum Model of Grand Unification Theory and Cosmology." In a recent article in *New Scientist*, John Gribbin noted, "Inflation has become the buzzword of cosmology in the 1980s because it may offer a solution to several serious, related problems physicists face in understanding the Universe. These boil down to the fact that the Universe is incredibly uniform (homogeneous and isotropic). On the scale of clusters of galaxies, the Universe is the same everywhere we look, and it is expanding evenly."[3]

This research front includes the most-cited, second-most-cited, and fourth-most-cited articles in this study as core documents, an indication that inflationary-universe models are indeed hot topics in physics today. The most-cited article was published in *Physics Letters B* by A.D. Linde, P.H. Lebedev Physical Institute, Moscow. The author described a new inflationary universe model that solves the homogeneity and isotropy problems noted by Gribbin as well as related difficulties involving horizon, flatness, and magnetic monopoles. The paper was cited 33 times in 1982 and 72 times in 1983.

The second-most-cited paper suggests another solution to the homogeneity, flatness, and monopole puzzles. Published in *Physical Review Letters* by Andreas Albrecht and Paul J. Steinhardt, University of Pennsylvania, Philadelphia, the paper received 88 citations—20 in 1982 and 68 in 1983. The fourth-most-cited article was also published in *Physical Review Letters*. Blas Cabrera, Stanford University, California, announced the detection for the first time of a moving magnetic monopole and described the instrument used to observe it. This paper was cited 12 times in 1982 and 71 times in 1983. However, Cabrera has since designed a new instrument and hasn't been able to confirm his 1982 finding. According to *New Scientist*, the "event" Cabrera observed was probably a "spurious cause," not a magnetic monopole.[4]

The third-most-cited paper is part of the core of research front #83-3458, "Voyager Observations of Saturn's Ring, Magnetosphere, and Ice-Rich Satellites with Emphasis on Titan and Its Atmosphere." Bradford A. Smith, University of Arizona, Tucson, and 28 colleagues from 14 institutions published their ob-

Table 3: The 31 journals represented on the list of the 106 1982 physical sciences papers most cited in 1982-1983. The numbers in parentheses are the impact factors for the journals. (1982 impact factor equals the number of citations received by 1980-1981 articles in a journal divided by the number of articles published by the journal during the same period.) Data were taken from the 1982 *JCR* ™. The figures at the right indicate the number of papers from each journal that appears on the list.

Journal	Number of Papers
Phys. Rev. Lett. (6.20)	24
Phys. Lett. B (3.66)	20
Nucl. Phys. B (3.82)	7
Phys. Rev. B—Condensed Matter (3.02)	5
Science (6.81)	5
J. Amer. Chem. Soc. (4.72)	4
J. Phys.—Lett. (2.56)	4
Phys. Rev. D—Part. Fields (2.87)	4
Anal. Chem. (3.71)	3
Astrophys. J. (4.07)	3
IEEE J. Quantum Electron. (3.27)	3
Rev. Mod. Phys. (20.71)	3
Appl. Phys. Lett. (3.10)	2
Nature (8.75)	2
Advan. Organometal. Chem. (7.67)	1
Advan. Phys. (10.61)	1
Angew. Chem. Int. Ed. (4.17)	1
Ann. Phys. NY (2.63)	1
Annu. Rev. Phys. Chem. (7.26)	1
Astron. Astrophys. (2.28)	1
Chem. Phys. Lett. (2.19)	1
Earth Planet. Sci. Lett. (2.75)	1
Electron. Lett. (1.51)	1
J. Magn. Resonance (2.22)	1
Mol. Cryst. Liquid Cryst. (1.16)	1
Mon. Weather Rev. (1.61)	1
Nucl. Phys. A (2.43)	1
Phys. Rep. (6.39)	1
Phys. Rev. A—Gen. Phys. (2.58)	1
Proc. IEEE (2.67)	1
Rep. Progr. Phys. (7.08)	1

Table 4: The institutional affiliations of the authors on the list. Institutions are listed in descending order of the number of times they appear in Table 1.

