

Class meeting date	Lecture subject	Required/ recommended reading
September 1 and 6	How big is that? An introduction to the sizes, masses, distances, ages and speeds commonly encountered in astronomy. Visit the on-line How Big Is That sheet.	<i>Seeds</i> , pp. 1-8.
September 8 and 13	Prologue in outer space. What is it like to be in the neighborhood of some typical black holes.	Thorne, pp. 23-59.
September 15, 20, 22, and 27	Einstein's theories: special relativity; the warping of space and time; the Lorentz transformation and the velocity-addition formulas; general relativity; experimental verifications of relativity.	Thorne, pp. 59-120. <i>Seeds</i> , 78-99.
September 29	General relativity predicts the existence of black holes; can quantum mechanics keep black holes from forming?	Thorne, pp. 121-163. <i>Hawking</i> , pp. 57-104.
October 4 and 6	Degenerate stars. White dwarf stars and the Chandrasekhar maximum mass; neutron stars and the Oppenheimer maximum mass; supernovae; the inevitable formation of black holes.	Thorne, pp. 164-257. <i>Seeds</i> , pp. 259 - 280.
October 11	Exam #1, covering all subjects discussed to date.	
October 13	Properties of real black holes.	Thorne, pp. 258-299.
October 18	Energetics of black holes, and the discovery of quasars.	Thorne, pp. 300-321.
October 20, 25, November 1, 3	Black holes unveiled. Astronomical objects thought, or known, to involve black holes: X-ray binary stars, active galaxy nuclei, the center of the Milky Way, and gamma-ray bursters.	Thorne, pp. 322-356. <i>Seeds</i> , pp. 281-306 and 357-378; <i>Silk</i> , pp. 247-271.
November 8	Ripples of curvature: the nature and the potential for the detection of gravitational	Thorne, pp. 357-396.

	radiation, general relativity's analogue of light.	
November 10	Black holes aren't quite black: quantum fluctuations near the horizon, and black-hole evaporation.	Thorne, pp. 412-448. <i>Hawking, pp. 105-120.</i>
November 15	Inside black holes: physics beyond the black-hole horizon.	Thorne, pp. 397-411, 449-482.
November 17	Exam #2, emphasizing subjects introduced since Exam #1	
November 22	Wormholes: How (potentially) to use black holes for space and time travel.	Thorne, pp. 483-522.
November 29	The expansion of the Universe and its large-scale structure: black hole formation in reverse.	<i>Hawking, pp. 1-36; Silk, pp. 109-149.</i>
December 1, 6, and 8	The Big Bang, its observation, and Big Bang cosmology: the present expansion and large-scale structure of the universe, and possibilities for its fate.	<i>Seeds, pp. 379-404; Hawking, pp. 37-84 and 121-150; Silk, pp. 31-107 and 151-184.</i>
December 20	Exam #3, emphasizing subjects introduced since Exam #2	