Study of dark matter with compact binary coalescence

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ICRR Inter-University Research Program 2020

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Title:
Collaboration for gravitational wave observatory in the study of dark matter with compact binary coalescence

- Team:

Lan Q. Nguyen*, G. Mathews, L. Arielle Phillips, A. Kedia, M. Correa, N. Khang, H. Tagoshi, S. Myoki.

- Budget: Y 200,000
- Period: April 2020 - April 2021
- Results:
  - 01 publication
  - 02 talks

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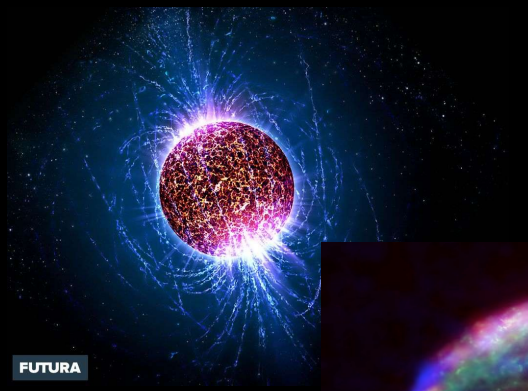
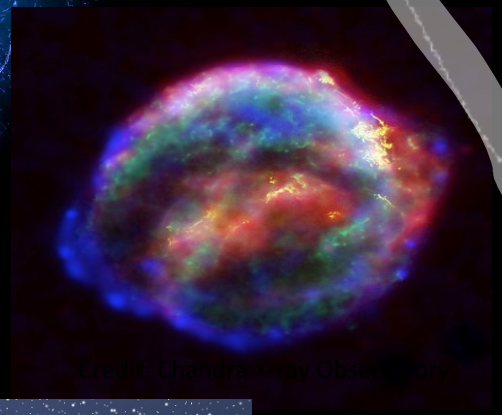
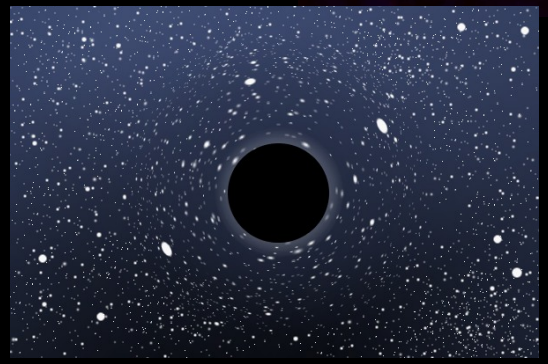
The Electromagnetic waves – “Seeing” the Universe

