Dark Matter Annihilation via Breit-Wigner Enhancement with Heavier Mediator

Y.C, Shao-Feng Ge, Jie Sheng and Tsutomu T. Yanagida, [arXiv: 2309.12043 [hep-ph]].

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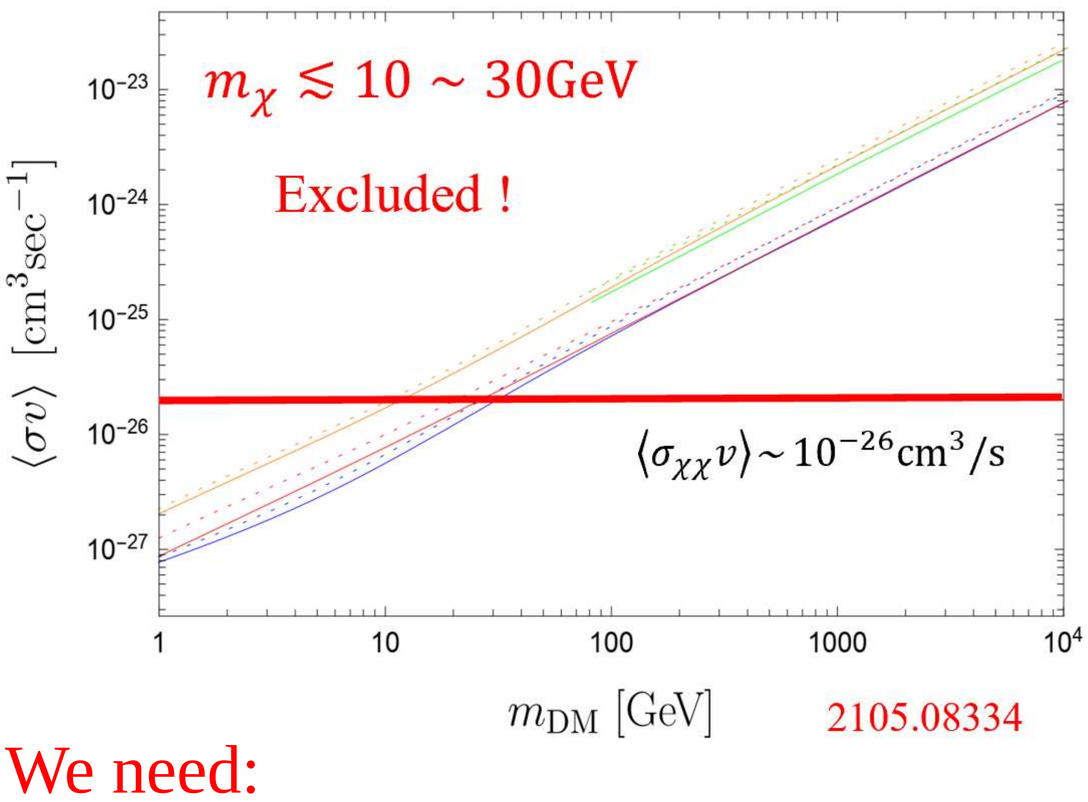
Research Interests:
Dark Matter Physics, BSM Phenomenology.

1. CMB constraint for Freeze out



We need:

