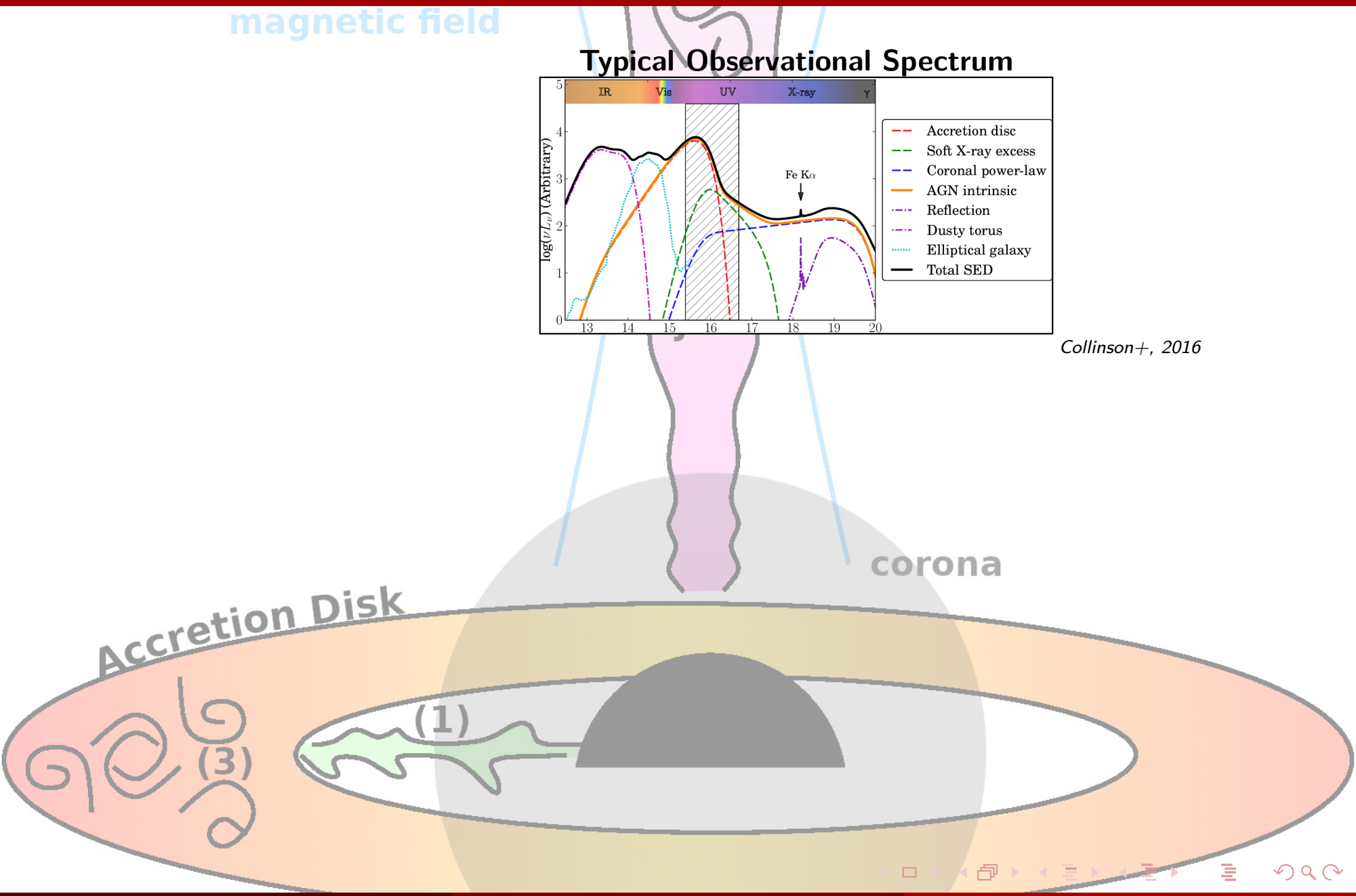
Photo-hadronic pair creation in magnetospheric current sheets of accreting black holes

