

## Joel R. Primack

### Distinguished Professor of Physics Emeritus, University of California, Santa Cruz

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**Education:** Princeton University A.B. 1966 Physics (Summa cum Laude, Valedictorian); Stanford University PhD 1970 Physics

**Academic Positions:** Junior Fellow, Society of Fellows, Harvard University 1970-73. Assistant Professor of Physics, UCSC 1973-1977; Associate Professor of Physics, UCSC, 1977-1983; Professor of Physics, UCSC 1983-present; Distinguished Professor 2007-; Emeritus 2014-. Chair, UCSC Committee on Educational Policy, 1992-94; Chair, UCSC Committee on Computing and Telecommunications, 2008- 2011; Chair, University Committee on Computing and Communications, 2010-12; Director, University of California systemwide High-Performance Astro-Computing Center (UC-HiPACC), 2010-2015, including organizing annual AstroComputing Summer Schools

**Advice** (partial list): SAGENAP advisory panel to DOE/NSF 2000-2001; NSF Astronomy Theory Review Panel 2000; DOE Lehman Review of SNAP Proposal 2001; Chair, NASA Cosmology panel on LTSA and ADP 2001; Cosmology Panel, Hubble Space Telescope Time Allocation Committee 2003, 2017; Editorial Board, Journal of Cosmology and Astroparticle Physics 2003-06; National Academy Beyond Einstein panel, 2006-07; National Academy Review of NASA Technology Roadmap, 2010-11

**American Physical Society activities** (partial list): Executive Committee, APS Division of Astrophysics, 2000-2002; APS Panel on Public Affairs (POPA) 2002-2004; Chair, POPA Task Force on Moon-Mars Program and Funding for Astrophysics 2004; Chair, APS Forum on Physics and Society 2005; Chair, APS Sakharov Prize committee 2009; Chair-Elect, APS Forum on Physics and Society, 2017-18, Chair 2019

**Outreach** (partial list): Smithsonian National Air and Space Museum, Advisory Committee on *Cosmic Voyage* IMAX film, 1994-1996. Co-organizer, "Cosmic Questions" Conference, Smithsonian Museum of Natural History, Washington, DC, April 14-16, 1999. Over 100 public lectures on cosmology, including Sackler Lecture (UC Berkeley, 2006); J. Robert Oppenheimer Memorial Lecture (Los Alamos, 2007); APS Public Lecture (St. Louis, 2008); Terry Lectures (with Nancy Abrams, Yale, 2009). TV documentaries including [Inside the Milky Way](#).

**Honors** (partial list): A. P. Sloan Foundation Research Fellowship, 1974-1978  
American Physical Society Forum on Physics and Society Award, 1977; Fellow, 1988  
American Association for the Advancement of Science, Fellow, 1995  
Humboldt Senior Award of the Alexander von Humboldt Foundation, 1999  
California Academy of Sciences, Fellow, 2009  
Spirit of Rustum Roy Award, Chopra Foundation, 2012  
Leo Szilard Lectureship Award of the American Physical Society, 2016  
President, Sigma Xi (Scientific Research Honor Society), 2018-19

### Books

- Joel R. Primack and Frank von Hippel, *Advice and Dissent: Scientists in the Political Arena* (New York: Basic Books, 1974; New American Library, 1976) [http://physics.ucsc.edu/~joel/Advice\\_and\\_Dissent.pdf](http://physics.ucsc.edu/~joel/Advice_and_Dissent.pdf)
- Joel R. Primack and Nancy Ellen Abrams, *The View from the Center of the Universe: Discovering Our Extraordinary Place in the Cosmos* (New York: Riverhead/Penguin, 2006; London: HarperCollins, 2006; Paris: Laffont, 2008; and other foreign editions) <http://viewfromthecenter.com/>
- Nancy Ellen Abrams and Joel R. Primack, *The New Universe and the Human Future: How a Shared Cosmology Could Transform the World* (Yale University Press, 2011; Barcelona: Antoni Bosch, 2013) <http://new-universe.org/>; <http://www.el-nuevo-universo.com/>

**Papers** Over 450 scientific papers, over 29,000 citations, h-index = 79; plus many popular articles in *American Scientist*, *IEEE Spectrum*, *Scientific American*, *Science*, *Sky & Telescope*, etc., and contributions to TV and planetarium shows. [https://scholar.google.com/scholar?q=%22Primack,+Joel%22&hl=en&as\\_sdt=1,5&as\\_vis=1](https://scholar.google.com/scholar?q=%22Primack,+Joel%22&hl=en&as_sdt=1,5&as_vis=1)

