

# Department of Theoretical Physics

## Lecture Series



### Sphalerons and matter-antimatter asymmetry of the Universe

Urjit Yajnik

Indian Institute of Technology Bombay

**Lecture 1** (Monday, 24 February 2020, 17:30, Room AG80)

Topology of Yang-Mills theory. Large gauge transformations. Instantons. Sphalerons in the presence of Higgs. Jackiw-Rebbi vacua and axial current anomaly.

**Lecture 2** (Tuesday, 25 February 2020, 13:00, Room A304)

Connection of the sphaleron to  $B + L$  number anomaly. The temperature dependent effective potential. Sphalerons at  $T \approx v_{EW}$  and fermion number violation rate. Anomaly at  $T > v_{EW}/\alpha_W$ .

**Lecture 3** (Wednesday, 26 February 2020, 17:30, Room A304)

Weinberg-Sakharov criteria for dynamical origin of baryon number. The options tree for matter-antimatter asymmetry. “Electroweak baryogenesis” a review and possible variants. Problem of inadequate  $CP$  violation. Leptogenesis - high scale in  $SO(10)$ . Connection to low energy neutrino data. Leptogenesis - low scale within Left-Right symmetric models.