

A different perspective on Primordial Black Holes

Nicola Bellomo

TCCAP, Weinberg Institute, UT Austin

TACOS 10/10/2022



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DISCLAIMER: The purpose of this talk
is not to advocate pro or against PBHs!



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- $f_{\text{PBH}}(1 \text{ PBH per Universe})$ link to Beyond SM Physics. [Kalaja, Bellomo+, 1908.03596](#)



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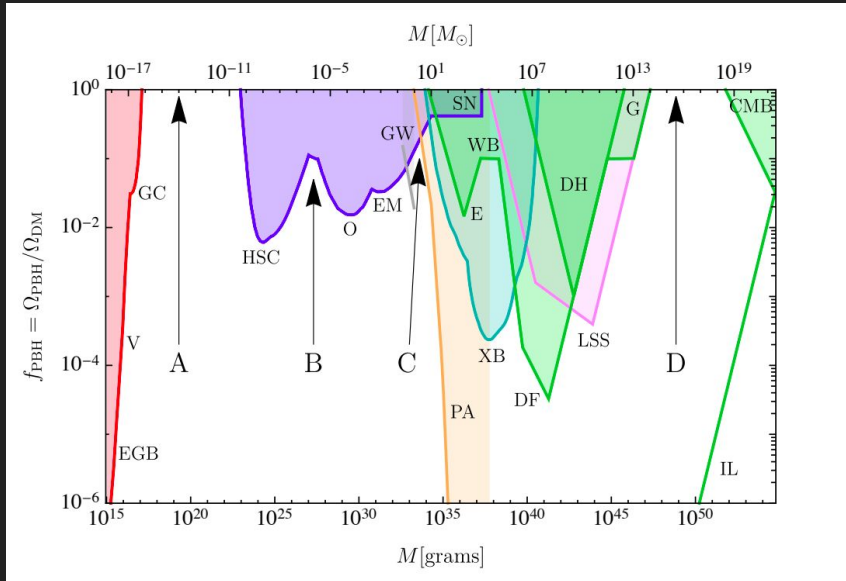
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- Their search is a byproduct of other experiments!



Abundance constraints on PBHs



Carr+, 2110.02821

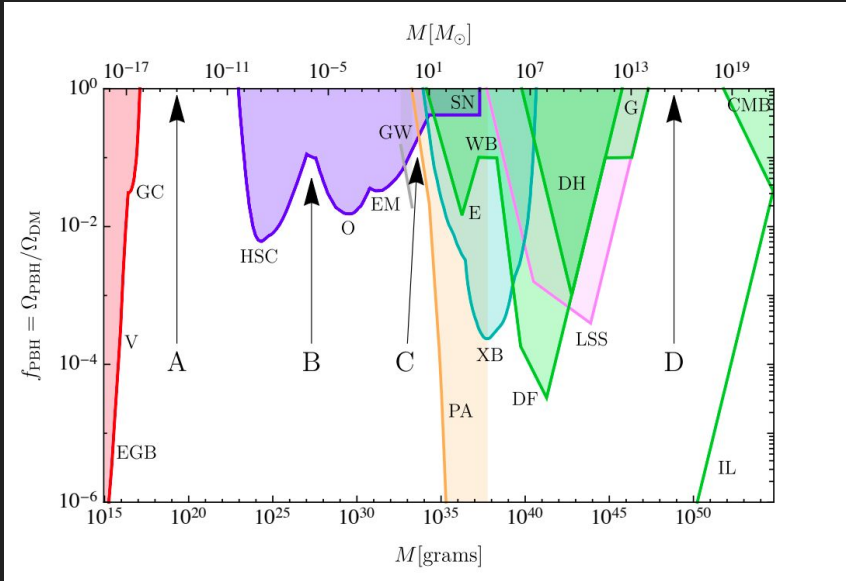
Rich phenomenology:

- Dynamical effects;
- Lensing effects;
- Accretion;
- Effects on Large Scale Structure.

