INVESTIGATING NEUTRINO PRODUCTIONS IN SWIFT J1644+57.

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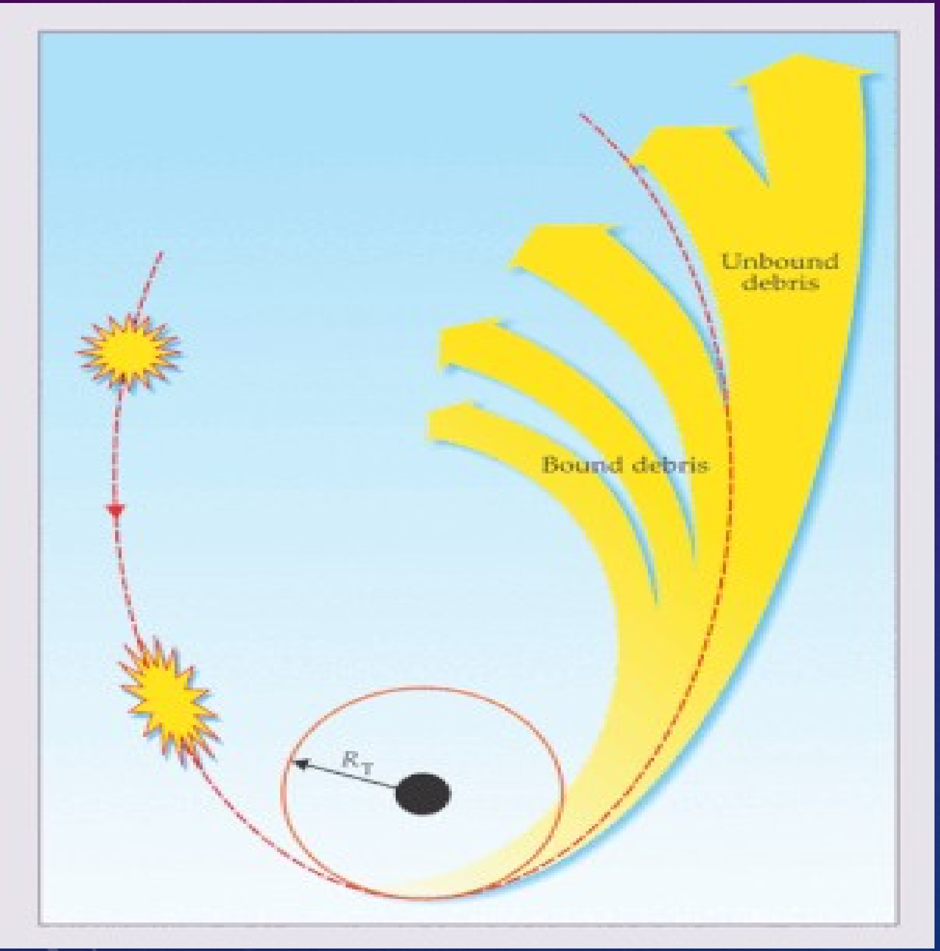
SWIFT J1644+57

- Swift J1644+57 is a tidal disruption event (see next slide)
- First detected in March 28, 2011
- Mistaken for a GRB.
- We study Swift J1644+57 because it is the best measured TDE in multiple wavebands.

WHAT IS A TIDAL DISRUPTION EVENT?

TIDAL DISRUPTION EVENT.



- Naturally produces protons which are injected and accelerated to ultra-high energies.
- Protons and electrons interact with dense photon field producing secondary particles and neutrinos.

WHY TDE AS A CANDIDATE NEUTRINO PRODUCING SITE?

- Naturally produces and accelerates protons.
- High photon number density in a TDE jet

  → intense neutrino emission.

- TDE ≡ transient event lasting for

  → particle acceleration sites in TDE jet should be relatively close to the SMBH.

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- TDE ≡ transient event lasting for $\sim 1yr$

  → particle acceleration sites in TDE jet should be relatively close to the SMBH.

WHY TDE AS A CANDIDATE NEUTRINO PRODUCING SITE?