Univ. California, CA		17
Berkeley	6	
Santa Barbara	4	
Irvine	2	
Los Angeles	2	
San Diego	2	
Santa Cruz	1	
CERN, Geneva, Switzerland		8
Harvard Univ., Cambridge, MA[1]		8
INFN, Italy		7
Frascati	2	
Pisa	2	
Bari	1	
Milan	1	
Rome	1	
MIT, Cambridge, MA		7
Bell Labs, Murray Hill, NJ		6
Univ. Paris XI, Orsay, France		6
Brookhaven Natl. Lab., Upton, NY		5
CalTech, Pasadena, CA		5
IBM, Thomas J. Watson Res. Ctr., Yorktown Heights, NY		5
Max Planck Soc. Adv. Sci., FRG		5
Inst. Phys. Astrophys., Munich	3	
Inst. Aeronom., Katlenburg-Lindau	1	
Inst. Extraterr. Phys., Munich	1	
Cornell Univ., Ithaca, NY[2]		4
Inst. Adv. Stud., Princeton, NJ		4
NASA		4
Goddard Space Flight Ctr., Greenbelt, MD	2	
Ames Res. Ctr., Moffett Field, CA	1	
Headquarters, Washington, DC	1	
Princeton Univ., NJ		4
Stanford Univ., CA		4
Univ. Oxford, UK		4
Univ. Pennsylvania, Philadelphia, PA		4
H.C. Oersted Inst., Copenhagen, Denmark		3
Nippon Telegr. Tel. Publ. Corp., Japan		3
Musashino Elect. Commun. Lab., Tokyo	2	
Ibaraki Elect. Commun. Lab.	1	
Univ. Arizona, Tucson, AZ		3
Univ. Cambridge, UK		3
Univ. Colorado, CO		3
Boulder	2	
Joint Inst. Lab. Astrophys., Boulder[3]	1	
Univ. London, UK		3
Imperial Coll. Sci. Technol.	2	
Univ. Coll.	1	
Univ. Regensburg, FRG		3
Acad. Sci. USSR, Moscow, USSR		2
Inst. Nucl. Res.	1	
P.H. Lebedev Phys. Inst.	1	
Carnegie Inst. Washington, DC[4]		2
CENS, Gif-sur-Yvette, France		2
CNR, Italy		2
Cosm. Phys. Inst., Milan	1	
Cosm. Phys. Data Inst., Palermo	1	
Higher Normal Sch., Pisa, Italy		2
Julich Nucl. Res. Ctr., FRG		2
NBS		2
Boulder, CO	1	
Washington, DC	1	
Normal Coll., Paris, France		2
Oak Ridge Natl. Lab., TN		2
Rome Univ., Italy		2
Stanislaw Staszic Univ. Min. Met., Kracow, Poland		2
SUNY, Stony Brook, NY		2
Univ. Illinois, Urbana, IL		2
Univ. Michigan, Ann Arbor, MI		2
Univ. Texas, Austin, TX		2
USN, Washington, DC		2
Argonne Natl. Lab., IL		1
Brandeis Univ., Waltham, MA		1
Carnegie-Mellon Univ., Pittsburgh, PA		1
CNRS, Grenoble, France		1
DESY, Hamburg, FRG		1
Eotvos Lorand Univ., Budapest, Hungary		1
Eur. Space Agcy., Noordwijk, the Netherlands		1
Ford Motor Co., Dearborn, MI		1
Goddard Inst. Space Stud., New York, NY		1
Griffith Univ., Nathan, Australia		1
Hamburg Univ., FRG		1
Hebrew Univ., Jerusalem, Israel		1
Hoffmann-La Roche, Inc., Nutley, NJ		1
Hungarian Acad. Sci., Budapest, Hungary		1
Huygens Lab., Leiden, the Netherlands		1
Indiana Univ., Bloomington, IN		1
Inst. Phys. Chem. Ind., Paris, France		1
Intl. Ctr. Theor. Phys., Trieste, Italy		1
Jagiellonian Univ., Kracow, Poland		1
Johns Hopkins Univ., Baltimore, MD		1
Kapteyn Astron. Inst., Groningen, the Netherlands		1
Linkoping Inst. Technol., Sweden		1
Madrid Autonom. Univ., Spain		1
Max Von Laue-Paul Langevin Inst., Grenoble, France		1
Michigan State Univ., East Lansing, MI		1
N. Dakota State Univ., Fargo, ND		1
Natl. Lab. High Energy Phys., Ibaraki, Japan		1
Natl. Radio Astron. Observ., Charlottesville, VA		1
New Mexico State Univ., Las Cruces, NM		1
NIKHEE, Nijmegen, the Netherlands		1
NOAA, Washington, DC		1
Northeastern Univ., Boston, MA		1
Ochanomizu Univ., Tokyo, Japan		1
Rand Corp., Santa Monica, CA		1
Rockefeller Univ., New York, NY		1
Rockwell Intl., Thousand Oaks, CA		1
SERC, Chilton, UK		1
Tech. Univ., Braunschweig, FRG		1
Texas A&M Univ., College Station, TX		1
Univ. Bari, Italy		1

Univ. Florida, Gainesville, FL	1
Univ. Geneva, Switzerland	1
Univ. Guelph, Ontario, Canada	1
Univ. Hawaii, Honolulu, HI	1
Univ. Iowa, Iowa City, IA	1
Univ. Liverpool, UK	1
Univ. Manchester, UK	1
Univ. Milan, Italy	1
Univ. New Hampshire, Durham, NH	1
Univ. Nijmegen, the Netherlands	1
Univ. Salamanca, Spain	1
Univ. Tokyo, Japan	1
Univ. Toronto, Canada	1
Univ. Tsukuba, Ibaraki, Japan	1
Univ. Virginia, Charlottesville, VA	1
Univ. Washington, Seattle, WA	1
Univ. Wisconsin, Madison, WI	1
US Geol. Survey, Flagstaff, AZ	1
USC, Tucson, AZ	1
USTL, Montpellier, France	1
Virginia Polytech. Inst. State Univ., Blacksburg, VA	1
Xerox, Palo Alto, CA	1
Yale Univ., New Haven, CT	1
York Univ., Ontario, Canada	1