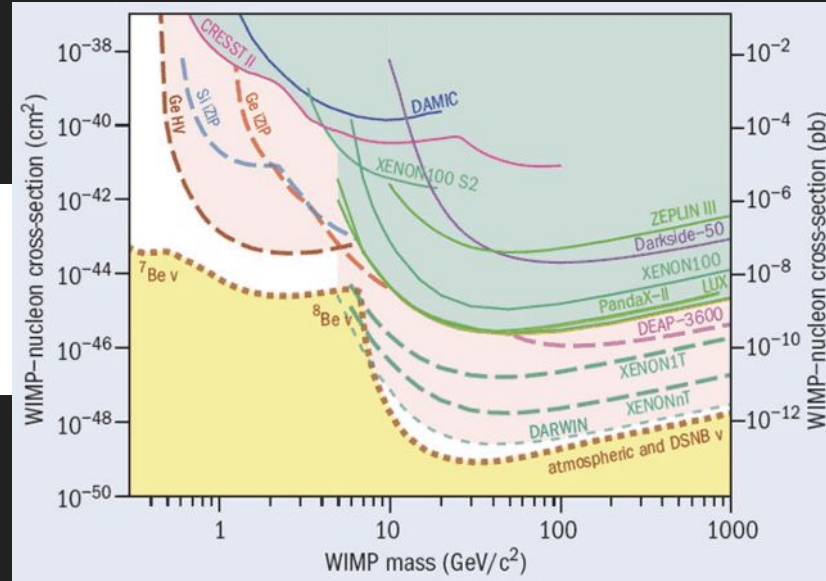


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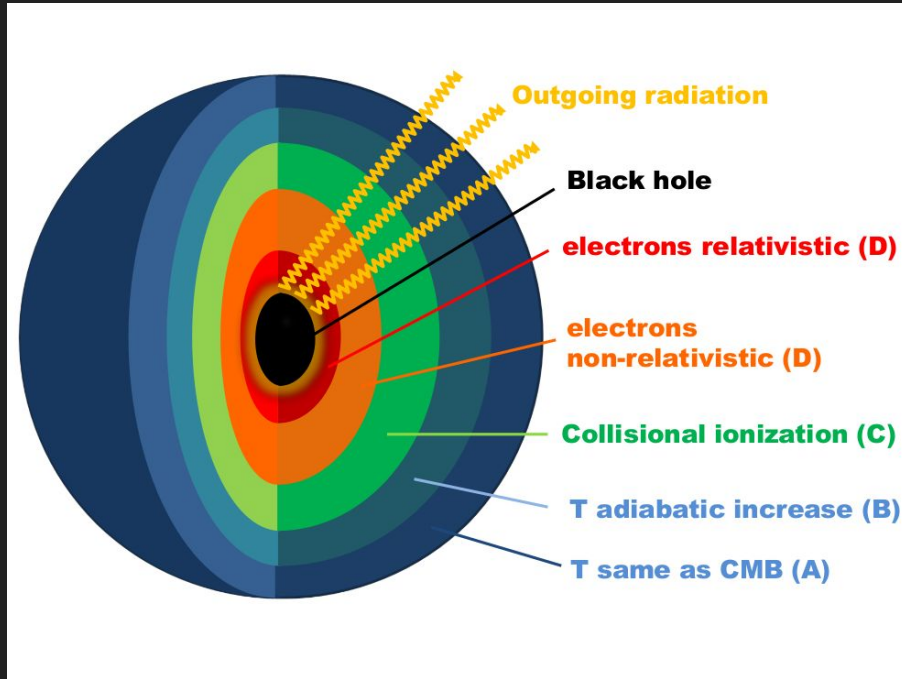


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CMB constraints on PBH: basic picture