- The total energy budget of a TDE is the rest-mass energy of the star (Dai & Fang 2017).
- For a star with mass $M_* \sim 1M_{\odot}$ has total available energy.

$$E_{tot} \sim 10^{54}\ ergs$$

- Typically magnetic driven jets, can carry $\leq 10\,\%$ of the accretion energy (McKinney et al (2014))

⇢ Total energy carried within the Swift J1644+57 jet would be $E_{jet} \sim 10^{53}\ erg$

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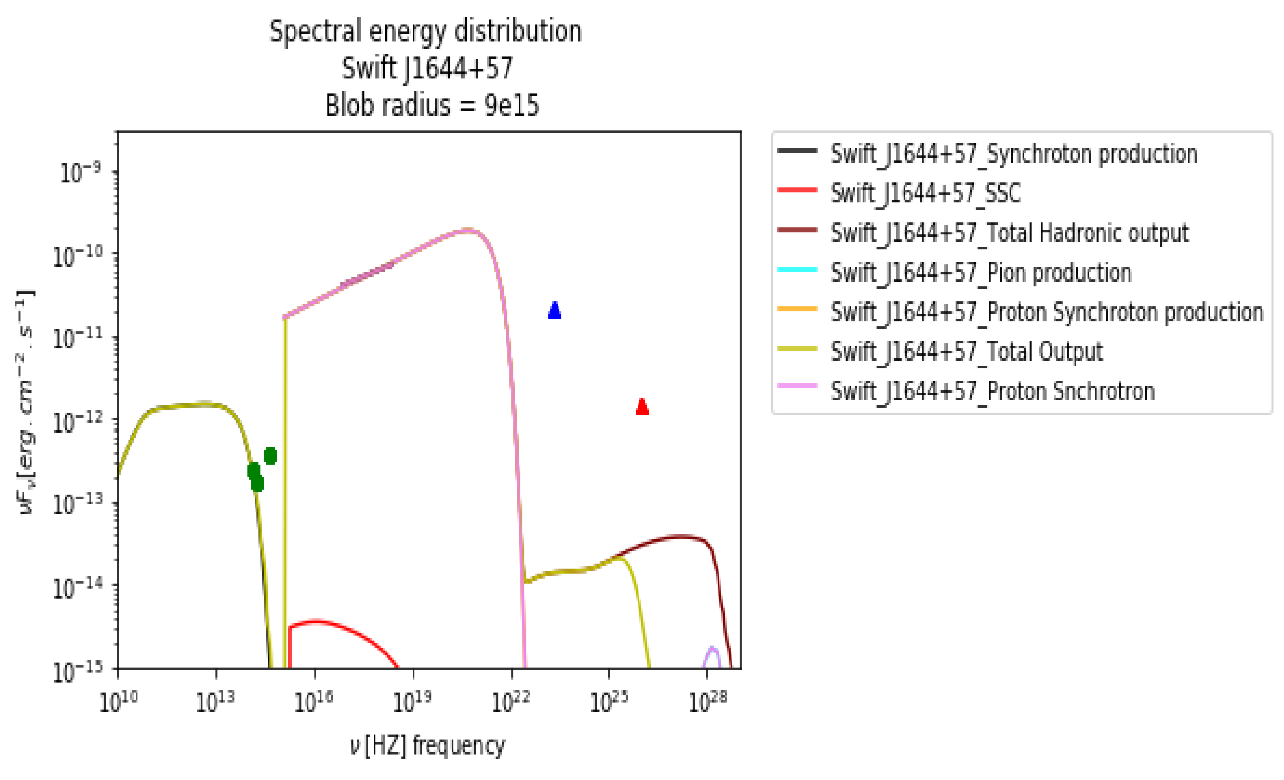
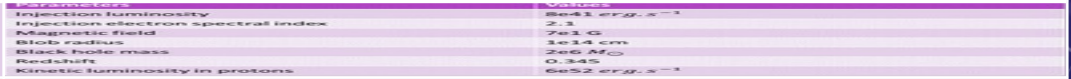
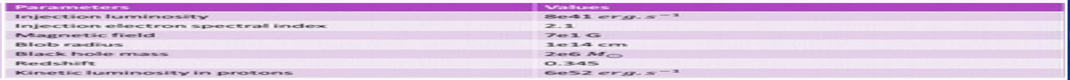
SPECTRAL ENERGY DISTRIBUTION. (SED)

- Produced spectral energy distribution plots using a hadronic jet radiation transfer code (Boettcher et al (2013)).
- The SEDs show us how the energy in the jet is distribution through the electromagnetic spectrum.



