

# James Cummings

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**Citizenship:** British.

**Immigration status:** Permanent resident of USA.

**Date of Birth:** 9 May 1961.

## Education:

B.A.(Honours) in Mathematics	Cambridge University, Jun 1983
Certificate of Advanced Study in Mathematics	Cambridge University, Jun 1984
Ph.D. in Mathematics	Cambridge University, Dec 1988

**Ph.D. thesis:** “Consistency results on cardinal exponentiation”.

**Ph.D. advisors:** Adrian Mathias (Cambridge 1984-86), Hugh Woodin (Caltech 1986-88).

## Postgraduate experience:

Member	MSRI, Berkeley	1989–1990
Instructor	MIT	1990–1991
Instructor	Dartmouth College	1991–1993
Postdoctoral Fellow	Hebrew University	1993–1995
Visiting Lecturer	MIT	1/1996–6/1996
Visiting Assistant Professor	Carnegie Mellon	7/1996–9/1997
Assistant Professor	Carnegie Mellon	10/1997–7/2000
Associate Professor	Carnegie Mellon	8/2000–7/2001
Tenured Associate Professor	Carnegie Mellon	8/2001–present

**Research interests:** Set theory and mathematical logic, with an emphasis on large cardinals, forcing and inner models. Also interested in finite combinatorics and in applications

of logic to algebra, analysis and computer science. See attached Research Statement.

### **Teaching Experience:**

1984-86: Supervisor (Cambridge University). Tutored undergraduates at all levels in pure mathematics.

1990-91: Instructor (MIT). Recitation instructor for undergraduate courses in multivariable calculus, linear algebra and differential equations. Instructor for graduate course in mathematical logic.

1991-93: Instructor (Dartmouth). Instructor for undergraduate courses in calculus, abstract algebra and set theory. Instructor for graduate courses in set theory and model theory.

1996-present: Assistant/Associate Professor (CMU). Instructor for undergraduate courses in calculus, abstract algebra, logic, combinatorics, topology, and symbolic programming. Instructor for graduate courses in set theory and abstract algebra. Active in course creation and curricular reform, see Section V.

### **Publications (in print):**

- 1) A model in which GCH holds at successors but fails at limits. *Trans. Amer. Math. Soc.* 329 (1992), no. 1, 1–39.
- 2) Strong ultrapowers and long core models. *J. Symbolic Logic* 58 (1993), no. 1, 240–248.
- 3) Possible behaviours for the Mitchell ordering. *Ann. Pure Appl. Logic* 65 (1993), no. 2, 107–123.
- 4) Possible behaviours for the Mitchell ordering. II. *J. Symbolic Logic* 59 (1994), no. 4, 1196–1209.
- 5) Coherent sequences versus Radin sequences. *Ann. Pure Appl. Logic* 70 (1994), no. 3, 223–241.
- 6) (with Saharon Shelah) A model in which every Boolean algebra has many subalgebras. *J. Symbolic Logic* 60 (1995), no. 3, 992–1004.
- 7) (with Saharon Shelah) Cardinal invariants above the continuum. *Ann. Pure Appl. Logic* 75 (1995), no. 3, 251–268.
- 8) (with Mirna Džamonja and Saharon Shelah) A consistency result on weak reflection. *Fund. Math.* 148 (1995), no. 1, 91–100.
- 9) Collapsing successors of singulars. *Proc. Amer. Math. Soc.* 125 (1997), no. 9, 2703–2709.
- 10) Souslin trees which are hard to specialise. *Proc. Amer. Math. Soc.* 125 (1997), no. 8, 2435–2441.
- 11) (with Matthew Foreman) The tree property. *Adv. Math.* 133 (1998), no. 1, 1–32.
- 12) Large cardinal properties of small cardinals (survey paper). *Set theory* (Curacao, 1995;

Barcelona, 1996), 23–39, Kluwer Acad. Publ., Dordrecht, 1998.

13) (with Saharon Shelah) Some independence results on reflection. *J. London Math. Soc.* (2) 59 (1999), no. 1, 37–49.

14) (with Arthur Apter) A global version of a theorem of Ben-David and Magidor. *Ann. Pure. Appl. Logic* 102 (2000), 199–222.

15) (with Arthur Apter) Identity crises and strong compactness. *J. Symbolic Logic* 65 (2000), no. 4, 1895–1910.

16) (with Arthur Apter) Identity crises and strong compactness II: strong cardinals. *Arch. Math. Logic* 40 (2001), no. 1, 25–38.

