

**Examination of the course “Astroparticle Physics”
PhD School in Astronomy and in Physics
2016/17**

Choose one of the following (a, b or c):

a) Give a seminar of 25' (+ ~15' questions) on an article, scientific or technical.

Some **scientific** articles you might choose for the final exam
(of course you can propose your own, and I'll answer you if it's OK for me)

1. Acceleration of petaelectronvolt protons in the Galactic Centre. By HESS Collaboration (F. Aharonian et al.). Nature 531 (2016) 476.
2. Search for Spectral Irregularities due to Photon–AxionLike-Particle Oscillations with the Fermi Large Area Telescope. By Fermi-LAT Collaboration (M. Ajello et al.). Phys. Rev. Lett. 116 (2016) no.16, 161101.
3. Detection of the Characteristic Pion-Decay Signature in Supernova Remnants. By Fermi-LAT Collaboration (M. Ackermann et al.). Science 339 (2013) 807.
4. Searches for Dark Matter annihilation signatures in the Segue 1 satellite galaxy with the MAGIC telescope. By MAGIC Collaboration (J. Aleksic et al.). JCAP 1106 (2011) 035.
5. Search for a Dark Matter annihilation signal from the Galactic Center halo with H.E.S.S. By HESS Collaboration (A. Abramowski et al.). Phys. Rev. Lett. 106 (2011) 161301.
6. Very-High-Energy Gamma Rays from a Distant Quasar: How Transparent Is the Universe? By MAGIC Collaboration (E. Aliu et al.). Science 320 (2008) 1752.
7. Evidence for a new light spin-zero boson from cosmological gamma-ray propagation? By Alessandro De Angelis, Marco Roncadelli, Oriana Mansutti. Phys. Rev. D76 (2007) 121301.
8. The energy spectrum of cosmic-ray electrons at TeV energies. By HESS Collaboration (F. Aharonian et al.). Phys. Rev. Lett. 101 (2008) 261104.
9. High Statistics Measurement of the Positron Fraction in Primary Cosmic Rays of 0.5-500 GeV with the Alpha Magnetic Spectrometer on the International Space Station. By AMS Collaboration (L. Accardo et al.). Phys. Rev. Lett. 113 (2014) 121101.
10. Probing Quantum Gravity using Photons from a flare of the active galactic nucleus Markarian 501 Observed by the MAGIC telescope. By MAGIC and Other Contributors (J. Albert et al.). Phys. Lett. B668 (2008) 253.
11. Observation of Gravitational Waves from a Binary Black Hole Merger. By LIGO and Virgo Collaborations (B. Abbott et al.). Phys. Rev. Lett. 116 (2016) 061102. [Physicists only]

Some **technical** papers/subjects you might choose
(of course you can propose your own, and I'll answer you if it's OK for me)

1. The e-ASTROGAM mission (A. De Angelis, V. Tatischeff et al.), 2017.
<https://arxiv.org/abs/1611.02232> . Accepted for publication in Experimental Astronomy.
Take only Sections 1, 3, 4, 5, 6.
 2. Describe the principle of operation of the AMS-02 detector.
 3. Describe the operation principle of a system of Imaging Air Cherenkov Telescopes.
 4. Describe the operation of a Silicon photomultiplier. Compare it to a CCD.
- b) Analyze the data on a Fermi source that you judge interesting. Write a short report (you can copy the general structure from a Fermi paper; you'll not be accused of plagiarism). Give a seminar of 15' (+ ~15' questions) on your result.**
- c) Propose an original scientific article on a subject covered in the course, write it and submit it to a journal (all the classroom will help you, and it will be a "social" article. Independent of the fact that the journal will accept it or not, the professor will offer a good luck party).**