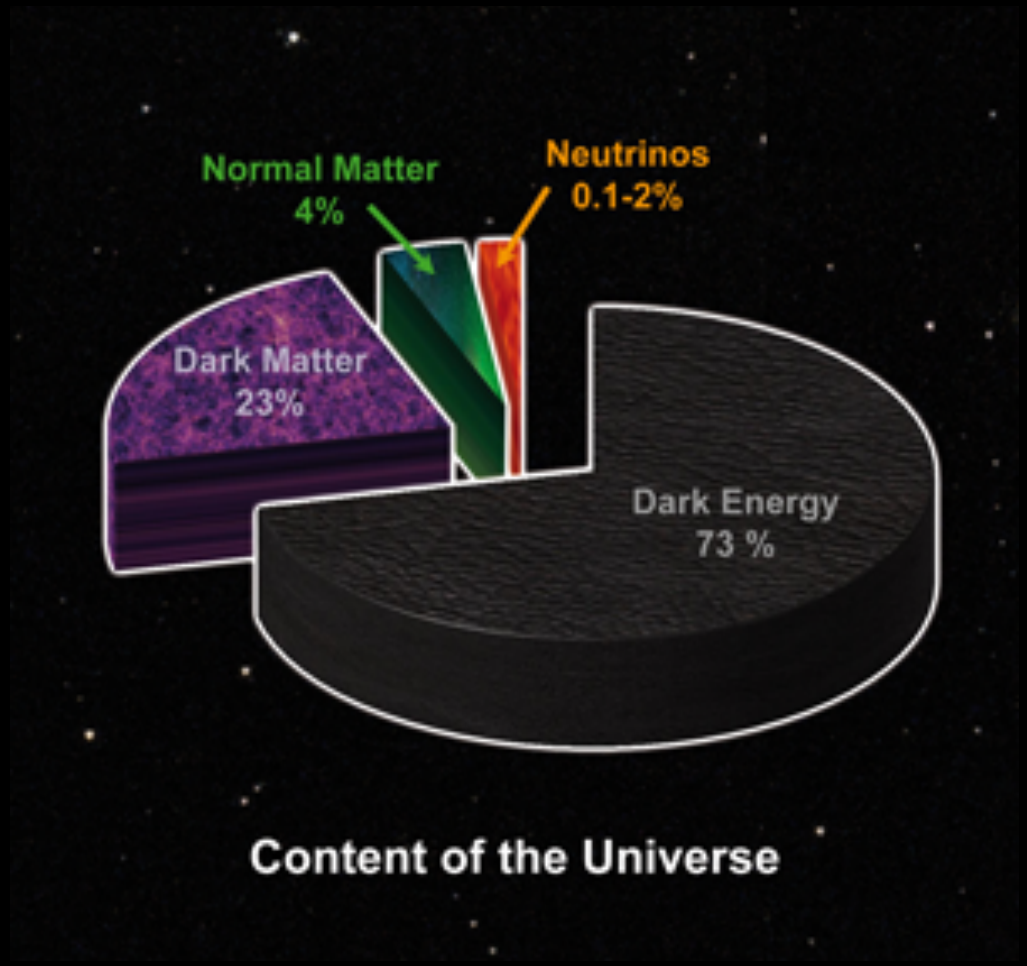






The Gravitational waves – “Hearing” the Universe

Origin and Nature of the Dark Matter?



(credit: HAP / A. Chantelauze)

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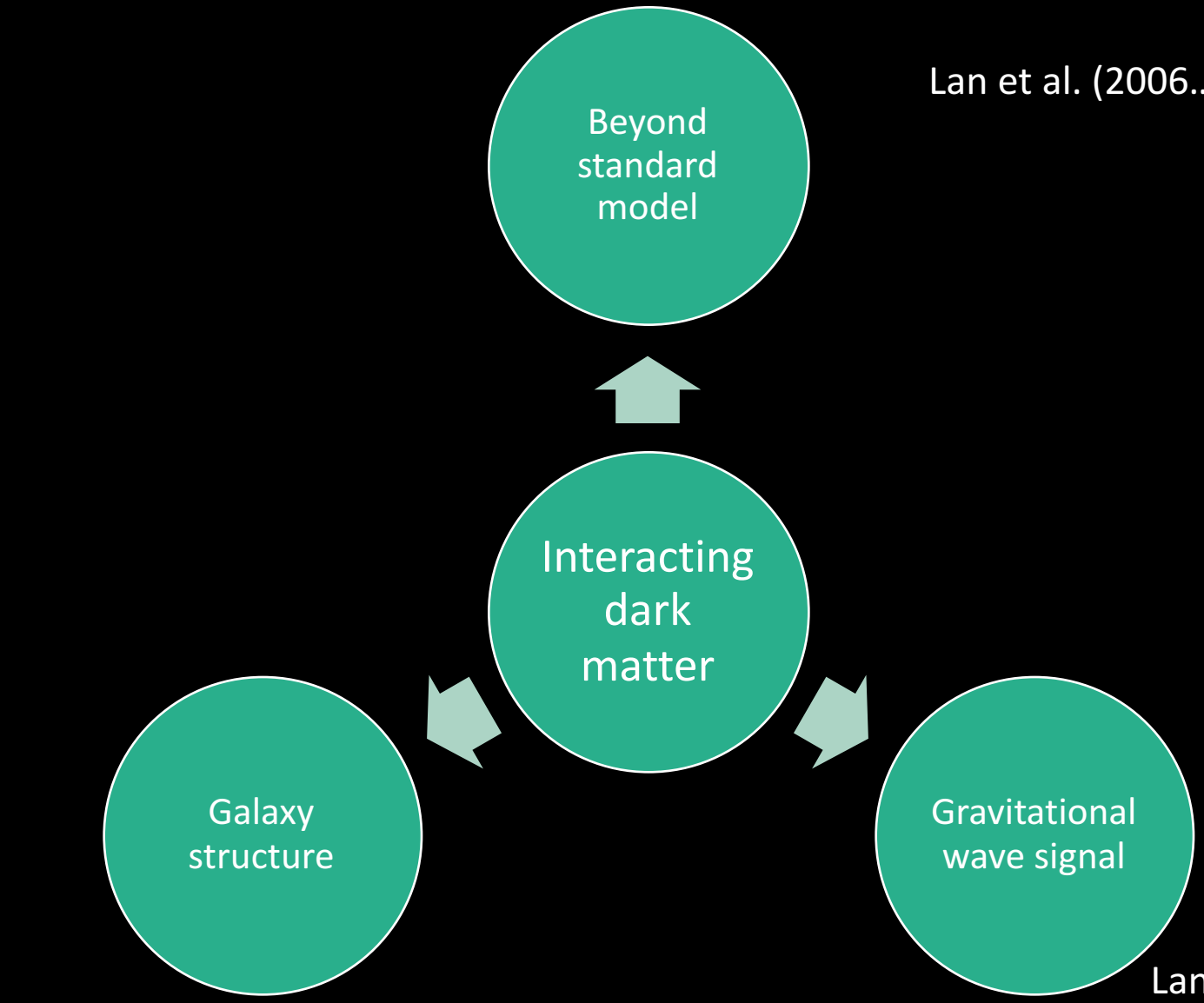