Despina Karavola
National and Kapodistrian University of Athens
PhD Student

Cosmic-Ray International Studies and Multi-messenger Astroparticle Conference
Trapani

June 2024

Simple X-Ray Corona Model



Typical Observational Spectrum

Collinson+, 2016

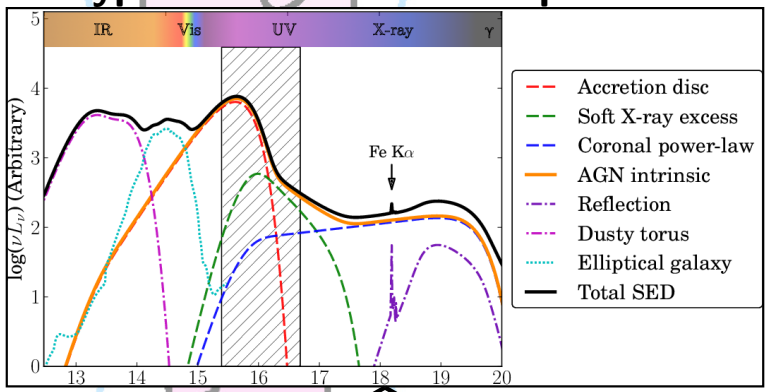
Simple X-Ray Corona Model

Numerical Leptohadronic Code Used:

