

Physics 80C, COSMOLOGY AND CULTURE, Spring Quarter 2002 DRAFT Syllabus

Instructors:

Nancy Ellen Abrams, Lecturer [nancy@physics.ucsc.edu](mailto:nancy@physics.ucsc.edu)  
Joel R. Primack, Professor of Physics [joel@physics.ucsc.edu](mailto:joel@physics.ucsc.edu)

Guest lecturers:

Triloki Nath Pandey, Professor of Anthropology [pandey@cats.ucsc.edu](mailto:pandey@cats.ucsc.edu)  
Brant Secunda, Huichol shaman, Dance of the Deer Foundation, Soquel

Course description: Introduction to scientific cosmology. Examination of cultural roles of creation myths and cosmologies; examples include Huichol, Zuni, Hindu, and ancient, medieval, and modern Western cosmologies. Possible cultural and religious repercussions of Big Bang and other modern origin stories.

Requirements satisfied: Topical in Natural Sciences or Social Sciences (T7).

Format: Lecture course, Tuesday-Thursday, 2 - 3:45 PM, Earth and Marine Sciences Building, rm. B210. Required readings are all in Reader Vol. 1, Cosmic Questions CD-ROM, and book by Thuan. Optional readings are in Reader Vol. 2, Cosmic Questions CD-ROM, and book by Hogan. In-class midterm examination. Several writing assignments. Take-home final examination.

Enrollment: requires permission of instructors based on 200-300 word essay on why you want to take this course, which should be submitted by email to [nancy@physics.ucsc.edu](mailto:nancy@physics.ucsc.edu)

REQUIRED BOOKS (at Bay Tree Bookstore, UCSC):

Cosmology and Culture Reader, Vol. 1.

James Miller, ed., Cosmic Questions CD-ROM (printed version: Annals of the New York Academy of Sciences, Vol. 950, December 2001), based on Cosmic Questions conference, April 14-16, 1999, National Museum of Natural History, Washington, D.C.

Trinh Xuan Thuan, The Birth of the Universe: the Big Bang and Beyond, translated from the French by I. Mark Paris (Harry N. Abrams, Inc., 1993) \$12.95.

OPTIONAL (at Bay Tree Bookstore, UCSC):

Cosmology and Culture Reader, Vol. 2.

Craig Hogan, The Little Book of the Big Bang: a Cosmic Primer (Copernicus Books, Springer-Verlag, 1998) \$20.

Nancy Ellen Abrams, Alien Wisdom music CD (Expanding Universe Productions, 2001) \$15.95.

## SYLLABUS (weekly topics)

I March 26 and 28: Introduction to Cosmology and Culture. Overview of Biblical, Medieval, Newtonian, and contemporary scientific cosmologies. Some ways to picture the universe. Contemplation as a way of absorbing counterintuitive concepts. Anthropological approaches to cosmology.

### READINGS FOR THIS WEEK'S CLASSES:

Nancy Ellen Abrams and Joel R. Primack, "Cosmology and 21st Century Culture," *Science*, Vol. 293, pp. 1769-1770 (7 September 2001)

Joel R. Primack\* and Nancy Ellen Abrams\*, "Cosmic Questions: An Introduction," including "The Hubble Deep Field Animation," Cosmic Questions CD-ROM

Evan Hadingham, *Early Man and the Cosmos* (Univ. of Oklahoma Press, 1985), Chronological Table, p. xi; "Ancient Astronomy and the Roots of Science," pp. 10-29

Joseph Campbell, *Inner Reaches of Outer Space*, pp. 11-35; 55-62

Bronislaw Malinowski, "The Role of Myth in Life," "Myths of Origin," *Magic, Science and Religion, and Other Essays* (Doubleday Anchor, 1954), pp. 96-117

[Optional: Mircea Eliade, *Myths, Dreams, and Mysteries* (Harper, 1960), pp. 155-189]

[Optional: Jaroslav Pelikan, "Athens and/or Jerusalem: Cosmology and/or Creation," Cosmic Questions CD-ROM\*]

II April 2 and 4: The Big Bang and expansion of the universe. Mythic dimensions of these ideas.

### READINGS:

Joel R. Primack, "Cosmological Certainty: Astrophysics in the New Millennium," *California Wild* (magazine of the California Academy of Sciences), Winter 2000, pp. 34-39

Sandra M. Faber\*, "The Big Bang as Scientific Fact," Cosmic Questions CD-ROM

Edward (Rocky) Kolb\*, "A Recipe for Primordial Soup," Cosmic Questions CD-ROM

[Optional: Hogan, Chs. 1 "The Big Picture" and 2 "A Survey of Space and Time"]

[Optional: *Cosmology: A Research Briefing*, National Research Council Board on Physics and Astronomy (National Academy Press, 1995), p. 1-11]

[Optional: Virginia Trimble, "Cosmology: Where in the Universe Are You?" *Beam Line*, Fall 1997, pp. 52-60]

III April 9 and 11: The concept of "truth" in science and religion.