Lan et al. (2006…)

Lan et al. in progress

Lan et al (2020…)

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I. Self-Interacting Dark Matter in Beyond Standard-Model Physics

Interacting dark matter

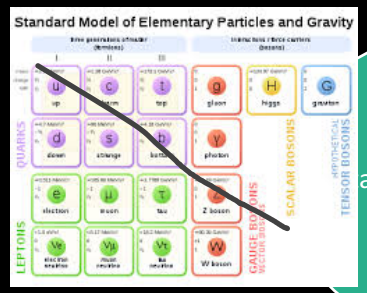
Beyond standard model

331 models

Two candidates for dark matter
Scalar higgs boson

MeV mass

andard model



No candidates for dark matter

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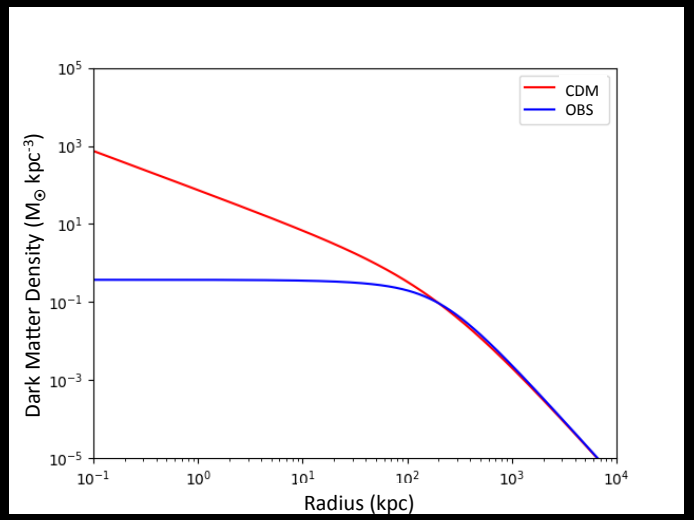
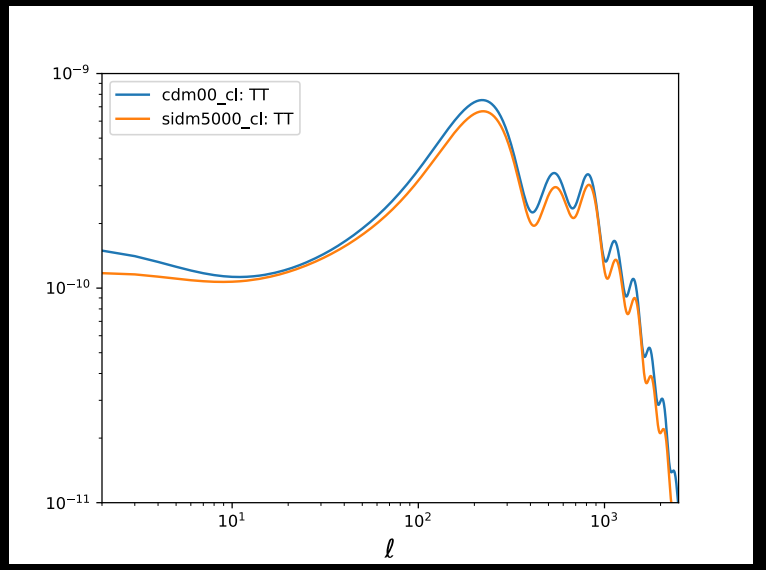
II. Self Interacting Dark Matter and Galaxy Structure Problems





