

“High Energy Astrophysics” Course Program

Prof. K. A. Postnov, Dr. A. N. Timokhin

Part I. Physical Processes

- Radiation in classical electrodynamics.
- Lorentz transformations.
- Elementary Processes.
 - Synchrotron Radiation. Curvature Radiation. Synchro-Compton radiation. Single-photon pair creation in strong magnetic field.
 - Inverse Compton scattering. Photon-photon pair creation.
 - Bremsstrahlung radiation. Pair production in the Coulomb field of an atomic nucleus.
 - Cherenkov radiation.
- Spectra formation.
 - Synchrotron radiation of electrons with power-law distribution function.
 - Synchrotron self-absorption
 - Synchrotron-Self-Compton (SSC) model
 - Comptonization.
 - Electron-positron cascades.
- Mechanisms of particle acceleration in astrophysical objects.

Part II. Sources of high-energy radiation

- Radiopulsars and magnetars.
- Supernova remnants and Pulsar Wind Nebulae.
- Active Galactic Nuclei and quasars.
- X-ray binaries and micro-quasars.
- Relativistic jets.
- Gamma-Ray Bursts.
- Solar flares.

Part III. Detectors and Instruments.

- Observations in hard X-rays (10 keV – 0.1 MeV).
- Observations in gamma-rays (0.1 MeV – tens of GeV).
- Registration of very high energy photons and cosmic rays (\sim hundreds of GeV and beyond).
- Modern space based high-energy observatories (Chandra, XMM, HETE, INTEGRAL, Constellation-X, XEUS, GLAST etc..)