[1]Includes Harvard-Smithsonian Ctr. Astrophys., Cambridge, MA

[2]Includes Natl. Astron. Ionosph. Ctr., Arecibo, PR

[3]Operated jointly with the Natl. Bureau of Standards, Washington, DC

[4]Includes Mount Wilson Las Campanas Observs., Pasadena, CA

servations in *Science* based on the *Voyager 2* space probe. The paper received 86 citations, 23 in 1982 and 63 in 1983. An earlier paper by Smith was the third-most-cited 1981 physical-sciences paper.[5]

Several other papers in this study also deserve mention. Two papers discuss semiconductor lasers. Charles Henry, Bell Laboratories, Murray Hill, New Jersey, describes a theory of the linewidth of semiconductor lasers. Soichi Kobayashi and colleagues, Nippon Telegraph and Telephone Public Corporation, Japan, published their findings on direct frequency modulation characteristics in semiconductor lasers. One of the uses of semiconductor lasers is in optical fiber technology. Thomas G. Giallorenzi and colleagues, USN, Washington, DC, reviewed the current state of the art of optical fiber technology and its future applications, in a paper cited 34 times in 1982 and 1983. All three papers appeared in *IEEE Journal of Quantum Electronics*.

H.T. Fortune, University of Pennsylvania, Philadelphia, points out[6] that the most-cited papers in physical sciences appear to include some of the most-read papers outside their particular specialty. That is, most physicists read papers on cosmology and new elementary particles, even if they are not working in these areas of physical sciences.

The 106 papers in this study were published in the 31 journals listed in Table 3. Just three journals account for 48 percent of the papers: *Physical Review Letters* (24 papers), *Physics Letters B* (20 papers), and *Nuclear Physics B* (7 papers). The same journals dominated our 1981 study.[5]

The authors of the most-cited 1982 physical-sciences papers were affiliated with 105 institutions located in 17 nations (see Table 4). The University of California accounts for 12 papers in the study. CERN, the multinational research organization based in Geneva, was represented in eight papers, an increase over our 1981 study.[5] It is noteworthy that the recent Nobel prize in physics was based on work done at CERN. Carlo Rubbia and Simon van der Meer, CERN, shared the 1984 Nobel prize in physics.

Table 5 lists the national affiliations of the 420 authors in this study, in order of the number of papers on which each nation's authors were listed. For example, 66 papers listed US authors. Of these, 55 were by US authors *only* and 11 were coauthored with researchers based in Canada, France, the Federal Republic of Germany (FRG), Italy, Japan, the Netherlands, Spain, and the UK. Six papers listed authors from Japan. In comparison, Japan accounted for just one of the most-cited 1981 physical-sciences papers.[5] Although authors from 17 nations

Table 5: National affiliations of the authors of the 1982 physical sciences papers most cited in 1982-1983, in order of the total number of papers in which each nation's authors appeared (column A). B = number of papers coauthored with scientists from other countries. C = nationality of coauthors.

Country	A	B	C
US	66	11	Canada, France, FRG, Italy, Japan, the Netherlands, Spain, UK
France	12	7	Denmark, FRG, Israel, Italy, the Netherlands, Switzerland, US
FRG	11	6	France, Italy, Japan, the Netherlands, Poland, Spain, Switzerland, UK, US
UK	10	6	Canada, FRG, Italy, the Netherlands, Poland, Spain, Switzerland, US
Switzerland	8	5	France, FRG, Hungary, Italy, the Netherlands, Poland, UK
Italy	8	7	France, FRG, the Netherlands, Poland, Switzerland, UK, US
Japan	6	3	FRG, US
Canada	3	2	UK, US
Denmark	3	2	France
the Netherlands	3	3	France, FRG, Italy, Poland, Switzerland, UK, US
Spain	2	2	FRG, UK, US
USSR	2	0	
Australia	1	0	
Hungary	1	1	Switzerland
Israel	1	1	France
Poland	1	1	FRG, Italy, the Netherlands, Switzerland, UK
Sweden	1	0	

are represented here, all the articles were in English.

Of the 420 authors in Table 1, 400 contributed one paper and 12 have two papers. Eight authors were listed on three papers each: K. Bechgaard, S. Ferrara, L. Girardello, A.C. Gossard, L. Ibanez, D. Jerome, D.V. Nanopoulos, and D.C. Tsui.

Twenty-seven papers are single-author works. In our study of 1981 papers,[5] just 12 listed one author. Twenty-five papers list two authors, 18 list three, 13 list four, 9 list five, 5 list six, and 2 list seven authors. One paper each lists 9, 13, 15, 16, 29, 38, and 56 authors. It is not unusual for high-energy physics papers to list scores of authors.

This concludes our analysis of the 1982 physical-sciences papers that were most cited in 1982 and 1983. Although several chemistry papers were cited enough to meet the threshold in this study, at least three years of citation data are needed to detect some of the most-significant chemistry papers. Different scientific fields have different "diffusion" rates. That's why we treat each field separately in these studies. More will be said on this point and other forms of delayed recognition in our essay on the 1981 chemistry papers most cited between 1981 and 1983.

* * * * *

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