**TAE 2022**

**LECTURES ON LHC Physics**

**1. Discuss an experimental way to prove the existence of**

**new neutrino types without a direct measurement.**

**2. Explain why the b-quark, despite its large mass, has a long, measurable lifetime (~10-12 s).**

**3. Explain why the W and Z production cross sections increase as the proton-proton cm energy increases at LHC.**

**4. Provide an experimental evidence for the existence of an additional quantum number for quarks: the color.**

**5. What is the “jet energy scale” uncertainty and how does it affect the jet cross section measurements?**

**6. Explain in which way the existence of quark substructures would show up in jet measurements.**

**7. Describe the limitations of an Effective Theory Approach in describing ADD Extra Spatial Dimensions at the LHC. Comment on how the experiments implement those limitations in their results.**

**8. In a scenario for which a stop is essentially mass-degenerate with the top quark: Which are the production channels with the best sensitivity to a pair production of stop particles ?**

**9. Explain the theoretical framework used on searches for Dark Matter in association with heavy flavours in simplified scenarios and presents its physics motivation.**

**10. Which are the parameters that dictated the design of the LHC experiments ATLAS and CMS for the main discoveries ?**