17) (with Matthew Foreman and Menachem Magidor) Squares, scales and stationary reflection. *J. Math. Log.* 1 (2001), no. 1, 35–98.

18) (with Arthur Apter) Blowing up the power set of the least measurable. *J. Symbolic Logic* 67 (2002), no. 3, 915–923.

19) (with Ernest Schimmerling) Indexed squares. *Israel J. Math.* 131 (2002), 61–99.

20) (with Matthew Foreman and Menachem Magidor) The non-compactness of square. *J. Symbolic Logic* 68 (2003), no. 2, 637–643.

21) (with Matthew Foreman and Menachem Magidor) Canonical structure in the universe of set theory. I. *Ann. Pure Appl. Logic* 129 (2004), no. 1-3, 211–243.

22) (with Ernest Schimmerling) Diamond and antichains. *Arch. Math. Logic* 44 (2005), no. 1, 71–76.

23) Compactness and incompactness phenomena in set theory. *Logic Colloquium '01*, 139–150, *Lect. Notes Log.*, 20, Assoc. Symbol. Logic, Urbana, IL, 2005.

24) Notes on singular cardinal combinatorics. *Notre Dame J. Formal Logic* 46 (2005), no. 3, 251–282

25) (with Matthew Foreman and Menachem Magidor) Canonical structure in the universe of set theory. II. *Ann. Pure Appl. Logic* 142 (2006), no. 1-3, 55–75.

26) (with Uri Abraham and Cliff Smyth) Results in polychromatic Ramsey theory. *J. Symbolic Logic* 72 (2007), no 3, 865–896.

27) (with Arthur Apter and Joel Hamkins) Large cardinals with few measures. *Proc. Amer. Math. Soc.* 135 (2007), 2291–2300.

28) (with Natasha Dobrinen) The hyper-weak distributive law and a related game in Boolean algebras. *Ann. Pure Appl. Logic* 149 (2007), 14–24.

### **Publications (to appear):**

1) (With Arthur Apter) An L-like model containing very large cardinals. To appear in *Arch. Math. Logic*

<http://www.math.cmu.edu/users/jcumming/papers/>.

### **Invited talks since 1996:**

“Collapsing successors of singulars”. Jan 1996, Set Theory Meeting, Mathematische Forschungsinstitut, Oberwolfach.

A course of lectures on “Large cardinal properties of small cardinals”. Jun 1996, Set Theory Meeting, CRM, Barcelona.

“Prikry forcing and strong weak square”. Jan 1997, Set theory special session, AMS Winter Meeting, San Diego.

“A global version of a theorem of Ben-David and Magidor”. Apr 1997, Association for Symbolic Logic Spring Meeting, MIT.

A course of lectures on “Singular Cardinal Problems” Sep 1998, Workshop in Set Theory, CIRM Marseilles.

“Condensation coherent squares and mutual stationarity”. Oct 1998, Set theory special session, AMS Sectional Meeting, PSU.

“Ubiquitous Prikryness”. Nov 1999, NYC logic conference at the CUNY Graduate Centre,

“Tight structures”. Dec 1999, Set Theory Meeting, Mathematische Forschungsinstitut, Oberwolfach.

“What do modern set theorists do, exactly?” Jan 2000, Set theory special session, AMS Winter Meeting, Washington DC.

“Club guessing, change of cofinality and weak square sequences”. Sep 2000, Workshop in Set Theory, CIRM Marseilles.

“Subcompactness, quasicompactness and stationary reflection”. Mar 2001, Set theory special session, AMS Sectional Meeting, Upenn Philadelphia.

“Compactness for the strong non-reflection principle via PCF”. Mar 2001, Boise set theory meeting, Boise State University.

“Square compactness and a cheap argument that not every point is necessarily good”. Apr 2001, Southeastern logic symposium, University of Florida at Gainesville.

“Compactness and incompactness phenomena in set theory”, Aug 2001, plenary talk at 2001 Logic Colloquium in Vienna.

“Quasicompactness, subcompactness and dense non-reflection”. Aug 2001, set theory workshop, Kurt Gödel logic centre, Vienna.

“Is it good to be approachable?”. Oct 2001, UCLA Logic Colloquium.

“Where do the squares end?”. Oct 2001, UC Irvine Logic Seminar.

“Scales and squares”. April 2002, Penn State Logic Seminar.

“More singular cardinal combinatorics”. Sep 2002, Set theory workshop, CIRM, Marseille.

