

A second tidal disruption event in coincidence with a high-energy neutrino

Simeon Reusch (DESY)

Our Work

We try to find sources of the high-energy neutrino flux detected by IceCube

TDEs are a promising source of high-energy neutrinos

We did follow-up for 29% of all 55 high-energy IceCube neutrinos since April 2018

Follow-up

1

High-energy IceCube neutrino alert

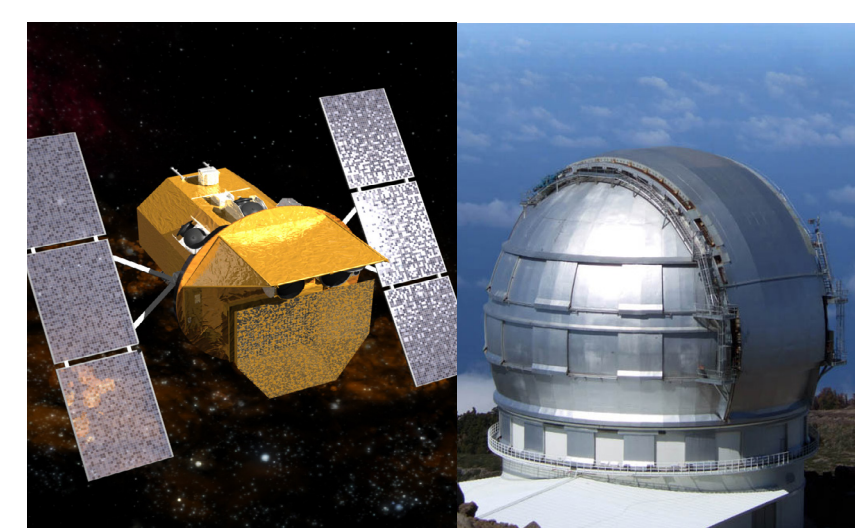


Observe with ZTF

2

Filter with AMPEL [1,2]
Reject solar system objects, artifacts, stars

3



Additional observations (X-Ray, UV, Radio, Spectra)
Reject unrelated transients

What is a TDE?

1



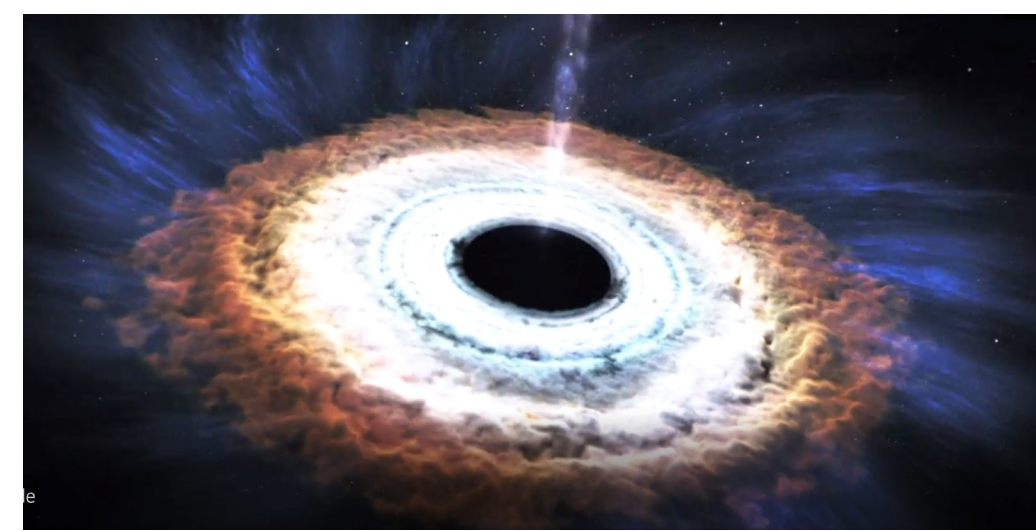
Star closely approaches SMBH

2



Star is ripped apart by tidal forces

3



Star debris gets accreted partially

Watch:

tiny.cc/tdevideo [3]

