Fysikermøtet, zoom/Stavanger, 21-24 June 2021

Pandemic Dark Matter



UiO : University of Oslo

The origin of dark matter (DM)

DM = crucial ingredient of cosmological standard model

Percent-level

single parameter!

- constant co-moving energy density
- only gravitational interactions
- cold + dissipation-less





- Existence of (particle) DM = evidence for new physics!
 - We have a rather good handle on what DM is **not**...
 - \subseteq ... but this still leaves very many possibilities



Any convincing model for dark matter must include a production mechanism that can explain the observed abundance

Weakly Interacting Massive Particles

- well-motivated from particle physics [SUSY, EDs, ...]
- Ithermal production in early universe:



Feably Interacting Massive Particles



Smooth transition between two regimes:



A new production mechanism



TB, Depta, Hufnagel, Rudermann & Schmidt-Hoberg, 2103.16572 Hryczuk & Laletin, 2104.05684

$$\dot{n_{\chi}} + \frac{3H}{n_{\chi}} = n_{\chi} n_{\psi}^{\text{eq}} \langle \sigma v \rangle$$

[for $n_{\chi} \ll n_{\psi}^{\text{eq}}$]

The 'SIR' compartmental model

A Contribution to the Mathematical Theory of Epidemics. By W. O. KERMACK and A. G. MCKENDRICK.

(Communicated by Sir Gilbert Walker, F.R.S.-Received May 13, 1927.)



reproduction number / R-value':

$$R \equiv \frac{\beta S}{\gamma} = \frac{n_{\psi}^{\rm eq} \langle \sigma v \rangle}{3H}$$

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Exponential DM production



Phase diagram: production from thermal bath



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Signals ?

Necessarily model-dependent



More model building avenues

Vector coupling with mass mixing

Very natural way of arranging for required hierarchy of interaction strengths!

Rich phenomenology to be worked out...

Conclusions

- Pandemic dark matter is a novel, generic
 mechanism for dark matter genesis from the thermal bath
- Mathematical analogy to the spread of diseases, works almost scarily well [see arXiv v1 for exploiting most of jt [see arXi
- Well-defined relation to 'classical' freeze-out and freezein regimes: significant new parameter space to obtain correct relic density
- Rich particle physics phenomenology, largely unexplored

Thanks for your attention!