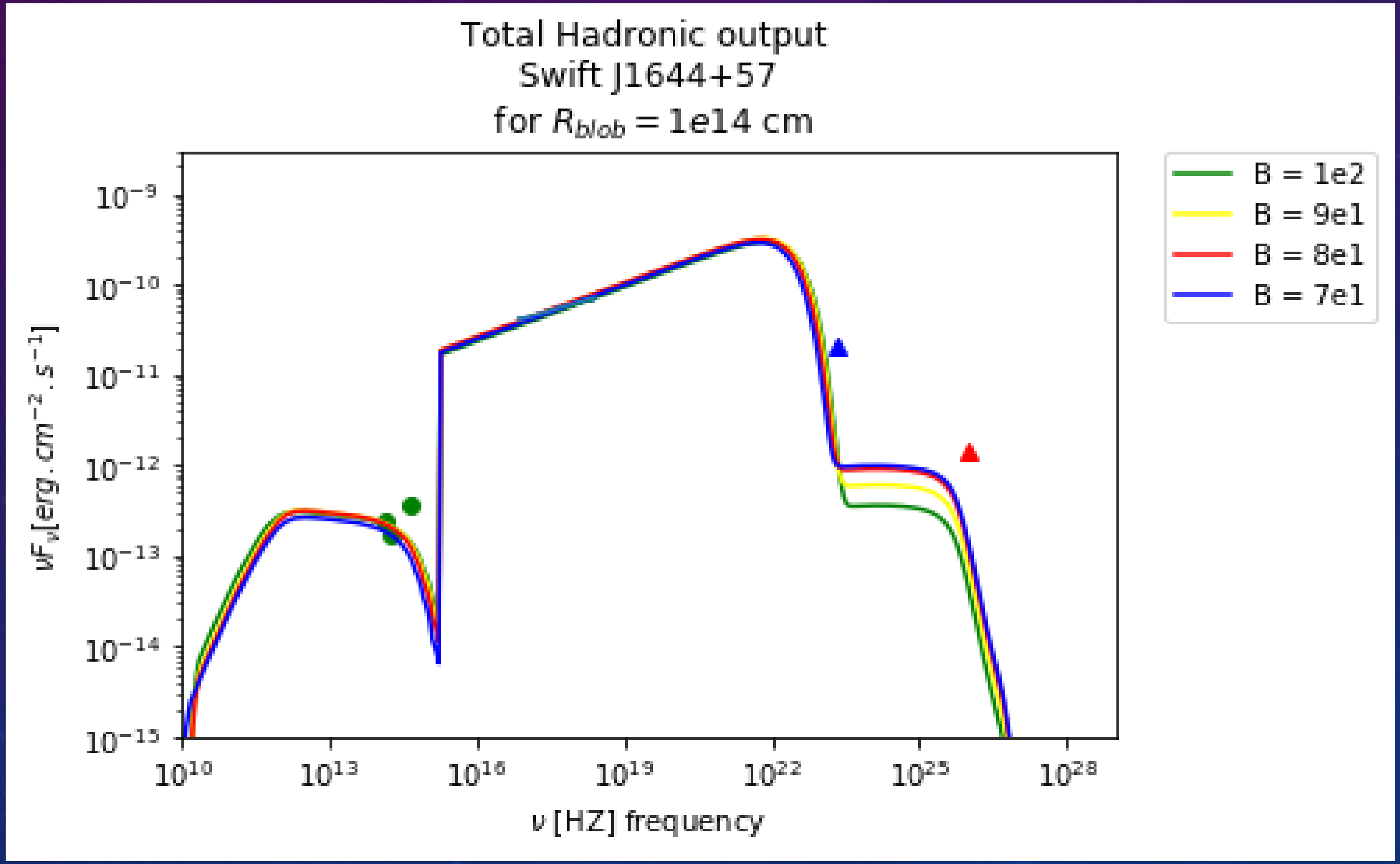
PARAMETERS.