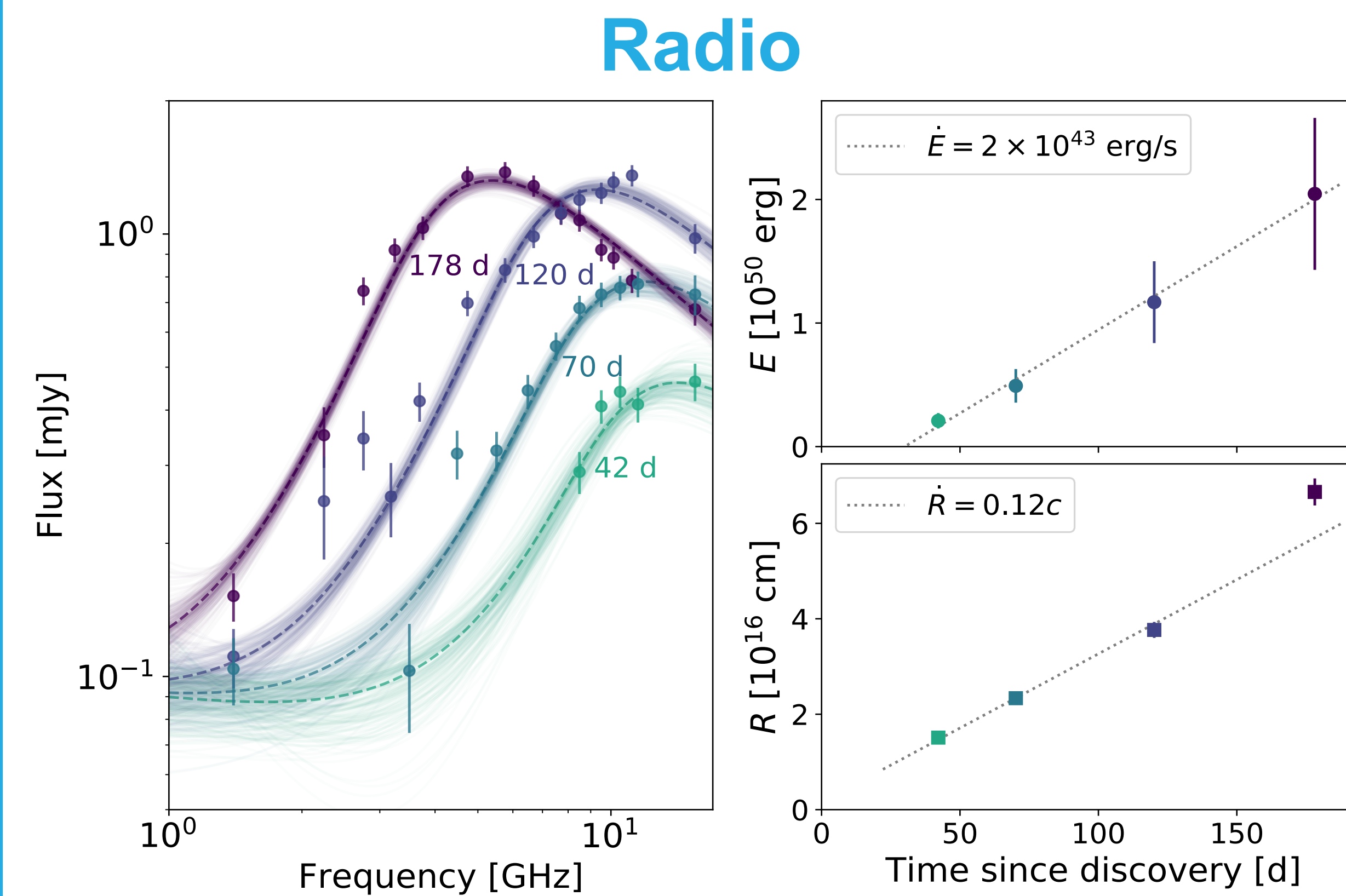
Coincidence

Last year, we found TDE AT2019dsg in coincidence with IceCube neutrino IC20191001A [1]