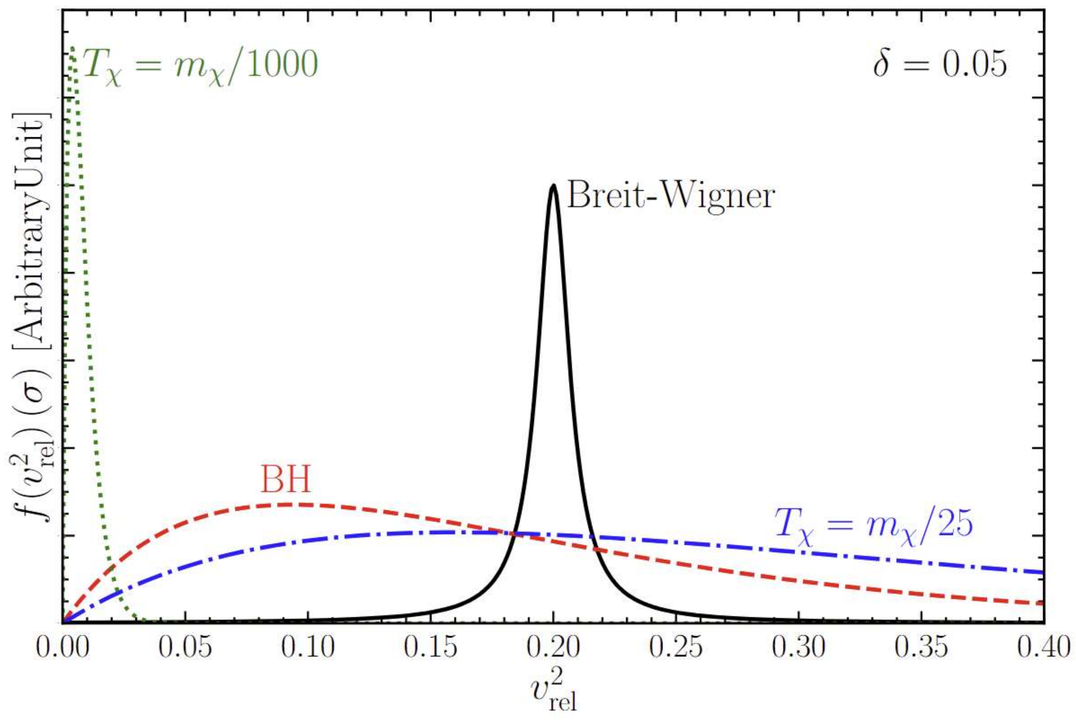
- Freeze out: $T \sim m_\chi/25$

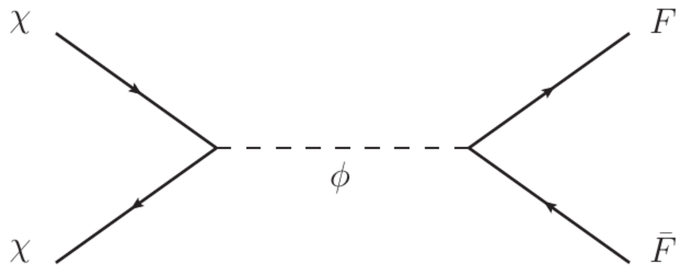
  $\langle\sigma_{\chi\chi}v\rangle \sim 10^{-26}\text{cm}^3/\text{s}$

- CMB: $T \sim eV$

  $\langle\sigma_{\chi\chi}v\rangle \ll 10^{-26}\text{cm}^3/\text{s}$

2. DM Production with BW Resonance





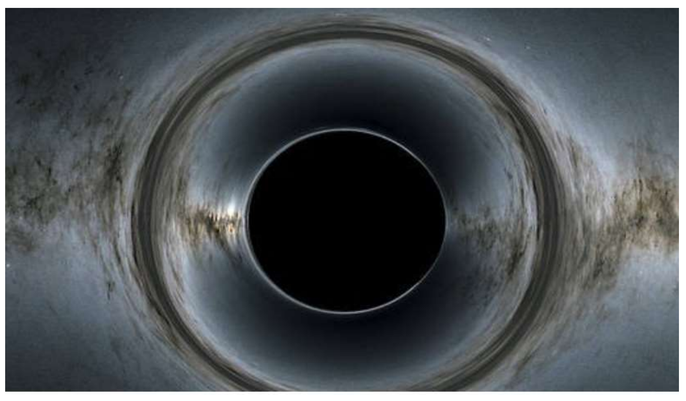
$$\sigma = \frac{16\pi\omega\beta_f}{s\bar{\beta}_i\bar{\beta}_f\beta_i}\frac{m_\phi^2\Gamma_\phi^2}{\left(s-m_\phi^2\right)^2+m_\phi^2\Gamma_\phi^2}B_iB_f$$

3. Right-Handed Neutrino DM model

- **Seesaw mechanism**
  - N_3, N_2 → Neutrino oscillation, Baryon asymmetry
  - N_χ → Z_2 odd, Stable DM

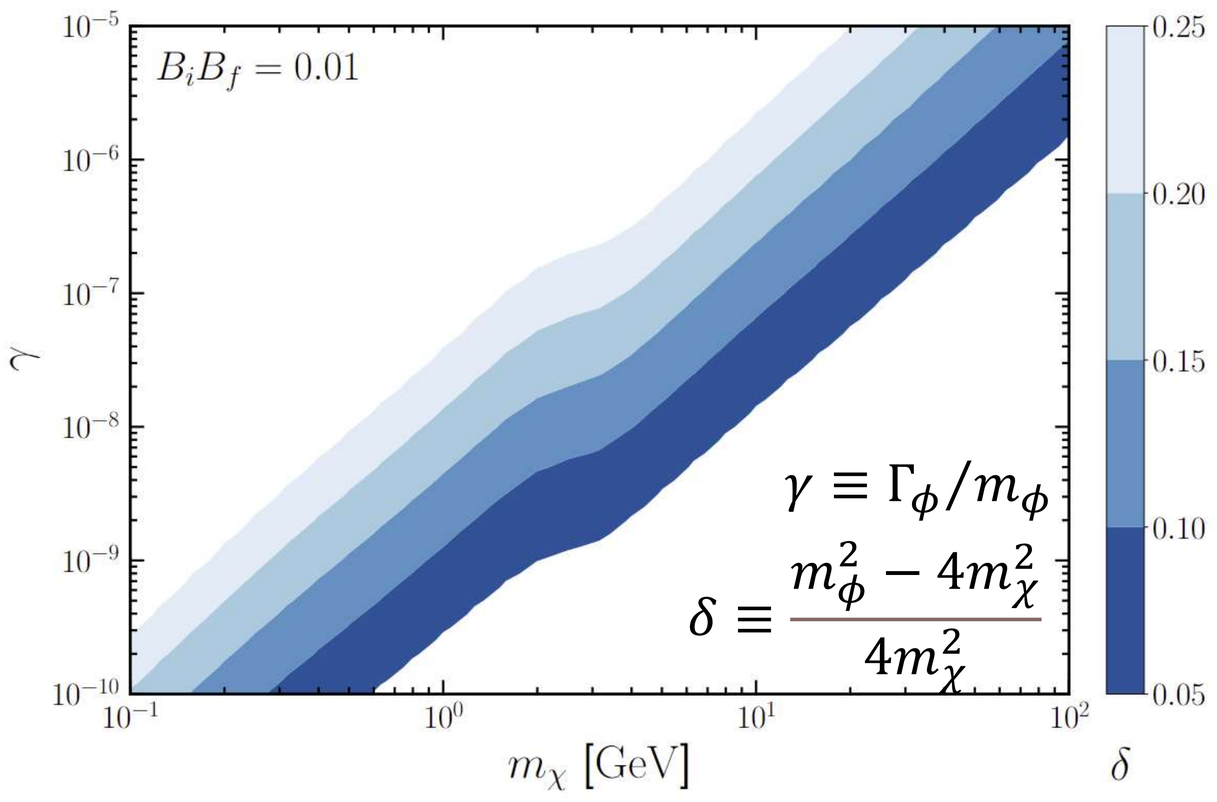
$$\mathcal{L}_{\rm int} = \left(y\phi \boldsymbol{N_\chi^T \epsilon N_\chi} + \text{ h.c. }\right) + \lambda m_\phi \phi H^\dagger H.$$

