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Course Syllabus and Calendar for Astronomy 2 (ASTR-2-02)
OVERVIEW OF THE UNIVERSE
Winter 2007

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WEEK # 1 - Fri 01/05

-> Course Overview; Answers to Frequently Asked Questions
-> Journey Back to the Big Bang
1/ Our connection to the cosmos
2/ Galaxies: our ultimate home
3/ Formation and evolution of galaxies; galaxy cannibalism
4/ Early Universe; inflation

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WEEK # 2 - Mon 01/08, Wed 01/10, Fri 01/12

-> Some General Astrophysical Concepts (Brief Summary):
1/ First principles of cosmology
2/ Newtonian physics; fundamental forces; gravitation
-> Dynamics:
1/ Kepler’s laws and the Solar System
2/ Dynamics (and mass) of the Milky Way galaxy
-> Planets within our Solar System and without

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WEEK # 3 - Wed 01/17, Fri 01/19 (no class on Mon 01/15 - HOLIDAY!)

-> Radiation:
1/ General properties; electromagnetic spectrum
2/ Atmospheric windows: optical, radio, sub-millimeter
3/ Black body radiation: Planck’s law, Wien’s law
4/ Quantum physics: Bohr atom; photons
-> Measuring Distances to Stars and Galaxies:
1/ Parallax
2/ Luminosity; flux; inverse square law of brightness
3/ Standard candles and rulers
4/ Hubble’s law; redshift as distance indicator

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WEEK # 4 - Mon 01/22, Wed 01/24, Fri 01/26

-> Special Theory of Relativity:
1/ Speed of light
2/ Simultaneity
3/ Length contraction; time dilation
4/ Mass-energy equivalence
-> General Theory of Relativity:
1/ Principle of equivalence
2/ Light bending; gravitational lensing
-> The Galaxy’s Constituents:
1/ Stars as black bodies
2/ Gaseous nebulae: emission and absorption lines
3/ Doppler shift

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WEEK #  5    -   Mon 01/29, Wed 01/31, Fri 02/02
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   -> Normal Galaxies:
        1/ Hubble sequence or Tuning fork diagram
        2/ Local Group
   -> Active Galaxies / Black Holes:
        1/ Active versus normal galaxies
        2/ Seyfert galaxies; radio galaxies; quasars
        3/ Black hole model for active galactic nuclei / central engines
        4/ Quantum black holes: Hawking-Penrose radiation


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WEEK #  6    -   Wed 02/07, Fri 02/09 (Midterm exam on Mon 02/05)
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     *** MIDTERM EXAM IN CLASS ON MON 02/05 ***
         - open book/notes
         - in the usual classroom (Kresge Classroom 321)
         - at the usual class time (2:00 - 3:10 pm)

   -> Cosmology / Expansion of the Universe:
        1/ Expanding Universe models: open versus closed Universes
        2/ Critical closure density (Omega); dark matter; non-zero Lambda
        3/ Experimental limits on Omega
        4/ Big Bang cosmology
        5/ Non-standard models: Steady State cosmology


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WEEK #  7    -   Mon 02/12, Wed 02/14, Fri 02/16
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   -> The Very Early Universe:
        1/ Microwave background radiation
        2/ Horizons; boundaries
        3/ Inflation: what is it?  what problems does it address?
        4/ Formation of structure (galaxies, clusters, superclusters)
        5/ Big Bang nucleosynthesis
        6/ Particle physics in early Universe: Grand Unified Theories
        7/ The Planck time


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WEEK #  8    -   Wed 02/21, Fri 02/23 (no class on Mon 02/19 - HOLIDAY!)
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   -> Large Scale Distribution of Galaxies:
        1/ Large-scale structure: bubbles, filaments & voids
        2/ Peculiar velocities; "Fingers of God"
   -> The Distribution of Stars in Galaxies:
        1/ Disk, bulge, halo: structure & kinematics
        2/ Globular clusters
        3/ Spiral structure
        4/ Stellar ages & composition


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WEEK #  9    -   Mon 02/26, Wed 02/28, Fri 03/02
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   -> The Birth and Life Cycle of Stars:
        1/ Star formation from a dense gas cloud; protostellar disks
        2/ Hertzspring-Russell diagram
        3/ Hayashi tracks
        4/ Main sequence; Properties as a function of stellar mass
        5/ Stellar evolution: dwarfs & giants
        6/ Star clusters as laboratories
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WEEK # 10    -   Mon 03/05, Wed 03/07, Fri 03/09
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   -> The Death of Stars:
        1/ White dwarfs
        2/ Supernovae
        3/ Neutron stars; pulsars (cosmic clocks)
        4/ Black holes


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WEEK # 11    -   Mon 03/12, Wed 03/14
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   -> The Interstellar Medium in Galaxies:
        1/ Gaseous phases: atomic, molecular, ionized hydrogen
        2/ Interstellar dust grains: composition, size, temperature
        3/ Extinction & reddening
   -> Dark Matter:
        1/ Definition; gravity as a probe of unseen matter
        2/ Rotation curves of spiral galaxies; stellar motion in ellipticals
        3/ Clusters of galaxies: kinematics, hot gas, gravitational lensing
   -> Overflow Material / Review


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         *** FINAL EXAM ON TUE 03/20         7:30 - 10:30 PM ***

         ***    Note, this is NOT at the usual class time    ***
         - open book/notes
         - in the usual classroom (Kresge Classroom 321)

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