Late-time dark matter acceleration

Cosmological constraints on magnetic monopoles

In preparation

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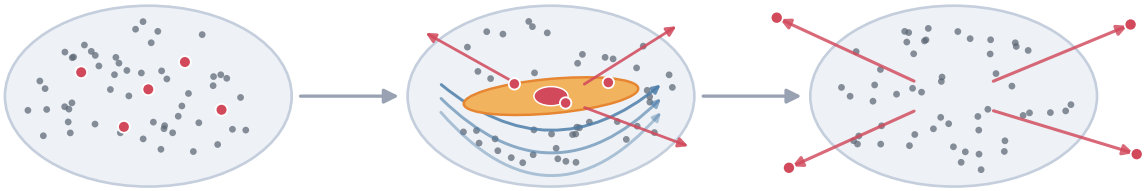
University of Warsaw

with Marcin Badziak, Adam Gomułka and Daniele Perri

1 CDM-like monopoles
initially clustered as cold dark matter

2 Energy injection
by Galactic magnetic fields

3 Free streaming
accelerated monopoles leave the halo



cold dark matter monopole component

smaller clustered fraction $\Longrightarrow$ scale-dependent suppression of $P_m(k, z)$

Late-time acceleration model

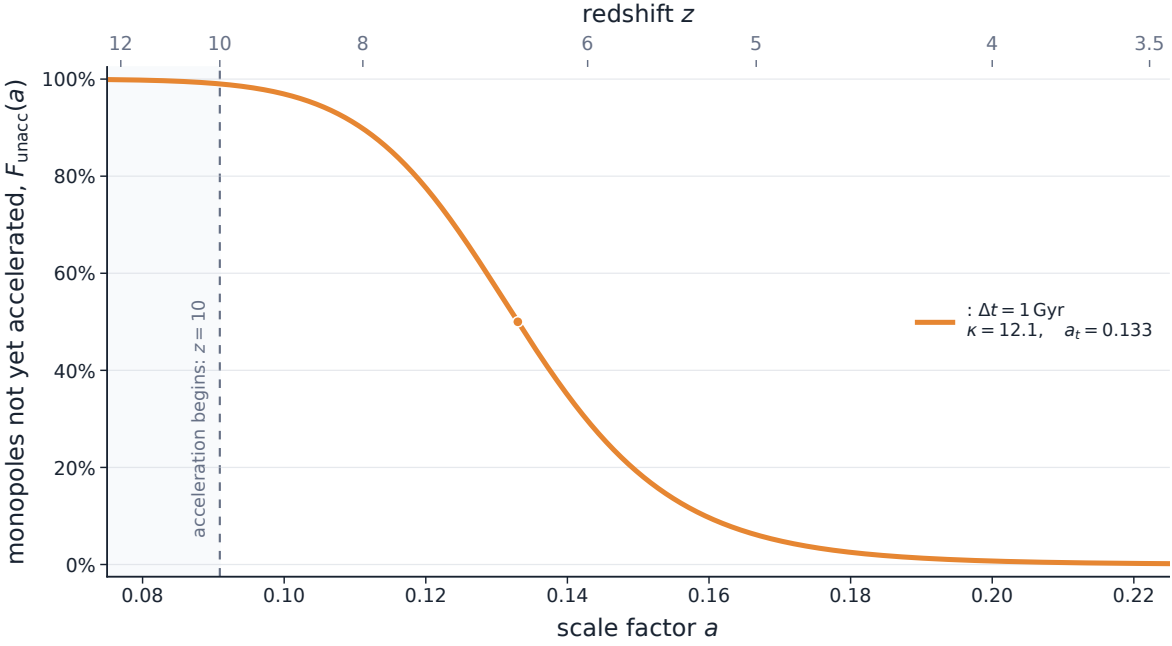
Cold-component density

$$\rho_{\mathrm{cdm}}(a) = \frac{\rho^0_{\mathrm{cdm}}}{a^3}\left[1 + f_{\mathrm{acc}}\frac{1-a^\kappa}{1+(a/a_t)^\kappa}\right].$$

