FUTURE COLLIDERS

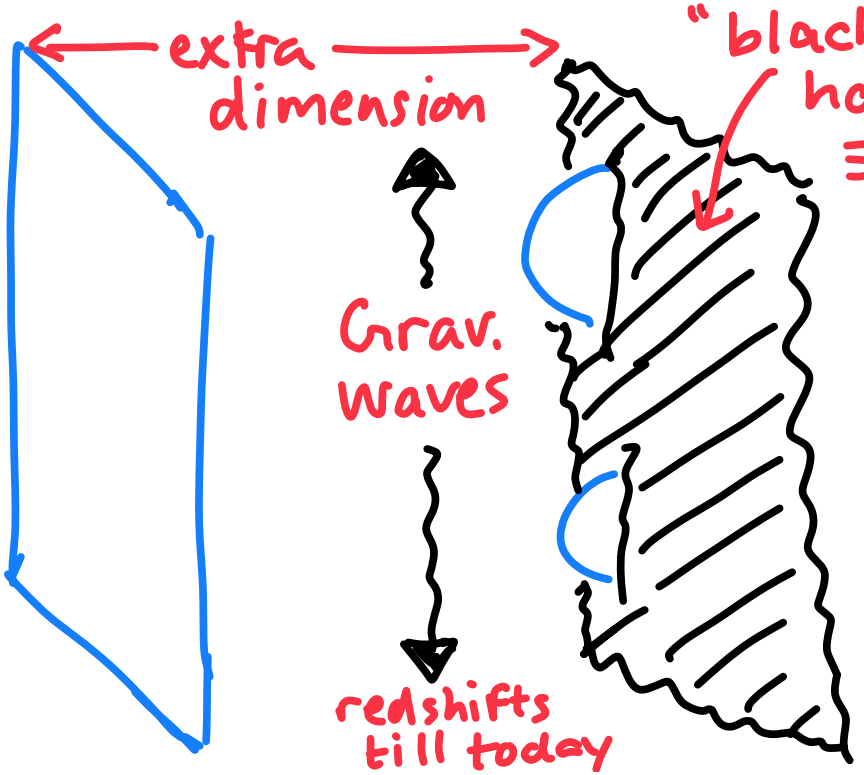
WIN – WIN – WIN !

Rich program of Classic physics explorations, after which we are guaranteed to dramatically transform our understanding

Experimental & Engineering challenges to excite a new generation.

Spin-off benefits to
- excitement of society in magic of $E=mc^2$
- education & training
- technology, materials
- international cooperation in 21st century

GRAVITATIONAL WAVE STOCHASTIC BACKGROUND FROM (MULTI-) TeV BSM PHASE TRANSITION



Happy coincidence that TeV – PeV cosmic phase transitions ⇒ gravitational waves within reach of proposed detectors.

GW frequency spectrum sensitive to collective BSM dynamics, while colliders sensitive to BSM particle structure.

Beautiful challenge of integrating these complementary probes

Cosmological Collider Physics

Collider production via $E = mc^2$,
& need detectors to record & preserve events.

Cosmic Inflation — Spacetime acceleration provides "free" energy $H_{\text{inflation}} \lesssim 10^{14}$ GeV, creating particles

If these particles decay to inflatons their spectroscopy recorded in CMB, Large Scale Structure, 21cm non-Gaussian correlations, preserved on super-horizon length scales.

Challenging precision cosmology! Important to integrate multi-TeV particle physics with far UV particle physics.

DARK MATTER

Well known that we must try to integrate any dark matter (in)direct detection with collider production of dark matter particles or mediators.

It poses one of the foremost grand mysteries in all of Science.