Ancient cosmologies and cultures of the Middle East. Old and new elements in the Hebrew creation myths.

### READINGS:

Robert J. Russell\*, "Did God Create Our Universe?" Cosmic Questions CD-ROM

Albert Einstein, "Religion and Science," "Science and Religion," *Ideas and Opinions* (Crown, 1982), pp. 36-49

Nancy Ellen Abrams and Joel R. Primack, "Einstein's View of God," in Russell Stannard, ed., *God for the 21st Century* (Templeton Foundation Press, 2000), pp. 153-156

Steven Weinberg, "The Giant and the Cow," and "Epilogue: The Prospect Ahead," *The First Three Minutes* (Basic Books, 1977), pp. 3-10, 150-155

Genesis 1:1-3:24, 6:1-9:19, *The Oxford Annotated Bible with the Apocrypha*, Herbert G. May and Bruce M. Metzger, eds. (Oxford Univ. Press, 1965), pp. xxi-xxiv, 1-11

Richard Elliot Friedman, *Who Wrote the Bible?* (Harper & Row, 1987), pp. 50-61, 236-8

"The Story of the Flood," *The Epic of Gilgamesh*, translation by N.K. Sandars, (Penguin Classics, 1960), pp. 105-110

Thorkild Jacobsen, "Enuma Elish-The Babylonian Genesis," Milton Munitz, ed., *Theories of the Universe* (Free Press, 1957), pp. 8-20

[Optional: Richard Elliott Friedman, "Big Bang and Kabbalah," *The Disappearance of God* (Little, Brown, 1995), pp. 219-237]

[Optional: Michael Coogan, *Stories from Ancient Canaan* (Westminster, 1978), pp. 9- 25, 75-115]

[Optional: E.M. Wilmot-Buxton, "How All Things Began," *The New Junior Classics*, Vol. III (P.F. Collier & Son, 1952), pp. 253-260 (Icelandic creation saga)]

[Optional: W.M.L. Hutchinson, "Prometheus the Firebringer," *The New Junior Classics*, Vol.III (P.F. Collier & Son, 1952), pp. 13-25]

IV April 16 and 18: Living, earth-centered cosmologies in traditional cultures. Guest lecture by Huichol shaman Brant Secunda. Possible relationship of such a cosmology to scientific cosmology. Contemplation.

#### READINGS:

Nancy Ellen Abrams, "A Shamanic Doorway to the Expanding Universe?" (unpublished)  
Brant Secunda, "Dreamers of the Sun: Huichol Shamanism," *Enlightenments*, Oct. 1993, pp.18-19

Triloki Pandey, "The Zuni View of Nature," in *Prakrti: Integral Vision*, Vol. 5, ed. Saraswati (Indira Gandhi National Center for the Arts, New Delhi, 1995), pp. 157-167

"Hymn of Creation," in *Vedic Reader*, ed. Arthur MacDonell (Oxford UP, 1972), pp. 207-211

Jon Kabat-Zinn, *Full Catastrophe Living* (Dell, 1991), pp. 153-7

Thomas Keating, *Open Mind, Open Heart: the Contemplative Dimension of the Gospel* (Amity House, Inc., 1986), pp. 19-20, 33-37

Aryeh Kaplan, *Jewish Meditation: a practical guide* (Schocken Books, 1985), pp. 64- 75

[Optional: Brant Secunda, "Journey to the Heart" (2 pages); Rochelle Gordon, "Places of Power: an interview with Huichol Shaman Brant Secunda," *Body Mind Spirit*, July/Aug 1994, pp. 39-42]

[Optional: Anindita N. Balslev\*, "The Idea of a Beginningless World-Process: Perspectives from the Hindu Tradition," *Cosmic Questions CD-ROM*]

V April 23 and 25: The modern creation story: cosmic evolution. Modern scientific view of stars and galaxies. Picturing the universe as a whole, from the edge of the universe to the smallest size possible according to relativity and quantum mechanics.