ATHEνA

$$\sigma_p = \frac{B^2}{4\pi n_{p,cold} m_p c^2}$$

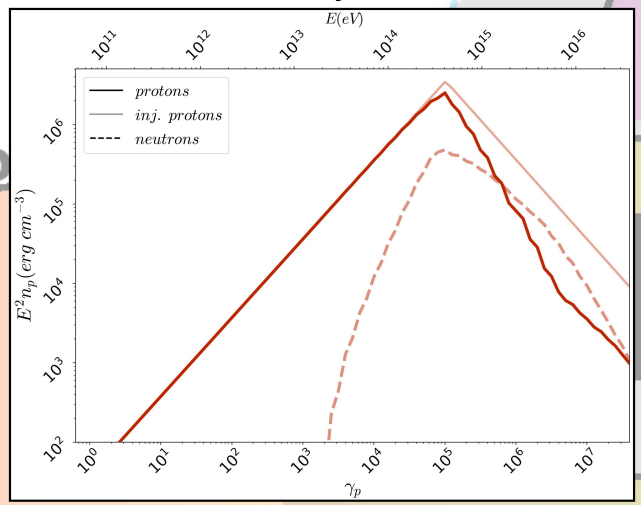
Typical Observational Spectrum

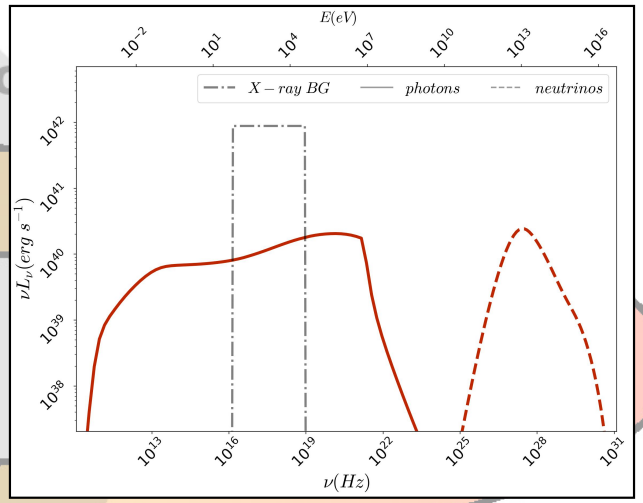


Collinson+, 2016

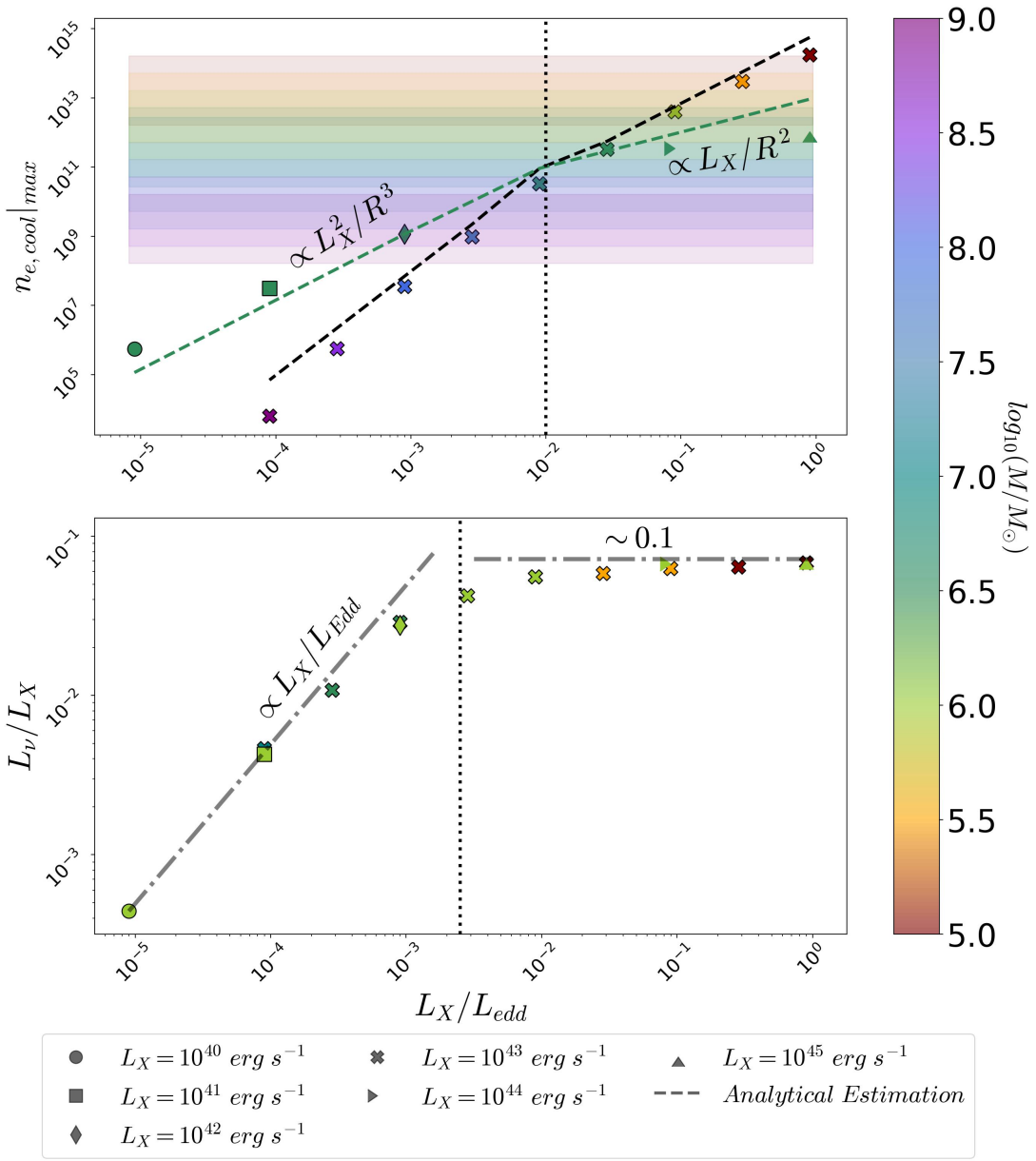
BPL p^+ energy dist. w/ peak at $\gamma_p = \sigma_p$

PL X-ray photon dist. $E \in [100eV, 100keV]$





What do we find?



- $L_X/L_{edd} \gtrsim 10^{-2} \Rightarrow$ sufficient pair density for a corona with $\tau \sim 0.1 - 10$
- $n_{e,cool} \propto L_X^2/R^3$ for optically thin sources to Thomson scattering
- $n_{e,cool} \propto L_X/R^2$ for opaque sources to Thomson scattering
- $L_\nu \propto L_X^2/L_{edd}$ for optically thin sources
- $L_\nu \propto L_X$ for opaque sources

Thank You!