3 ECTS PhD-school: Dark Matter; Distribution, origin, detection and production

Report of Contributions

Contribution ID: **0** Type: **not specified**

Cosmology, Astronomy and Dark Matter 1

Monday, 26 September 2016 09:00 (1 hour)

- Brief review of observables, measurement and timescales in astronomy
- Classical evidences for dark matter: galaxy clusters and the virial theorem; rotation curves
- What dark matter is not

Presenter: Prof. READ, Justin (University of Surrey)

Contribution ID: **1** Type: **not specified**

Dark Matter production and indirect searches 1

Monday, 26 September 2016 10:15 (1 hour)

Production: Introduction; Freeze-out mechanism; Freeze-in mechanism; Decays of other particles; Gravitational production; Misalignment mechanism; Spontaneous symmetry breaking; Asymmetric DM

Presenter: Prof. CEMBRANOS, Jose (Complutense University of Madrid)

Contribution ID: **2** Type: **not specified**

Direct searches and searches at the LHC 1

Monday, 26 September 2016 11:30 (1 hour)

- What are we looking for?
- Overview of what we know and do not know about the dark matter and possible candidates for the dark matter.
- Dark matter particles as the earliest relics from the Big Bang.

Presenter: Prof. GELMINI, Graciela (University of California Los Angeles)

Contribution ID: **3** Type: **not specified**

Problem solving

Monday, 26 September 2016 13:30 (5h 20m)

Contribution ID: **4** Type: **not specified**

Cosmology, Astronomy and Dark Matter 2

Tuesday, 27 September 2016 09:00 (1 hour)

- Cosmology primer
- Homogeneous Universe; FLRW metric; Friedmannn equation; the "Lambda Cold Dark Matter" (LCDM) standard cosmological model

Presenter: Prof. READ, Justin (Surrey)

Contribution ID: **5**   Type: **not specified**

Dark Matter production and indirect searches 2

Tuesday, 27 September 2016 10:15 (1 hour)

Production: Freeze-out mechanism; Freeze-in mechanism; Decays of other particles; Gravitational production; Misalignment mechanism; Spontaneous symmetry breaking; Asymmetric DM

Presenter: Prof. CEMBRANOS, Jose (Madrid)

Contribution ID: **6** Type: **not specified**

Direct searches and searches at the LHC 2

Tuesday, 27 September 2016 11:30 (1 hour)

- Introduction to dark matter searches.

- Introduction of direct dark matter detection. World wide efforts.

- The main elements of the expected rate in direct detection experiments (detector response, cross section and halo model) and their uncertainties.

Presenter: Prof. GELMINI, Graciela (UCLA)

Contribution ID: **7** Type: **not specified**

Problem solving

Tuesday, 27 September 2016 13:30 (5h 20m)

Contribution ID: **8** Type: **not specified**

Cosmology, Astronomy and Dark Matter 3

Wednesday, 28 September 2016 09:00 (1 hour)

- Inhomogeneous Universe
- Numerical simulations of structure formation in LCDM
- Evidence for dark matter from the Cosmic Microwave Background (CMB) and Large Scale Structure
- The "bullet cluster" and evidence for particle dark matter

Presenter: Prof. READ, Justin (Surrey)

Contribution ID: **9**　　　　　　　　　　　　　　　　　Type: **not specified**

Dark Matter production and indirect searches 3

Wednesday, 28 September 2016 10:15 (1 hour)

- Indirect detection I : Gamma rays

Presenter:　Prof. CEMBRANOS, Jose (Madrid)

Contribution ID: **10**   Type: **not specified**

Direct searches and searches at the LHC 3

Wednesday, 28 September 2016 11:30 (1 hour)

- The local distribution of dark matter in our galaxy.
- The expected annual modulation of the direct detection rate.
- Past hints of dark matter in direct detection experiments.

Presenter: Prof. GELMINI, Graciela (UCLA)

Contribution ID: **11** Type: **not specified**

Problem solving

Wednesday, 28 September 2016 13:30 (5h 20m)

Contribution ID: **12**   Type: **not specified**

Cosmology, Astronomy and Dark Matter 4

Thursday, 29 September 2016 09:00 (1 hour)

- The Lyman-alpha forest and the temperature of dark matter
- Near-field cosmology and "small scale puzzles" in LCDM
- Including the effect of "baryons" (stars and gas) in the models

Presenter: Prof. READ, Justin (Surrey)

Contribution ID: **13**   Type: **not specified**

Dark Matter production and indirect searches 4

Thursday, 29 September 2016 10:15 (1 hour)

- Indirect detection II : Neutrinos

Presenter: Prof. CEMBRANOS, Jose (Madrid)

Contribution ID: **14** Type: **not specified**

Direct searches and searches at the LHC 4

Thursday, 29 September 2016 11:30 (1 hour)

- Halo-dependent and halo-independent direct detection data analysis.
- The future of direct dark matter detection.
- Introduction of search strategies at the LHC

Presenter: Prof. GELMINI, Graciela (UCLA)

Contribution ID: **15** Type: **not specified**

Problem solving

Thursday, 29 September 2016 13:30 (5h 20m)

Contribution ID: **16**   Type: **not specified**

Cosmology, Astronomy and Dark Matter 5

Friday, 30 September 2016 09:00 (1 hour)

- Beyond LCDM. Self-interacting and warm dark matter; alternative gravity models.
- Future probes of dark matter: Gravitational lensing; stellar stream bumps.

Presenter: Prof. READ, Justin (Surrey)

Contribution ID: **17**   Type: **not specified**

Dark Matter production and indirect searches 5

Friday, 30 September 2016 10:15 (1 hour)

- Indirect detection III : Antimatter (antiprotons and positrons)

Presenter: Prof. CEMBRANOS, Jose (Madrid)

Contribution ID: **18**   Type: **not specified**

Direct searches and searches at the LHC 5

Friday, 30 September 2016 11:30 (1 hour)

- Complete and simplified dark matter models and their searches at the LHC.
- Complementarity of dark matter searches.

Presenter: Prof. GELMINI, Graciela (UCLA)

Contribution ID: **19**   Type: **not specified**

Wrap-up and distribution of examination problems

Friday, 30 September 2016 13:30 (1 hour)