Parameters	**Values**
Injection luminosity	
Injection electron spectral index	2.1
Magnetic field	7e1 G
Blob radius	1e14 cm
Black hole mass	
Redshift	0.345
Kinetic luminosity in protons	

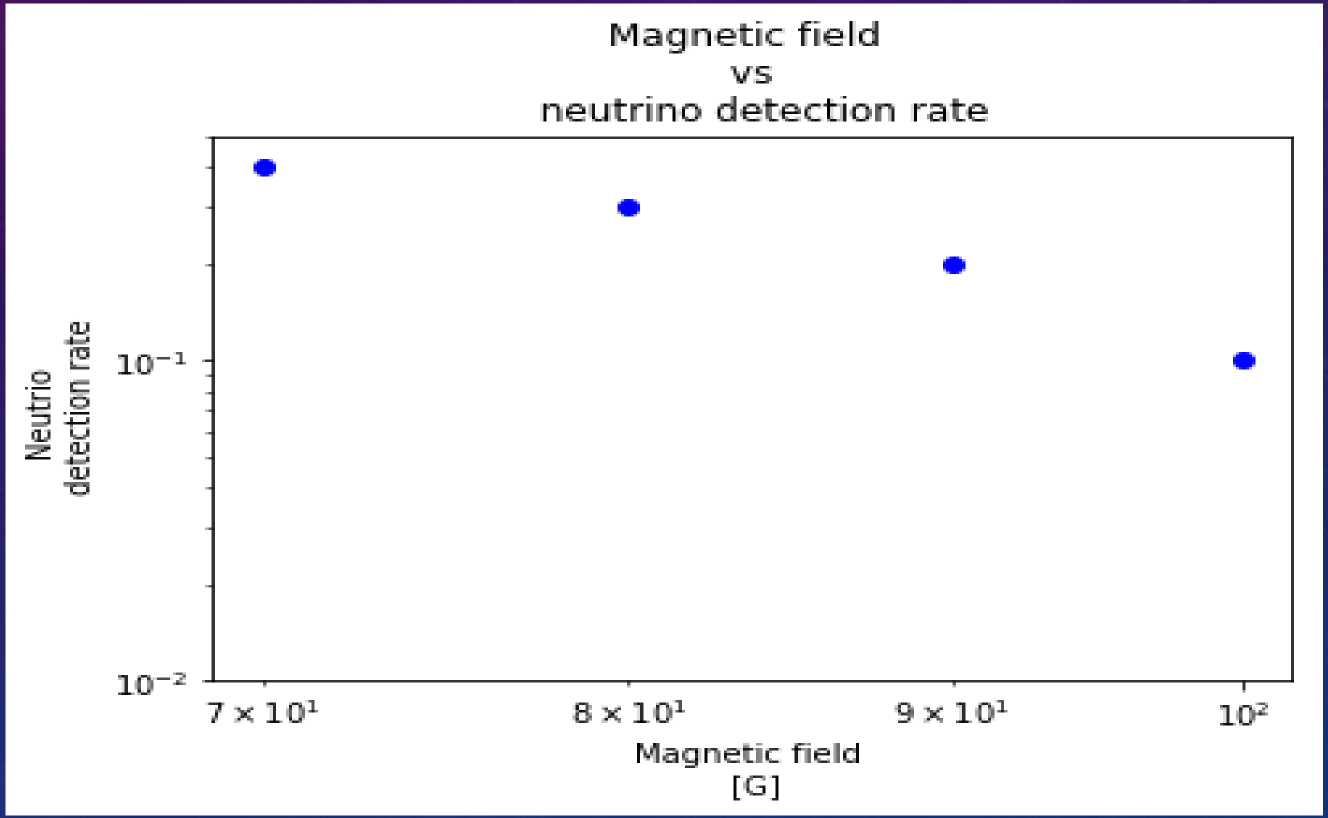
Parameters	Values
Injection luminosity	8e41 $erg.s^{-1}$
Injection electron spectral index	2.1
Magnetic field	7e1 G
Blob radius	1e14 cm
Black hole mass	2e6 $M_{\odot}$
Redshift	0.345
Kinetic luminosity in protons	6e52 $erg.s^{-1}$

