

ENTRANCE EXAM FOR PhD. STUDY

field of study: ASTRONOMY

specialization: INTERPLANETARY MATTER

Topics from the field: ASTRONOMICAL DEVICES

1. Astronomical telescope

Refractor, reflector, ocular; aberrations of telescope, resolution of telescope. Earth's atmosphere and telescope.

2. Dispersion of light

Dispersion of light, dispersive prism, examples of usage – spectroscopy.

3. Interference of light

Interference of light. Fabry-Perot and Michaelson interferometer, interference filters.

4. Diffraction

Diffraction of light, diffraction grating – description, physics, properties, modes of exploitation in astronomy – spectroscopy.

5. Polarization

Polarized light, its origin and modes of exploitation in astrophysics. Measuring of polarized light.

Topics from the field: CELESTIAL MECHANICS

1. Basic terms of spherical astronomy

Astronomical coordinate systems. Deriving transformational relationships between equatorial and ecliptical coordinate systems.

2. Integrals of the problem of two and more bodies

Analytically solvable integrals of the problem of two and N-bodies, respectively. The laws of conservation resulting from them. Description of individual integration constants.

3. Kepler's laws

Wording of Kepler's laws. Mathematical expression of 2nd and 3rd Kepler law.

4. Restricted 3-body problem

Restricted 3-body problem in Celestial mechanics. Hill's surfaces and curves of zero velocity in restricted 3-body problem.

5. Orbital elements

Definition of orbital elements. Types of orbital elements. Osculating elements, proper and mean elements.

Topics from the field: INTERPLANETARY MATTER

1. Distribution of asteroids in the Solar System

Statistics of orbits, commensurability, asteroid families. Special orbit asteroids: types: Amor, Apollo, Aten, Trojans, Hidalgo, Centaurs.

2. Theories of origin and reservoir of comets

Theories of comets origin. Discovery of the Oort cloud. Evolution of orbits. Original and current view on the Oort cloud. Trans-Neptunian belt. Comet reservoirs and their relationship to the origin of the Solar System.

2. Evolution of the cometary nucleus.

Apparent and absolute magnitude. Changes of magnitude – geometric, short-term and secular. Physical evolution of comets. Chemical composition, structure.

3. Meteor showers

Birth and evolution of meteor showers. Their parent bodies. Formation of sporadic meteor background.

4. Frequencies and radiant of meteors

Daily and annual variation of the sporadic meteors number and its origin. Radiant of the meteor shower and methods of calculation of theoretical radiants.

RECOMMENDED LITERATURE

- Brouwer, D., Clemence, J.: ●Methods of Celestial Mechanics. Academic Press, New York, 1964.
- Binzel, R.P., Gehrels, T., Matthews, M.S.: ●Asteroids II. Univ. Arizona Press, Tucson, 1989.
- Krishna Swamy, K.S.: ●Physics of comets. World Scientific Publ. Co., Singapore, 1986.
- Murad, E., Williams, I.P.: ●Meteor in the Earth Atmosphere. Cambridge Univ. Press, 2002.