This year, we have AT2019fdr in coincidence with neutrino IC200530A

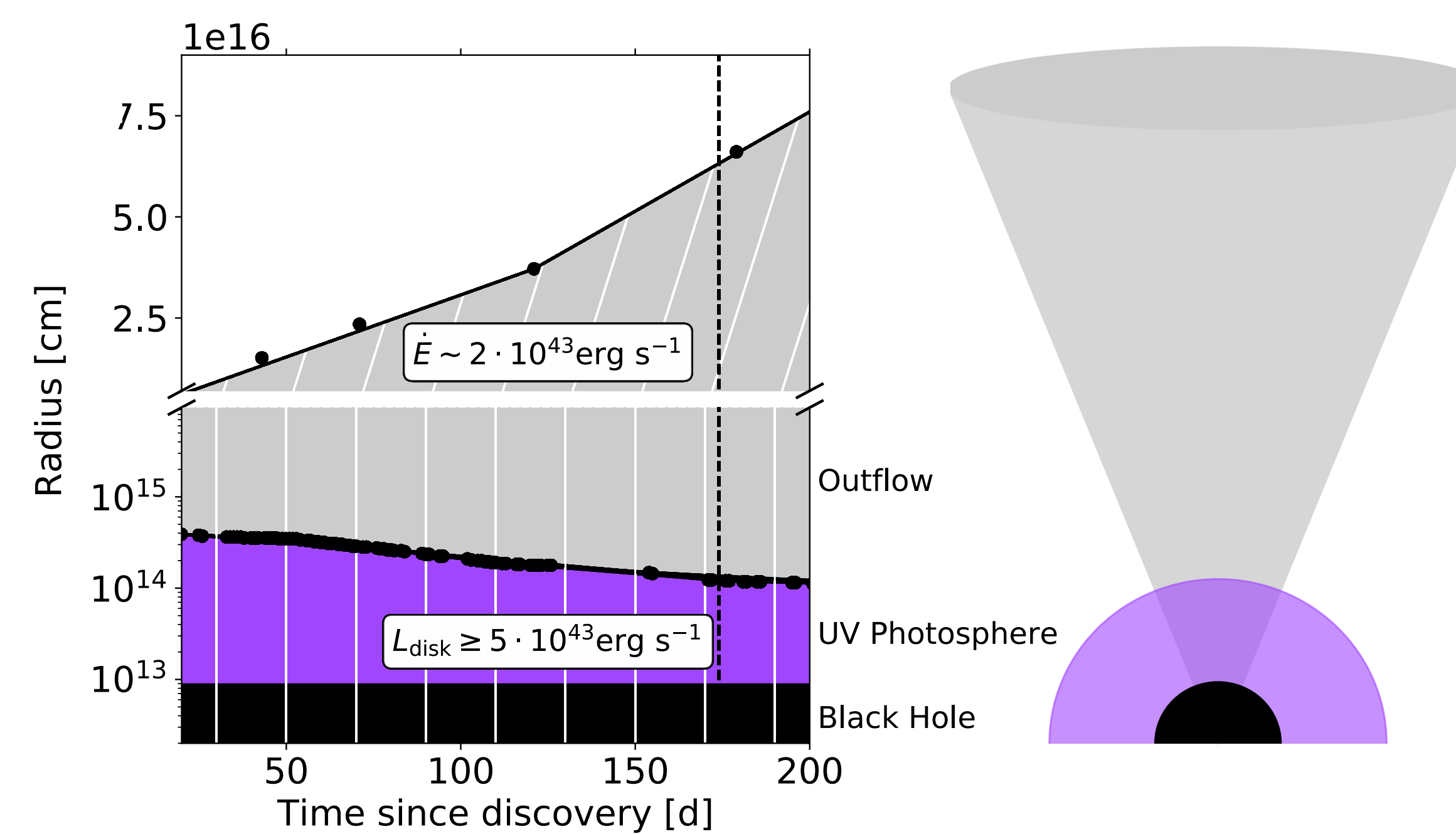
TDEs are rare! Lightning rarely strikes twice, so this is strong evidence of an emerging trend

AT2019dsg (last year)



AT2019dsg (coincident with neutrino IC191001A) is one of only a few radio-emitting TDEs so far. This confirms particle acceleration and is the first direct evidence for a central engine within a TDE, active until neutrino detection [1]