Burrows
et al 2011

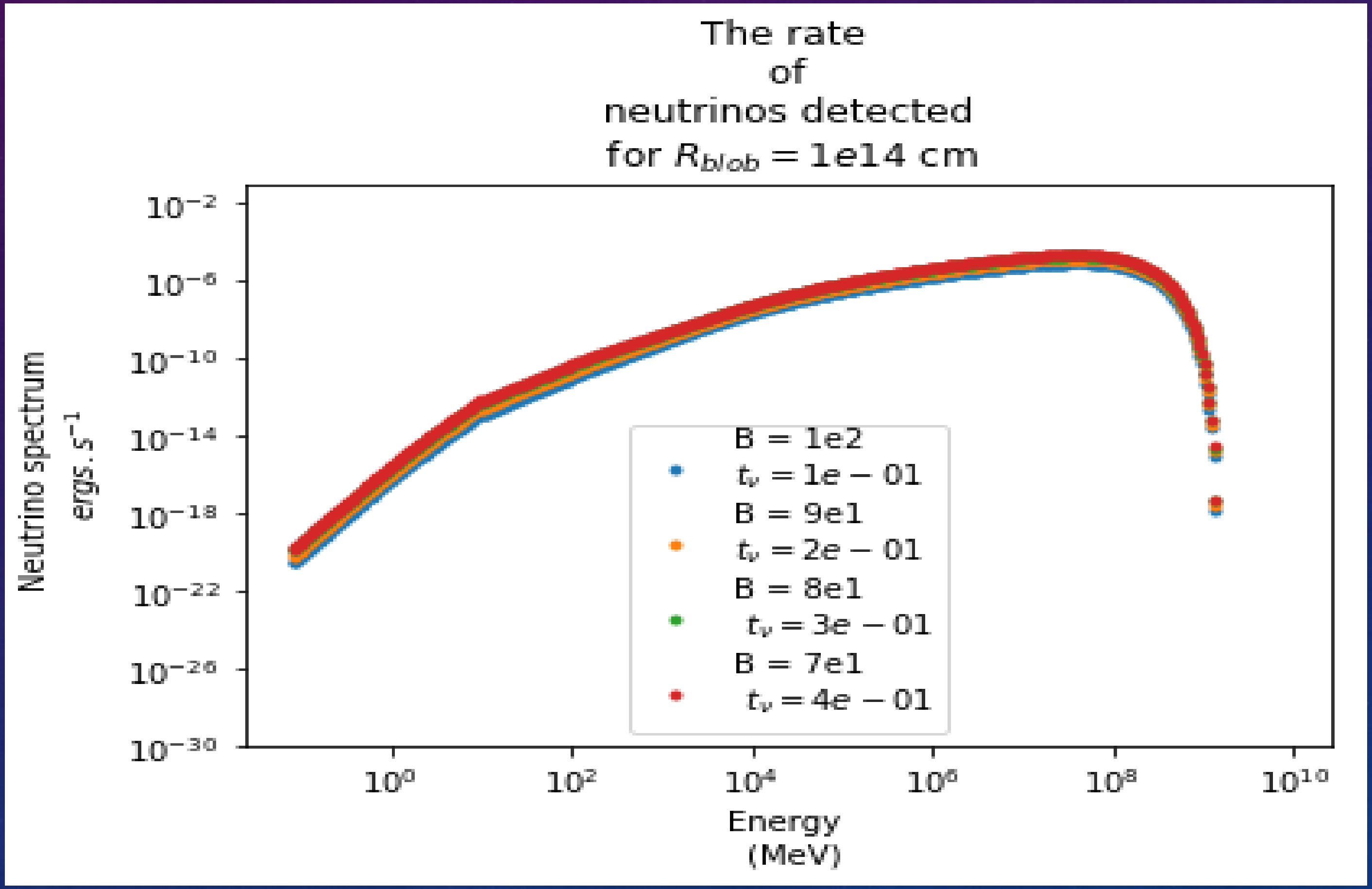
MAGNETIC FIELD VARIATION.



B-FIELD VS. NEUTRINO DETECTION RATE



NEUTRINO EMISSION SPECTRUM.



CONCLUSION.

- In this study we performed a parameter study focused on the magnetic field within the jet of a TDE. These fields are responsible for accelerating protons to energies above the photopion threshold. At larger magnetic field the pion production is suppressed. This implies that increasing the magnetic fields decreases the neutrino production rate.
- TDEs are a plausible neutrino producing source but they could only be responsible for a sub-fraction of the total observed IceCube neutrinos solely because they are transient sources.
- In future we will look at other parameter variations to see how these parameters may affect the neutrino production.

KE A LEBOGA
THANK YOU
SPASIBA