THE SUN, STARS, GALAXIES & COSMOLOGY

Lecturer: Sandra Savaglio

THE SUN (Silvia Perri)
— Deriving the mass and temperature
— Light sources and continuum spectra
— Black Body radiation, Stefan-Boltzmann law, Wien law
— Absorption and emission lines
— The core, Standard Model and nuclear reactions
— Average age estimate of the Sun
— Energy transport
— Solar neutrino problem
— Sun spots, photosphere, chromosphere, solar corona
— Solar flare, coronal mass ejection (CME), solar cycle
— Butterfly diagram, Babcock model
— Space weather

STARS
— Measuring stars: size, temperature, luminosity, mass
— Comparing stars, Hertzsprung-Russel diagram
— Interstellar medium: chemical composition, photo excitation, photo emission, collisional excitation, from warm and hot medium to giant molecular clouds
— Dust, dust reddenng
— Formation of stars, Jeans mass
— Planetary systems
— Extrasolar planets
— Main Sequence for stars
— Nuclear reactions
— Mass distribution function
— Star life beyond the Main Sequence: stars with mass M < 11 solar masses and M > 11 solar masses
— Stellar populations: Population I, Population II and Population III
— Supernovae Type I and II
— Gamma-ray bursts (GRBs)
— Supernova 1987A
— Recycling of matter in the insterstellar medium
— Stellar remnants for M < 11 solar masses: White Dwarfs
— Stellar remnants for M > 11 solar masses: neutron stars, pulsars, stellar black holes, binary systems

OUR GALAXY
— The Milky Way: geometrical distribution of gas and stars, mass, rotation curve, star clusters, dark matter, spiral density wave theory
— Globular clusters in the Milky Way

— Halo and bulge of the Milky Way, central black hole
— Formation and evolution of the Milky Way

OTHER GALAXIES
— Normal galaxies: elliptical, spiral and irregular galaxies
— Mass of galaxies
— Stellar population synthesis models
— Distance of galaxies: geometrical method, standard candles, redshift, surface brightness, Tully-Fisher relation
— Hubble Law
— Galaxy spectra
— Formation and evolution of galaxies
— Dark matter in galaxies
— Interaction between galaxies and galaxy mergers

ACTIVE GALAXIES
— Active galactic nuclei (AGN), quasi-stellar object (QSO), quasars, radio sources
— Seyfert galaxies
— Radio galaxies
— Central engine of AGN, supermassive black hole, broad line region (BLR), narrow line region (NLR)
— Unified model

COSMOLOGY
— Spatial distribution of galaxies
— Clusters of galaxies
— Large scale structure
— Intergalactic gas and dark matter
— Origin and evolution of the universe: cosmological principle
— Cosmological models: Einsterin, de Sitter, Friedmann-Robertoson-Walker models
— Lemaitre Universe and Big Bang
— Expansion of the universe, Hubble parameter, space curvature, critical density
— Energy density of matter and radiation and their evolution, dark energy
— First minutes of the Universe: Standard Model
— Inflation, baryogenesis
— Primordial nucleosynthesis, abundances of light elements, recombination
— The Cosmic Microwave Background