Model

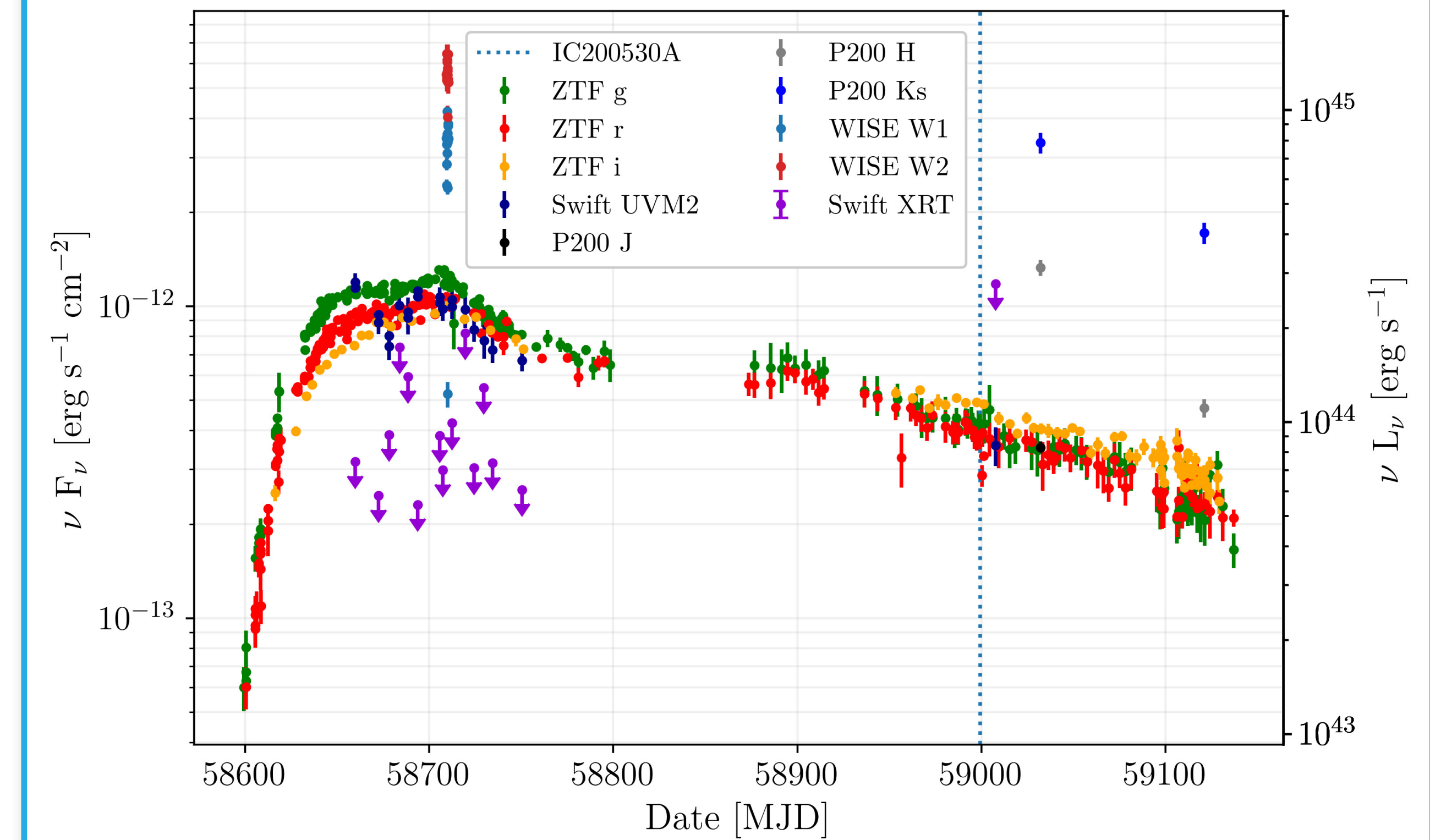


Watch: tiny.cc/outflow

Observations can be modeled with synchrotron emission from a mildly relativistic outflow. This is first evidence suggesting that TDEs contribute to the neutrino flux

AT2019fdr (preliminary)

