



Fred Hiskens

FIPs in the ALPs round table

About me!



The University of Melbourne

Final year PhD student working on
astroparticle phenomenology

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Melbourne (Naarm), Australia



Image: Freepik.com



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Interesting



Weird

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Hobbies/interests

Hiking, teaching, comedy, sport (tennis,
football, AFL)



Physics!



Projects so far

My work concerns developing/extending bounds on various FIPs using stellar evolution simulations

Interested in the constraining power of *asymptotic giant branch* (AGB) stars

Good probe of novel energy-loss, but duration is short compared with earlier phases

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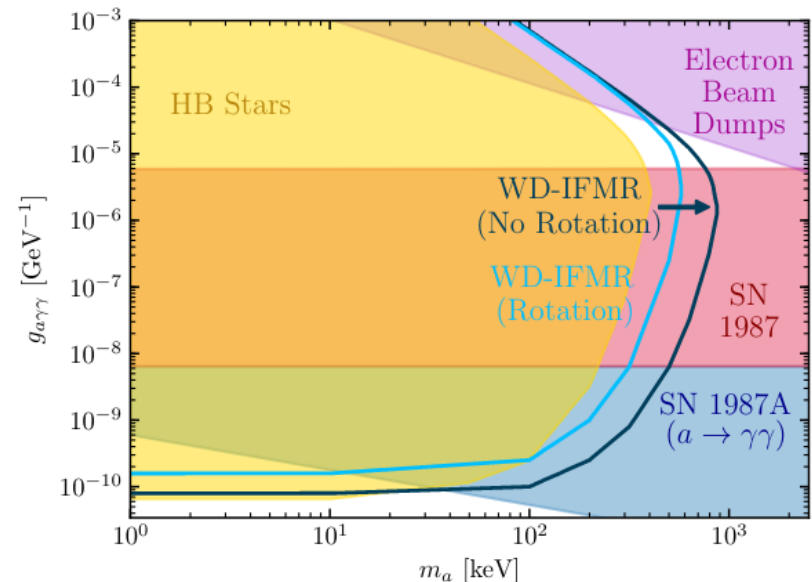
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1

Constraining ALPs using the white dwarf initial-final mass relation: [2102.00379](#)

IFMR – semi-empirical relation linking initial stellar masses to masses of white dwarfs into which they evolve

Depends on AGB physics – but visible in white dwarfs (numerous)



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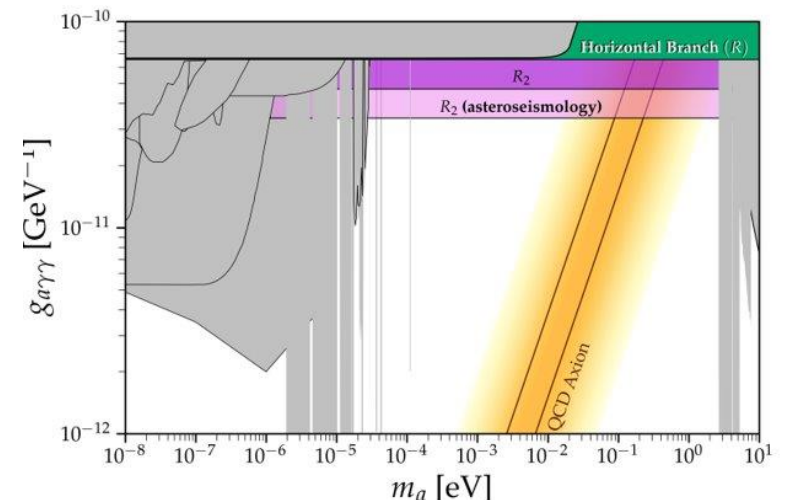
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2

Advancing globular cluster constraints on the axion-photon coupling: [2207.03102](#)

Constraint based on the ratio of AGB to horizontal branch stars in globular clusters

Stronger and more robust than traditional R-parameter constraint



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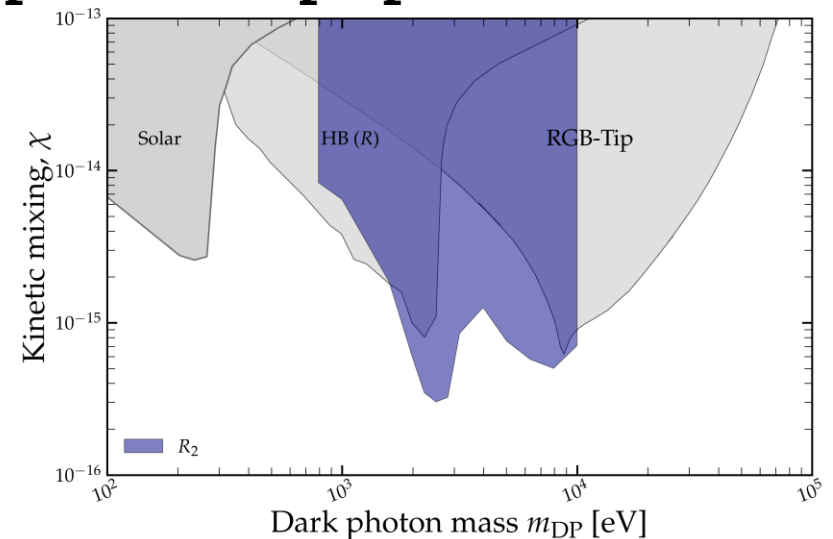
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3 Globular cluster constraints on dark photons - in preparation

Transverse dark photons can be resonantly produced in stars

$$\omega_{\text{pl}}(r) \approx m_{\text{DP}}$$

Interplay between novel energy-loss and convective structure of the star



Physics!

Future work

Within stellar physics:

Applications of machine learning for stellar BSM bounds

Quantify impact of FIPs on metallicity evolution of the universe

Other topics:

Generally interested in FIP cosmology, dark matter, etc...