#### READINGS:

Thuan, Ch. II "The Realm of the Galaxies," Ch. III "The Big Bang," and Ch. IV "The Life and Death of Stars"

Sheldon Glashow, "Life on Log Time," and excerpt from "What Is an Elementary Particle?" *The Charm of Physics* (American Institute of Physics), pp. 42-54, 109-113

Nancy Ellen Abrams and Joel R. Primack, "What is the Universe?" and "The Cosmic Serpent Swallows Its Tail" (draft chapters from unpublished manuscript of a book in progress, *The Universe, The Earth, and You*)

J. B. S. Haldane, "On Being the Right Size," *On Being the Right Size* (Oxford University Press, 1985), pp. 1-8

Michael LaBarbera, "The Strange Laboratory of Dr. LaBarbera," University of Chicago Magazine, October 1996, pp. 18-24

Alan Watts, excerpt from *In My Own Way* (Pantheon, 1972), pp. 376-377

[Optional: *Cosmology: A Research Briefing*, pp. 12 - 40]

[Optional: Hogan, Chs. 3 "A Summary of Physics," 4 "The Cosmic Expansion," 5 "Cosmic Background Radiation," and 6 "Primordial Matter"]

VI April 30 and May 2: Medieval Christian and Jewish cosmologies. Cultural impacts of the Copernican-Newtonian revolution.

READINGS:

C. S. Lewis, "The Heavens," *The Discarded Image* (Cambridge, 1967), pp. 92-121

Daniel Matt, *The Essential Kabbalah* (Harper San Francisco, 1995), pp. 1-19

Daniel Matt, trans., *Zohar: the Book of Enlightenment* (Paulist Press, 1983), pp. 43-45, 49-53, notes pp. 204-214

Owen Gingerich\*, "Scientific Cosmology Meets Western Theology: A Historical Perspective," *Cosmic Questions CD-ROM*

Isaac Newton, "Letter to Richard Bentley," Milton Munitz, ed., *Theories of the Universe* (Free Press, 1957), pp. 211-214

Nancy Ellen Abrams and Joel R. Primack, "Scientific Revolutions in Cosmology: Overthrowing vs. Encompassing" in Willian Stoeger, ed., *Philosophy in Science*, Vol. 9, pp. 75-96 (Pachart Press, 2001)

[Optional: Richard S. Westfall, "Newton and the Scientific Revolution," *Newton's Dream* (McGill: Queen's Univ. Press, 1988), pp. 4-18]

[Optional: Thomas S. Kuhn, "The Ancient Two-Sphere Universe" (excerpt), "The Assimilation of Copernican Astronomy," *The Copernican Revolution* (Vintage, 1959), pp. 1-8, 185-228]

[Optional: Lawrence Kushner\*, "What Did the Mystic Say to the Hot Dog Vendor? Six Neo-Kabbalistic Metaphors for Cosmic Design," *Cosmic Questions CD-ROM*]

VII May 7 and 9: What happened before the Big Bang? Inflation and eternal inflation. Connections with medieval Jewish mysticism (Kabbalah). MIDTERM EXAM (45 minutes, in class May 9, notes and books allowed)

READINGS (to be done by May 7):

Alan H. Guth\*, "Eternal Inflation," *Cosmic Questions CD-ROM*

Joel R. Primack and Nancy Ellen Abrams, "In A Beginning...Quantum Cosmology and Kabbalah," *Tikkun*, Vol. 10 (1), pp. 66-73 (Jan/Feb 1995)

"The Handwriting of God," *Newsweek*, May 4, 1992, p. 76

[Optional: Hogan, Chs. 7 "The Formation of Structure" and 8 "The Beginning"]

[Optional: Neil Turok\*, "Inflation and the Beginning of the Universe," *Cosmic Questions CD-ROM*]

VIII May 14 and 16: Einstein's question about the creation of the

universe: "Did God have a choice?" Anthropic cosmology. Dreams of a Final Theory.

#### READINGS:

Thuan, p.134-139 ("A Meaningless Universe," excerpts from pieces by Jacques Monod, Steven Weinberg, and Freeman Dyson)

Ian Barbour, "Religious Responses to the Big Bang," talk at American Association for the Advancement of Science Annual Meeting, Boston, Feb. 14, 1993, 15 pages

John D. Barrow\*, "Cosmology, Life, and the Anthropic Principle," Cosmic Questions CD-ROM

Steven Weinberg, "Facing Finality," "What About God?" Dreams of a Final Theory (Pantheon, 1992), pp. 230-261

[Optional: Steven Weinberg\*, "A Universe with No Designer"; John Polkinghorne\*, "Understanding the Universe"; "An Exchange Between Steven Weinberg and John Polkinghorne" (text and video both on CD-ROM) Cosmic Questions CD-ROM]

[Optional: John Leslie\*, "The Meaning of Design," Cosmic Questions CD-ROM]

[Optional: Daniel Matt, God and the Big Bang (Jewish Lights, 1996), pp. 79-90, notes pp. 184-6]

[Optional: Carl Sagan, "The Great Demotions," Pale Blue Dot (Random House, 1994), pp. 23, 26-39]

[Optional: Hogan, Ch. 9 "The Future"]

IX May 21 and 23: Modern myths of the origin of life. The discovery of geologic time. The Origin of Species. Evolution as continuous creation. The search for extraterrestrial intelligence (SETI). The Gaia myth.