Core cusp problem

Small scale structure problems

To big to fail

Missing satellite

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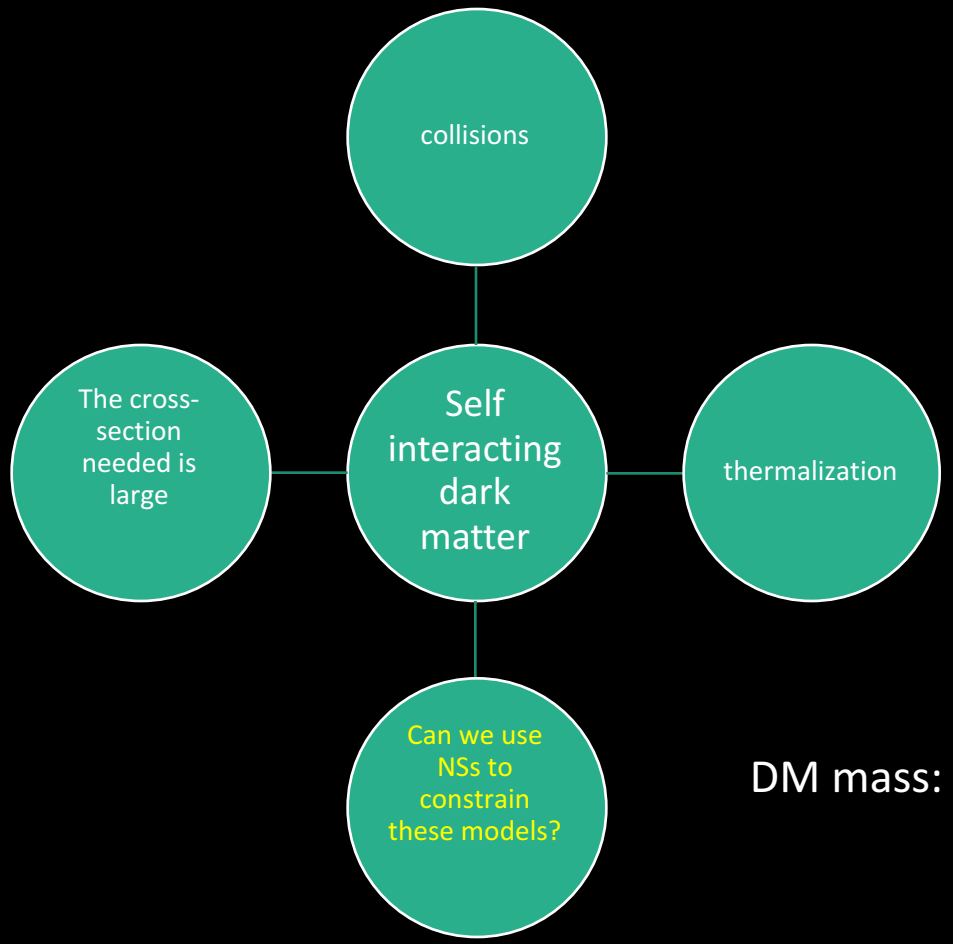
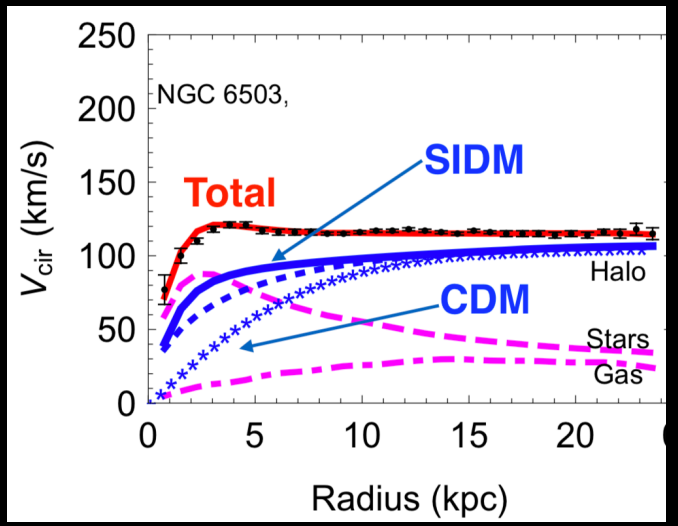
III. Dark Matter and the Gravitational Wave Signal from binary neutron star mergers