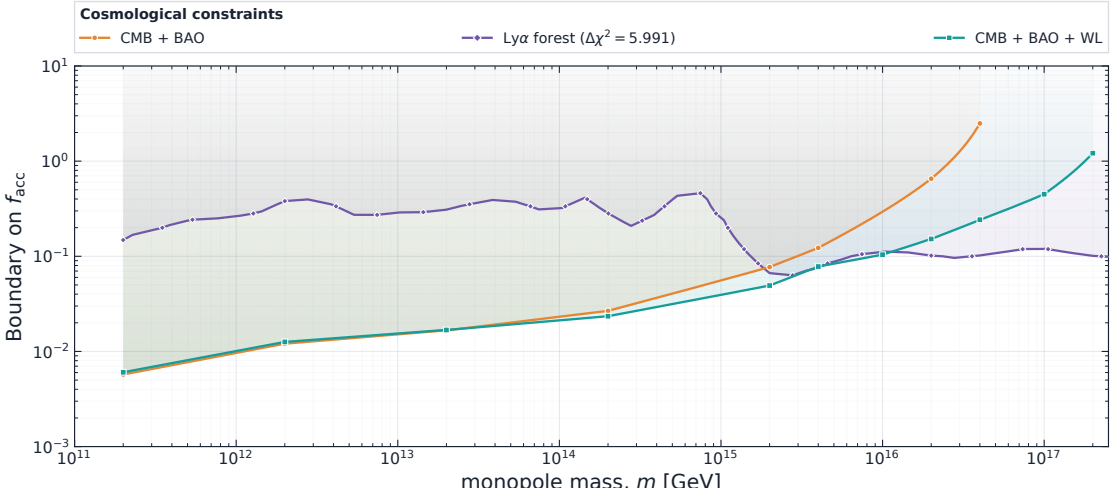
$$(a^3\rho_{\mathrm{cdm}})_{\mathrm{early}} = (1+f_{\mathrm{acc}})(a^3\rho_{\mathrm{cdm}})_{\mathrm{today}}$$

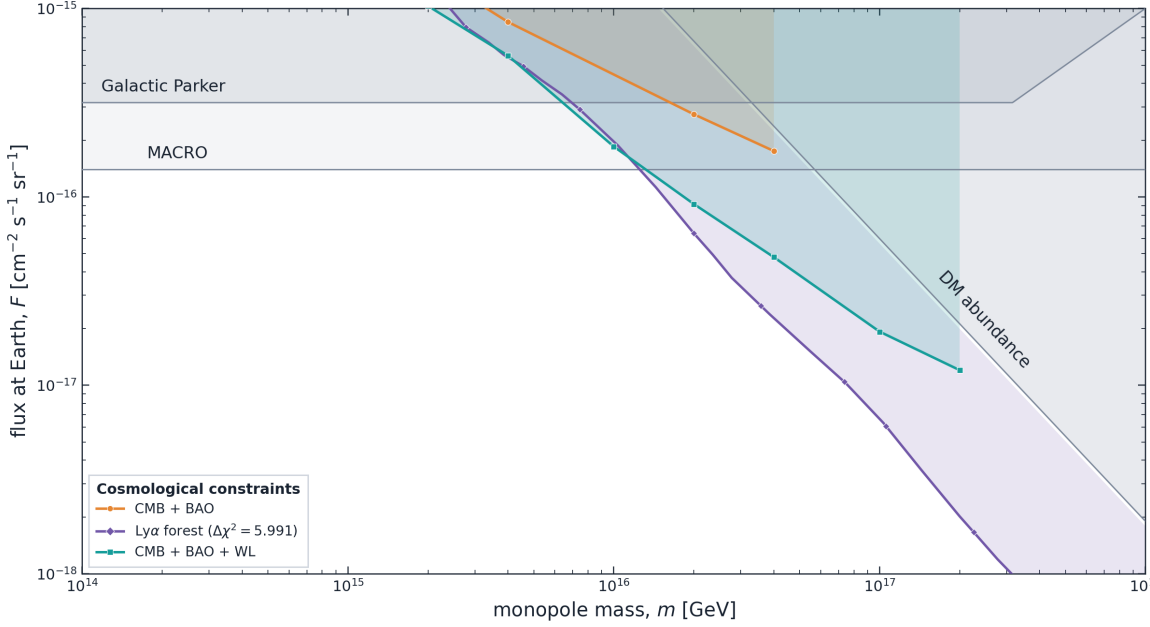
f_{acc}	a_t	κ	η
transfer amplitude	transition epoch	transition sharpness	kinetic-energy gain

Energy: $E_{\mathrm{acc}} = m_{\mathrm{acc}}(1+\eta)$ **Consistency:** $\eta m_{\mathrm{acc}} \ll \rho_{\mathrm{crit}}(a_{\mathrm{acc}})H^{-3}_{\mathrm{acc}}$.


redshift z
12
10
8
6
5
4
3.5
100%
80%
60%
40%
20%
0%
monopoles not yet accelerated, $F_{\mathrm{unacc}}(a)$
acceleration begins: $z = 10$
: $\Delta t = 1\,\mathrm{Gyr}$
$\kappa = 12.1, \quad a_t = 0.133$
0.08
0.10
0.12
0.14
0.16
0.18
0.20
0.22
scale factor a

Limits on f_{acc}




Galactic Parker
MACRO
DM abundance
Cosmological constraints
CMB + BAO
Lyα forest (Δχ² = 5.991)
CMB + BAO + WL
flux at Earth, F [cm⁻² s⁻¹ sr⁻¹]
monopole mass, m [GeV]
10⁻¹⁵
10⁻¹⁶
10⁻¹⁷
10⁻¹⁸
10¹⁴
10¹⁵
10¹⁶
10¹⁷
10¹⁸

Thank you

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