Primack is best known for helping to create the modern cosmological standard model,  $\Lambda$ CDM. He was the first to propose that the lightest supersymmetric partner particle is a natural candidate for the dark matter particle (Pagels & Primack 1982), which led to warm dark matter (Blumenthal, Pagels, Primack 1982) and then cold dark matter (Primack & Blumenthal 1983; Blumenthal, Faber, Primack, Rees 1984; Primack 1984). Subsequent work:

- **baryonic contraction of dark matter galactic halos** (Blumenthal, Faber, Flores, & Primack 1986)
- **how to discover dark matter** (Primack, Seckel, & Sadoulet, Annual Rev. Nuclear & Particle Physics 1988)
- calculations of **linear power spectra for many CDM variants** (John Holtzman's 1989 dissertation based on Blumenthal & Primack 1983 code, and comparison with observations Holtzman & Primack 1993)
- **dynamical effects of a cosmological constant**, including on the growth rate of structure (Lahav, Lilje, Primack, & Rees 1991)
- **cosmological structure formation simulations** on CDM variants Cold + Hot Dark Matter (Klypin et al. 1993, Primack et al. 1995) and LCDM (Klypin, Primack, & Holtzman 1996) **compared with observations**
- **conflicts between steep central dark matter halo profiles in dark matter simulations vs. observations** of dwarf galaxies and galaxy clusters (Flores & Primack 1994, based on Ricardo Flores dissertation research with Primack)
- improvements in **semi-analytic modeling of the galaxy population** (Rachel Somerville's thesis paper Somerville & Primack 1999; also Somerville, Primack & Faber 2001 and many subsequent papers including Somerville et al. 2012, Gilmore et al. 2012, Porter et al. 2014ab, Brennan et al. 2015, Pandya et al. 2017)
- **semi-analytic modeling of damped Ly $\alpha$  systems** (Ari Maller's dissertation papers with Prochaska, Somerville, and Primack 2000-2002)
- **dark matter halo concentration evolution and angular momentum distribution** (Primack's grad student James Bullock's dissertation papers with Avishai Dekel, Anatoly Klypin, and Primack 2001)
- **dark matter halo assembly history and angular momentum evolution** (Primack's grad student Risa Wechsler's dissertation papers with Avishai Dekel, Anatoly Klypin, and Primack 2002)
- **halo occupation distribution and predicted evolution of the galaxy two-point correlation function** (Kravtsov et al. 2004), subsequently shown to have correctly predicted observed galaxy correlations
- **Gini-M20 non-parametric classification of galaxy images** (Lotz, Primack, & Madau 2004 and many subsequent papers, including observability timescales for morphological indications of galaxy mergers (Lotz, Jonsson, Cox, and Primack 2008, 2011ab) used for measurement of **galaxy merger rates** compared with theory (Lotz et al. 2011)
- **shapes of dark matter halos** (Brandon Allgood's dissertation paper with Primack, 2006)
- the **Sunrise code for producing images from galaxy simulations** including the effects of stellar evolution and dust scattering, absorption, and re-emission of light (Patrik Jonsson's dissertation and postdoc research with Primack, 2002-2010; papers with Greg Snyder and Raymond Simons, 2015-2018)
- high-resolution **Bolshoi cosmological simulations compared with observations** (Klypin, Trujillo-Gomez, & Primack 2011, Trujillo-Gomez, Klypin, Primack, Romanowsky 2011, Prada et al. 2012, with analyses by Peter Behroozi, Mike Busha, Risa Wechsler et al. 2012, and the Klypin-Primack *Bolshoi-Planck* simulations 2016, Halo Demographics Rodriguez-Puebla et al. 2016, Galaxy-Halo Connection Rodriguez-Puebla 2017)
- **high-resolution hydrodynamic cosmological galaxy simulations**, including roles of cold streams and violent disk instabilities, compared with HST CANDELS survey (papers with Daniel Ceverino, Avishai Dekel, Sandra Faber, Anatoly Klypin, Nir Mandelker, Sandro Tacchella, Matteo Tomassetti, Adi Zolotov, et al. 2010-)
- **deep learning for galaxies**, papers published & in preparation in collaboration with Marc Huertas-Company

**Scientific leadership** Primack led in creation of the Congressional Science and Technology Fellowship Program, the American Physical Society (APS) Forum on Physics and Society, APS studies on public policy issues, NSF Science for Citizens Program, AAAS Science and Human Rights program