DM mass: mχ~ 50 MeV



Kamada, Kaplinghat, Pace, Yu, (2018)

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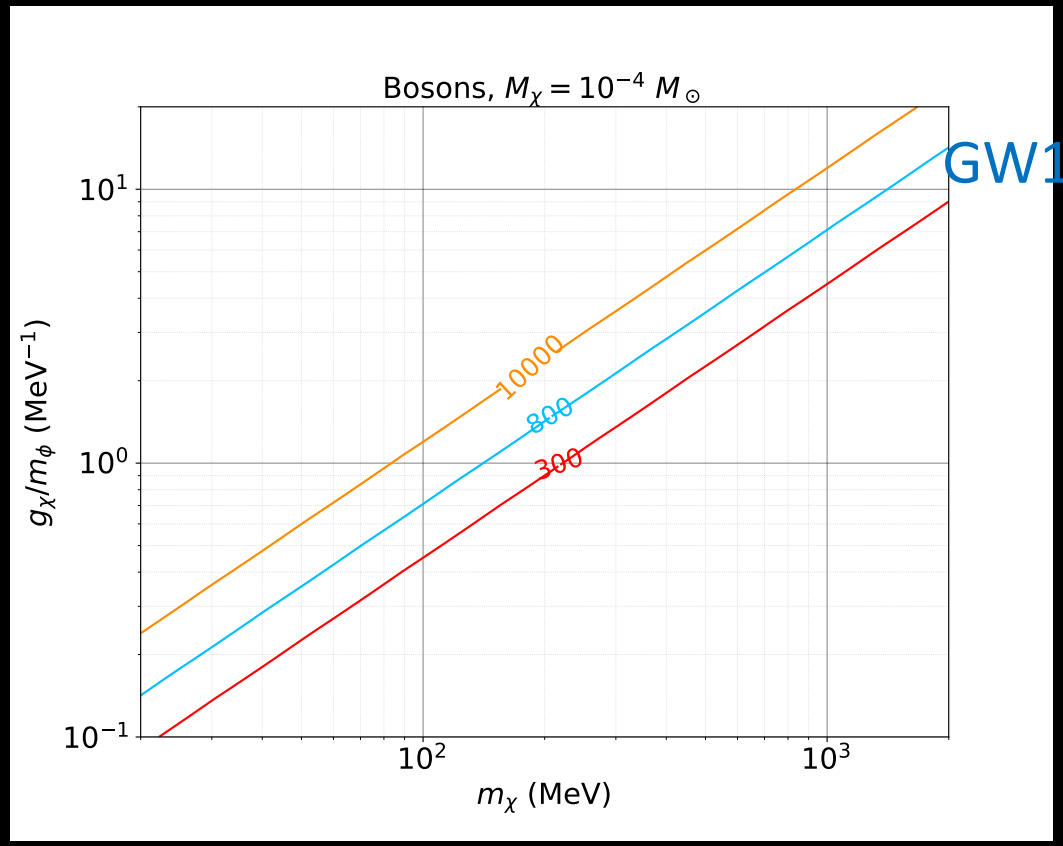

GW170817 from merging neutron stars

Tidal deformability for 1.4 $M_\odot$ Neutron star with $10^{-4} M_\odot$ of dark matter.