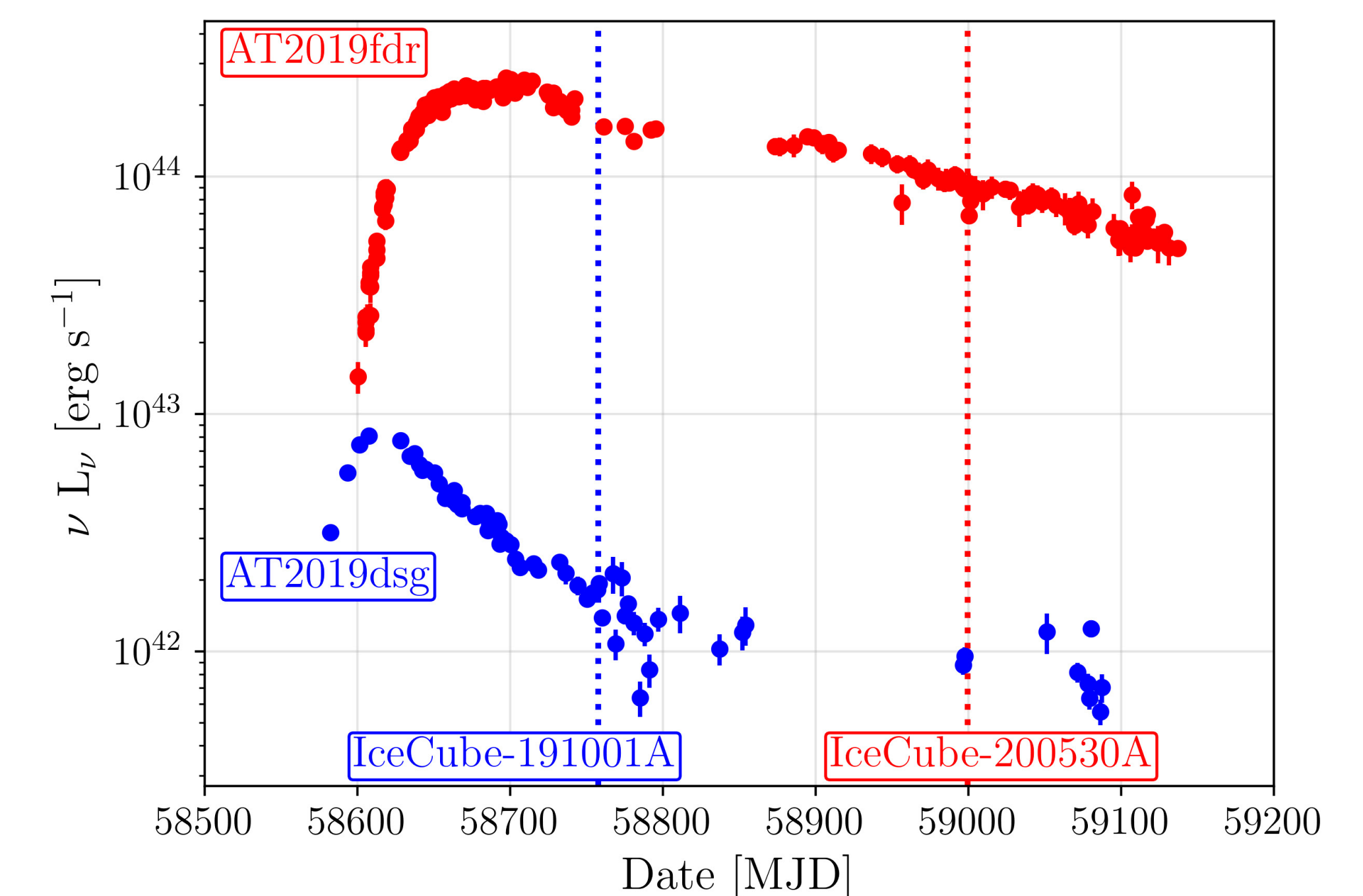
Optical + UV + Gamma-Ray



AT2019fdr (coincident with neutrino IC200530A) is very bright and red, shows ongoing activity since 1.5 years

Data analysis is still ongoing.
Paper in preparation

Comparison AT2019dsg/AT2019fdr



The disrupted star must be much bigger for AT2019fdr (red), as it's significantly more luminous than AT2019dsg

[1] [A high energy neutrino coincident with a tidal disruption event](#), R. Stein et. al., accepted (2020)

[2] [Transient processing and analysis using AMPEL](#), J. Nordin et. al., A&A 631 (2019)

[3] NASA Goddard Space Flight Center



HELMHOLTZ
Young Investigators