“Uniform structures”. Mar 2003, Southeastern Logic Symposium, University of Florida.

“PCF, mutual stationarity and fine structure”. Oct 2003, Baumgartner Festschrift, Dartmouth College.

“More on PCF, mutual stationarity and fine structure”, Jan 2004, Set theory special session, Association of Symbolic Logic meeting, Phoenix.

A series of lectures on “Consistency results in singular cardinal combinatorics”. May 2004, Singular Cardinal Combinatorics meeting, Banff International Research Station.

“The PCF structure in a model of Gitik”. Sep 2004, Set theory workshop, CIRM, Marseille.

“Quasicompactness and reflection”. Oct 2004, North Texas Logic Conference, UNT Denton.

“Rainbow Ramsey theory”. May 2005, NYC logic conference, CUNY graduate center.

“More Rainbow Ramsey theory”. Dec 2005, Set theory workshop, MFO Oberwolfach.

A series of lectures on “Independence results in Rainbow Ramsey theory”. June 2006, Kurt Gödel logic centre, Vienna.

“Square on singulars”. Sep 2006, Set theory workshop, CIRM, Marseille.

“PCF in a diagonal Prikry extension”. Mar 2007, Singular Cardinal Combinatorics and Inner Model Theory workshop, University of Florida.

“Advising undergraduate honours theses in logic”. Mar 2007, Special session on undergraduate research in logic, Association for Symbolic Logic meeting, University of Florida.

“The extent of square on singulars”, May 2007, UC Irvine Logic Seminar.

“Prikry extensions”, Jul 2007, First European Set Theory Meeting, IMPAN Bedlewo.

“Full reflection”, Oct 2007, Foremanfest, UCLA.

“Reflection”, Jan 2008, Set theory workshop, MFO Oberwolfach.

### **Professional service outside CMU:**

Reviewer/referee for National Science Foundation, US-Israel Binational Science Foundation, Journal of Symbolic Logic, Annals of Pure and Applied Logic, Israel Journal of Math-

ematics, London Mathematical Society journals, American Mathematical Society Journals, Journal of Combinatorial Theory.

Organiser for January 2001 meeting of the Association for Symbolic Logic in New Orleans, October 2002 meeting of the Mid-Atlantic Mathematical Logic Seminar at CMU, May 2004 meeting of the Association for Mathematical Logic at CMU, February 2006 Magidor Festschrift at UC Irvine.

Organiser (with Ernest Schimmerling) of “Appalachian set theory”, an innovative series of one day minicourses in set theory funded by NSF. Initial grant period 2006-2009.

### **Grants:**

Grant from the Faculty Development Fund at CMU. Spring 1997.

Grant from the Volkswagen-Stiftung to visit the Mathematisches Forschungsinstitut at Oberwolfach. Summer 1997.

Grant from the Ben-Gurion University of the Negev to visit Beersheva. Summer 1997.

PI on NSF Grant DMS-9703945 (grant period 7/1997–6/2000, amount \$73919).

Recipient of NATO Collective Linkage Grant PST.CLG 975324 (along with Arthur Apter, Mirna Dzamonja, Joel Hamkins, Peter Komjath, Charles Morgan and Philip Welch).

PI on NSF Grant DMS-0070549 (grant period 5/2000-4/2003, amount \$76602). A supplement funded my graduate student John Krueger in the amount of \$36717.

PI on NSF Grant DMS-0400982 “Problems in combinatorial set theory” (grant period 8/2004-7/2007, amount \$100063).

co-PI with Ernest Schimmerling on NSF Grant DMS-0631446 “Appalachian set theory” (grant period 10/2006-9/2009, amount \$45000).

Grant from the University of Vienna to spend six weeks as a Distinguished Visiting Researcher at the Kurt Gödel Logic Centre. Summer 2006.

PI on NSF Grant DMS-0654046 “Combinatorial set theory” (grant period 8/2007-7/2010, amount \$124036).

Grant from the University of Vienna to spend two weeks as a Visiting Professor at the Kurt Gödel Logic Centre. Summer 2007.

### **Committee work:**

Departmental: Graduate admissions committee 1997–2001. Undergraduate curriculum reform committee 2002–2004. ACO recruiting committee 2006-2007. Chair of website committee 2007-2008.

College: MCS website committee 1999-2000. Adhoc committee on non-tenured promotions 2000-2001 and 2007-2008.

University: Adhoc committee on non-tenured promotions 2001-2002.