4. Black hole acceleration



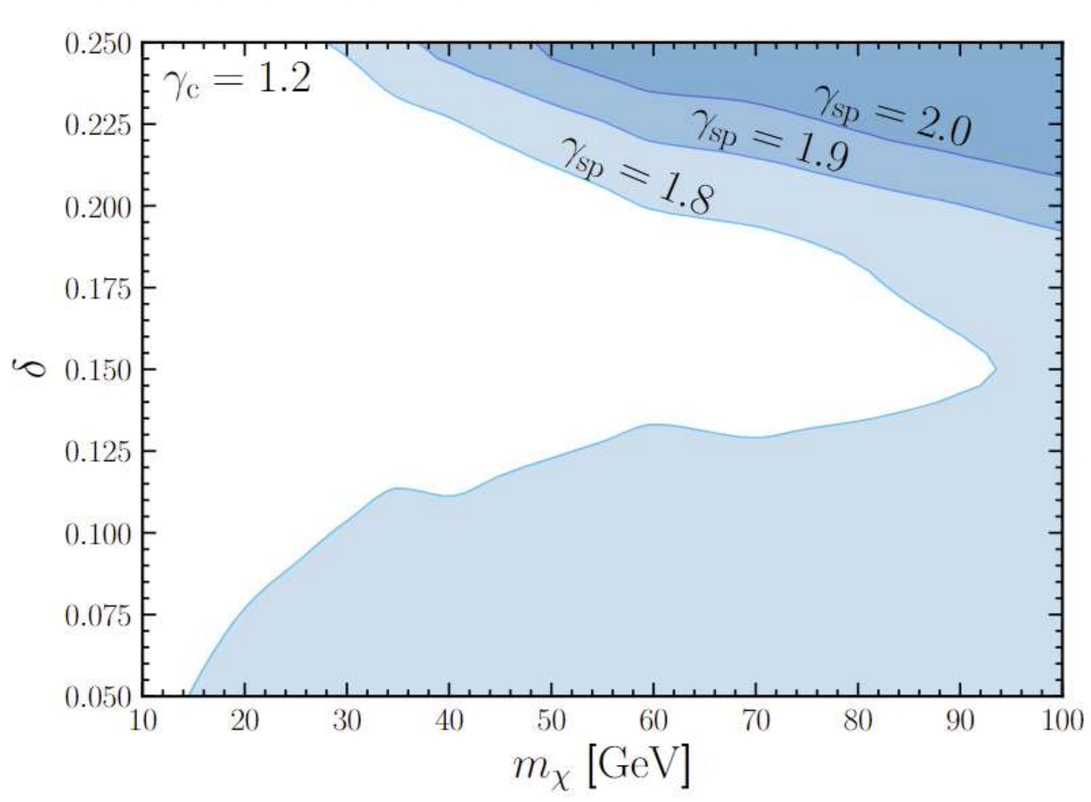
$$v^2 \sim \frac{GM}{r}$$
$$v(r) \sim \frac{1}{\sqrt{r}}$$
$$\rho \propto r^{-7/3}$$

- **Relic Density:**



The parameter space to generate the correct relic density $\Omega_\chi h^2 = 0.12$ for the Breit-Wigner resonance scenario with a heavy mediator.

- **Constraints from Fermi-LAT**



The allowed parameter space not exceeding the constraints from each data bin of the Fermi-LAT gamma-ray observation at 95 % C.L.