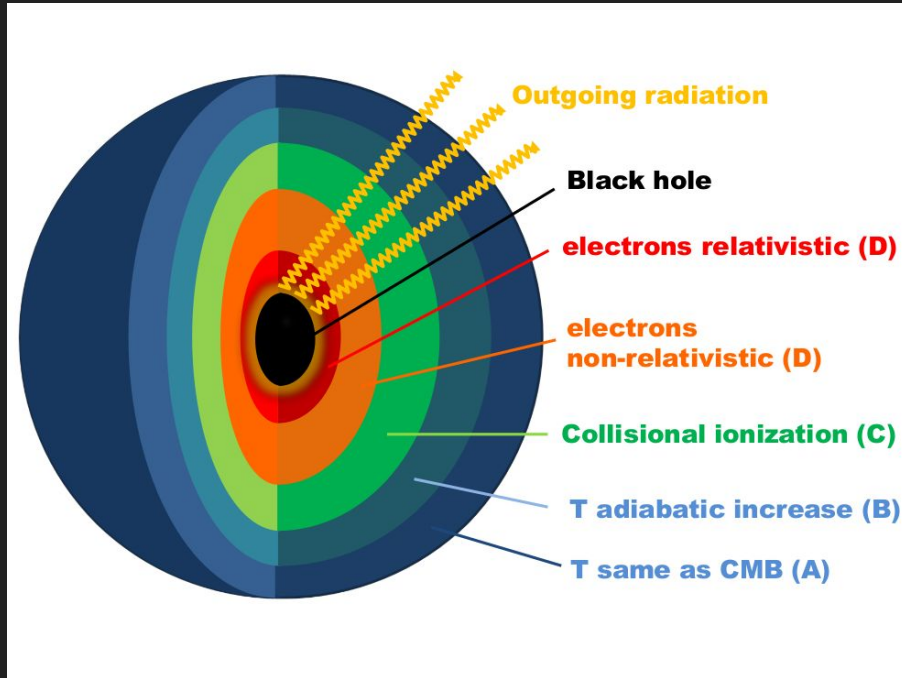


Sasaki+, 1801.05235



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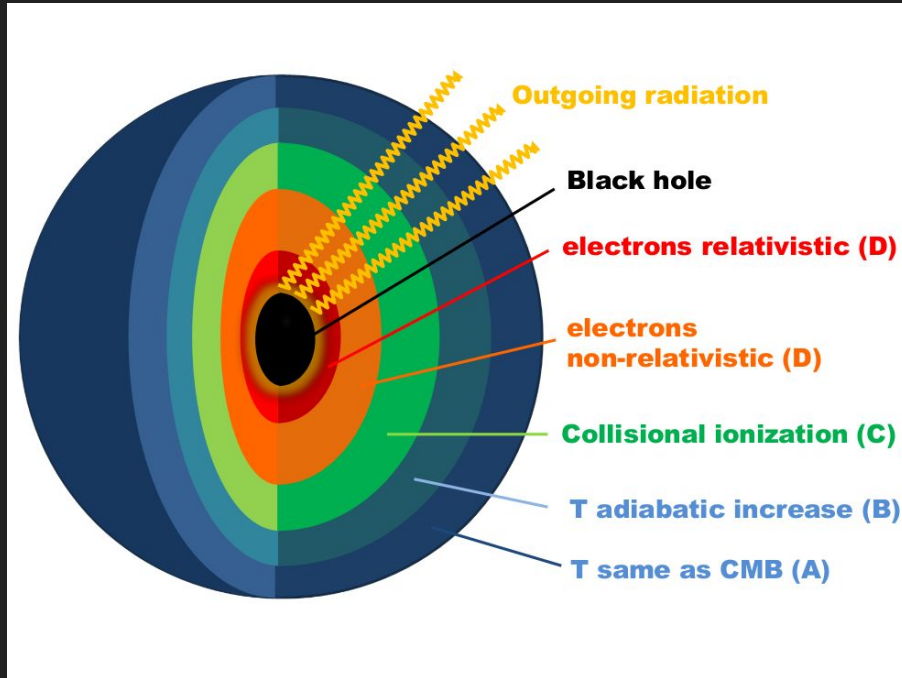
CMB constraints on PBH: basic picture



PBH abundance depends on:

1. Radiation luminosity;
2. Accretion rate.

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Models studied so far cover different geometries (disk vs spherical), gas ionization models, etc.

Including outflows

Competing effects: reduced accretion vs increased luminosity.

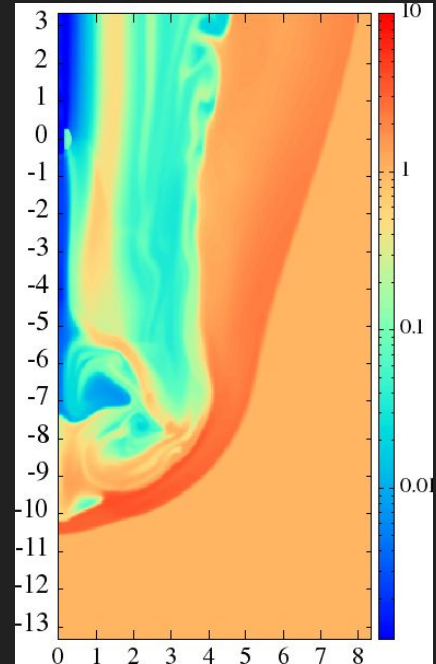


Including outflows

Competing effects: reduced accretion vs increased luminosity.

Reduction in accretion estimated through numerical
2D&3D simulation varying:

1. Degree of collimation of the outflow;
2. Relative orientation between between outflow and direction of PBH motion;
3. PBH velocity.



