AS103: Relativistic Astrophysics around Compact stars*(20 lectures in 30 hrs)*

(A certificate course for UG, PG and PG+ students)

***Instructors:** S.K. Chakrabarti, P. Nandi, S. Nath*

***Teaching assistants**: Sayak, Shraddha, Kuldeep, Mohit*

***Mode of Instruction**: English*

Syllabus

Final stages of massive stars (6 Lectures)

Instructor: P. Nandi

Overview, Supernovae: Core collapse vs. thermonuclear runaway, Chandrasekhar limit and white dwarf degeneracy, Core-collapse supernovae (Types Ib, Ic, II, IIn), Thermonuclear supernovae (Type Ia), Binary star systems and their influence on supernovae, Multi-wavelength observations of supernovae (optical, X-ray, radio), Light curve analysis: understanding the evolution of the explosion, Supernovae as distance indicators, The Degenerate Remnants of Stars: White Dwarfs, The Chandrasekhar Limit, Neutron Stars and its interior, Pulsars. The Black Holes: Introduction to Black Holes, Black Hole Formation, Accretion Disks and Active Galactic Nuclei, Detection of Black Holes, Black Holes and Gravitational Waves, Extreme Black Holes and Future Research.

Accretion power in Astrophysics (6 Lectures)

Instructor: S.K. Chakrabarti

Introduction, Gravity and Potential Energy, Hydrodynamics, accretion – general considerations, Bondi Flow, Accretion flow with angular momentum, Thin accretion disk, Thick disk and advective flows, Compton-cloud formation, Accretion in Binary systems, Black Holes and Accretion, Accretion Power in AGN, Recent Developments in Accretion Research.

Active Galaxies (4 Lectures)

Instructor: P. Nandi

Definition and classification of Active Galactic Nuclei (AGN), History of discovery, The importance of studying Active Galaxies, Supermassive black holes, Accretion disks, Jets and outflows, Radio galaxies, Seyfert galaxies, Blazars, Quasars, Feedback on galaxy evolution, New observing facilities, Future Research.

Hands-on season (4 Lectures)

Instructor: P. Nandi

X-ray Astronomy Basics, The electromagnetic spectrum and X-ray astronomy, Physical processes behind X-ray emission, Accessing and preprocessing X-ray data, Observational tools used for X-ray astronomy, Data Reduction and Analysis Techniques, Software learning (ds9, Xspec, Gnuplot, Astropy (Python) etc.), Spectrum and light curve generation, data fitting using simple models

Sitapur Observatory trip(1 night)

Instructors: Devendra Bisht, Ashish Raj, Kuldeep Belwal, Mohit Bisht, Shraddha Biswas

Discussion on the observables in the night sky, software guided observation using optical telescopes.