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Studying the properties of axion dark matter using massive stars

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Dark matter makes up 25% of the energy-mass budget of the Universe, about five times more than bayonic matter, and yet we still don't know what it is made of. Nonetheless, phenomena such as gravitational lensing, the abnormally fast rotation of galaxies, as well as density perturbations in the cosmic microwave background radiation have provided not only evidence of this type of matter, but hints about the characteristics of its fundamental particles as well. Even so, the mistery of dark matter has been puzzling scientists for decades now, with multiple hypothetical particles being proposed, one of them being the axion. The axion is a very light particle that was originally proposed as a solution to the conservation of charge and parity problem of the strong force. Despite multiple efforts to detect this "invisible" boson, no experimental evidence has been found. But all is not lost, the silver lining is that several constrains on the axion's mass, as well as its coupling constants have been set, opening the door to new challenges.
The present work aims to contribute to this exclusion process by setting constraints provided by the interior structure and evolution of massive stars.

Primary author: SEVERINO, Clara

Presenter: SEVERINO, Clara