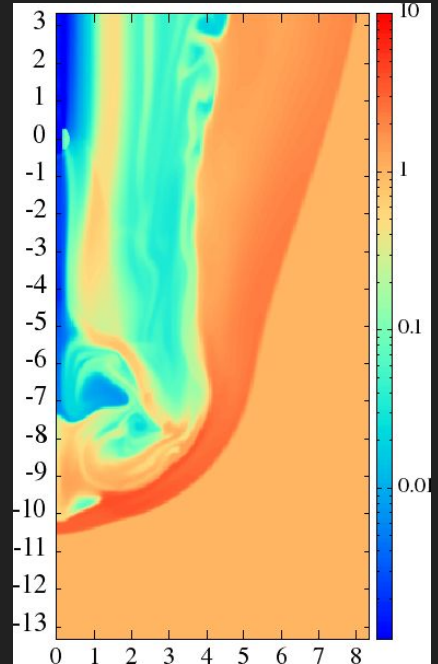
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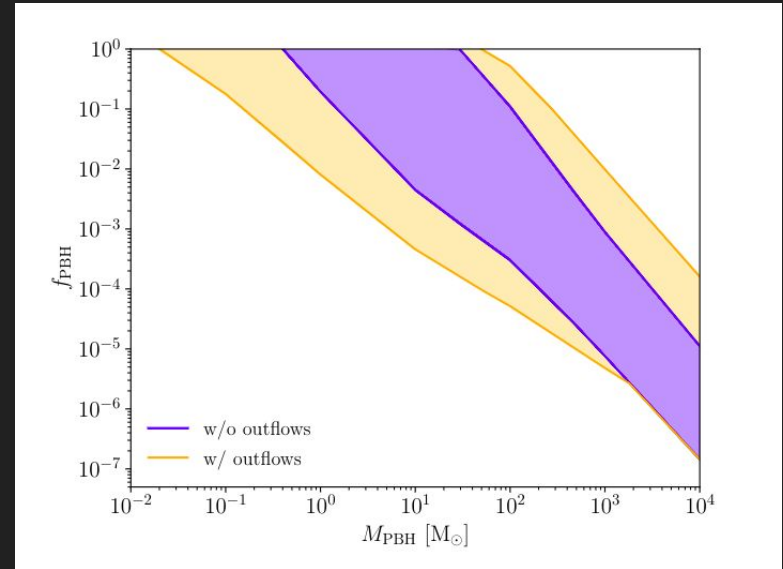
1. Degree of collimation of the outflow;
2. Relative orientation between between outflow and direction of PBH motion;
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Results: reduction of one order of magnitude in accretion rate on average.



Effects on CMB abundance constraints

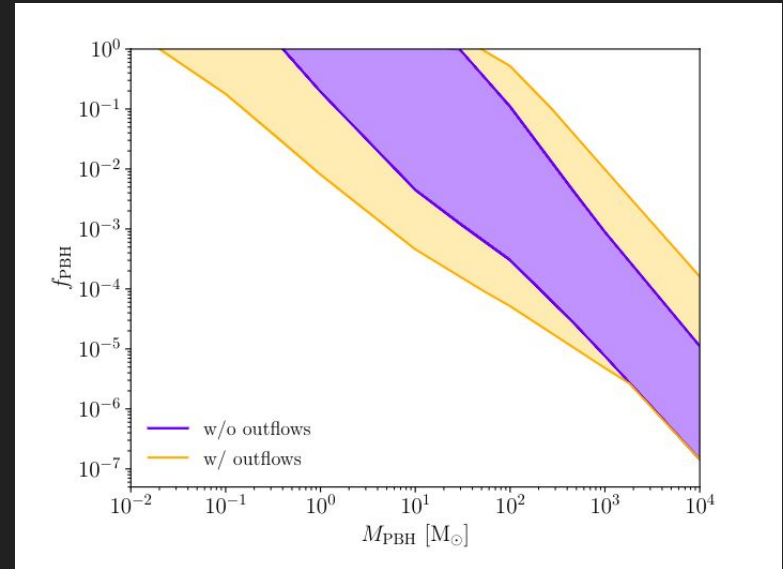
Agnostic way to present constraints: uncertainty bands.



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Conclusion: theoretical error in modelling still the dominant source of error.



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Conclusion: theoretical error in modelling still the dominant source of error.

CMB cannot be used to rule-in or rule-out PBH as dominant component of dark matter.