#### READINGS:

Thuan, Ch. V "A Planet is Born"

Loyal Rue, "The Epic of Evolution" (talk at Star Island conference, 1995), 17 pages

Lewis Thomas, The Lives of a Cell (Bantam, 1974), pp. 1-4, 170-174

John Maynard Smith, "Science and Myth," The Natural History Reader, ed. Niles Eldredge (Columbia University Press, 1987), pp. 222-229

Sara Via\*, "Are We Alone? Lessons from the Evolution of Life on Earth," Cosmic Questions CD-ROM

James Lovelock, *The Ages of Gaia: a Biography of our Living Earth* (W.W. Norton, 1988), pp. 15-41

Lynn Margulis and Michael Dolan, "Gaia: Cosmic Beginnings and Nonhuman Ends," *Cosmic Beginnings and Human Ends*, ed. Clifford N. Matthews and Roy Abraham Argheese (Open Court, 1995), pp. 187-204

[Optional: Seth Shostak\*, "The Outlook for Cosmic Company"; Irven DeVore, "Not Likely"; John F. Haught, "Theology After Contact," *Cosmic Questions CD-ROM*]

X May 28 and 30: Intelligent life in the Universe? Understanding the modern world in light of cosmology. Implications for 21st century life and culture.

Take-home Final Exam distributed, due in Physics Department Office by 5 pm Tuesday June 4.

#### READINGS:

Joel E. Cohen, "Ten Myths of Population," *Discover*, April 1996, pp. 42-47

Lynn White, jr., "The Historical Roots of Our Ecologic Crisis," *Science*, Vol. 155, pp. 1203-1207 (10 March 1967)

Lewis Thomas, "The Iks," *The Lives of a Cell* (Bantam, 1974), pp. 126-129

Joel R. Primack and Nancy Ellen Abrams, "Gravity, the Ultimate Capitalist Principle," *Tikkun*, Vol. 16 (5), pp. 59-61 (Sept/Oct 2001)

#### RECOMMENDED BOOKS (prices are given for books still in print)

David S. Ariel, *The Mystic Quest: An Introduction to Jewish Mysticism* (Schocken, 1992) \$14

Ian G. Barbour, *When Science Meets Religion* (Harper San Francisco, 2000) \$16

Francis M. Cornford, *From Religion to Philosophy* (Princeton UP, 1991) \$19.95

Michael Coogan, *Stories from Ancient Canaan* (Westminster, 1978) \$14

Mircea Eliade, *Myths, Dreams, and Mysteries* (Harper, 1960) Richard

Elliott Friedman, *The Disappearance of God* (HarperCollins, 1996) \$14

Richard Elliot Friedman, *Who Wrote the Bible?* (Harper & Row, 1987) \$14

John Gribbin & Martin Rees, *Cosmic Coincidences* (Bantam Books, 1989)

Evan Hadingham, *Early Man and the Cosmos* (Univ. of Oklahoma Press, 1985) \$22

Edward R. Harrison, *Masks of the Universe* (Macmillan, 1985)

Thomas S. Kuhn, *The Copernican Revolution* (Harvard U. Press, 1957) \$12.95

C. S. Lewis, *The Discarded Image* (Cambridge U. Press, 1994) \$9.95

David C. Lindberg and Ronald L. Numbers, *God and Nature* (UC Press, 1986) \$24.95

James Lovelock, *Gaia: A New Look at Life on Earth* (Oxford U Press, 1979) \$11.95

James Lovelock, *The Ages of Gaia* (Norton, 1988) \$13

Daniel Matt, *The Essential Kabbalah* (Harper San Francisco, 1995) \$12.00 pap.

Daniel Matt, trans., *Zohar: the Book of Enlightenment* (Paulist Press, 1983) \$12.95

Daniel Matt, *God and the Big Bang* (Jewish Lights, 1996) \$16.95

Kenneth R. Miller, *Finding Darwin's God* (Cliff Street Books, 2000) \$14

Jeremy Naydler, *Temple of the Cosmos: The Ancient Egyptian Experience of the Sacred* (Inner Traditions, 1996) \$19.95

Martin Rees, *Before the Beginning* (Helix Books, 1997) \$16

Martin Rees, *Just Six Numbers* (Basic Books, 2000) \$14

Dorothy L. Sayers, *The Mind of the Maker* (Harper San Francisco, 1979) \$13

Lewis Thomas, *The Lives of a Cell* (Bantam, 1974) \$11.95

Stephen Toulmin & June Goodfield, *The Discovery of Time* (U Chicago Press, 1982) \$15

\*NOTE: The Cosmic Questions CD-ROM includes video interviews with each of the authors (we recommend that students view them as they read pieces by these authors)