Ann Nelson, Sanjay Reddy, Dake Zhou, JCAP 2019

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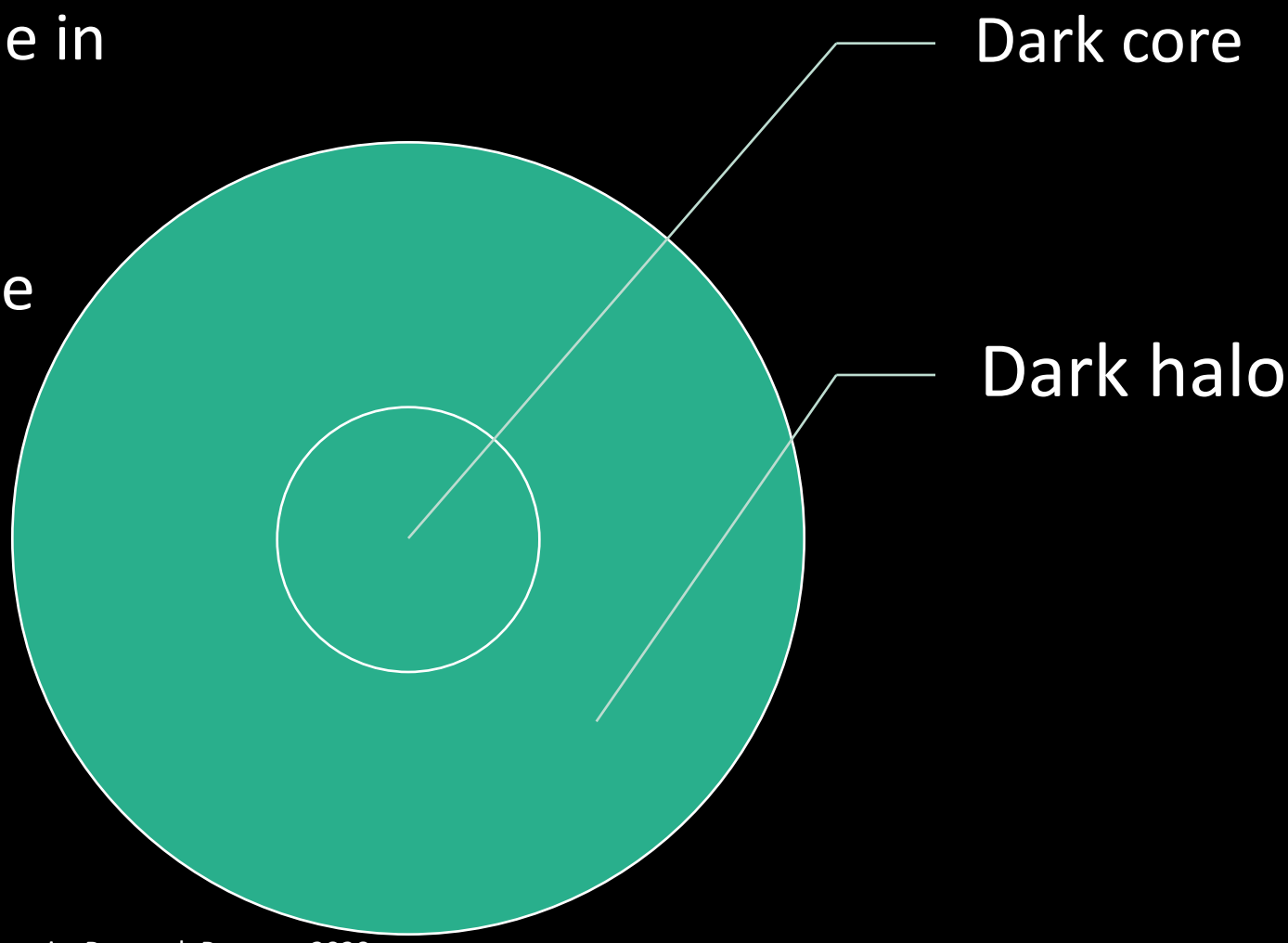
Ongoing research

- MeV dark matter can play a role in neutron stars.
- Dark matter production during supernovae and mergers can be significant.
- Dark matters and their tidal polarizability



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