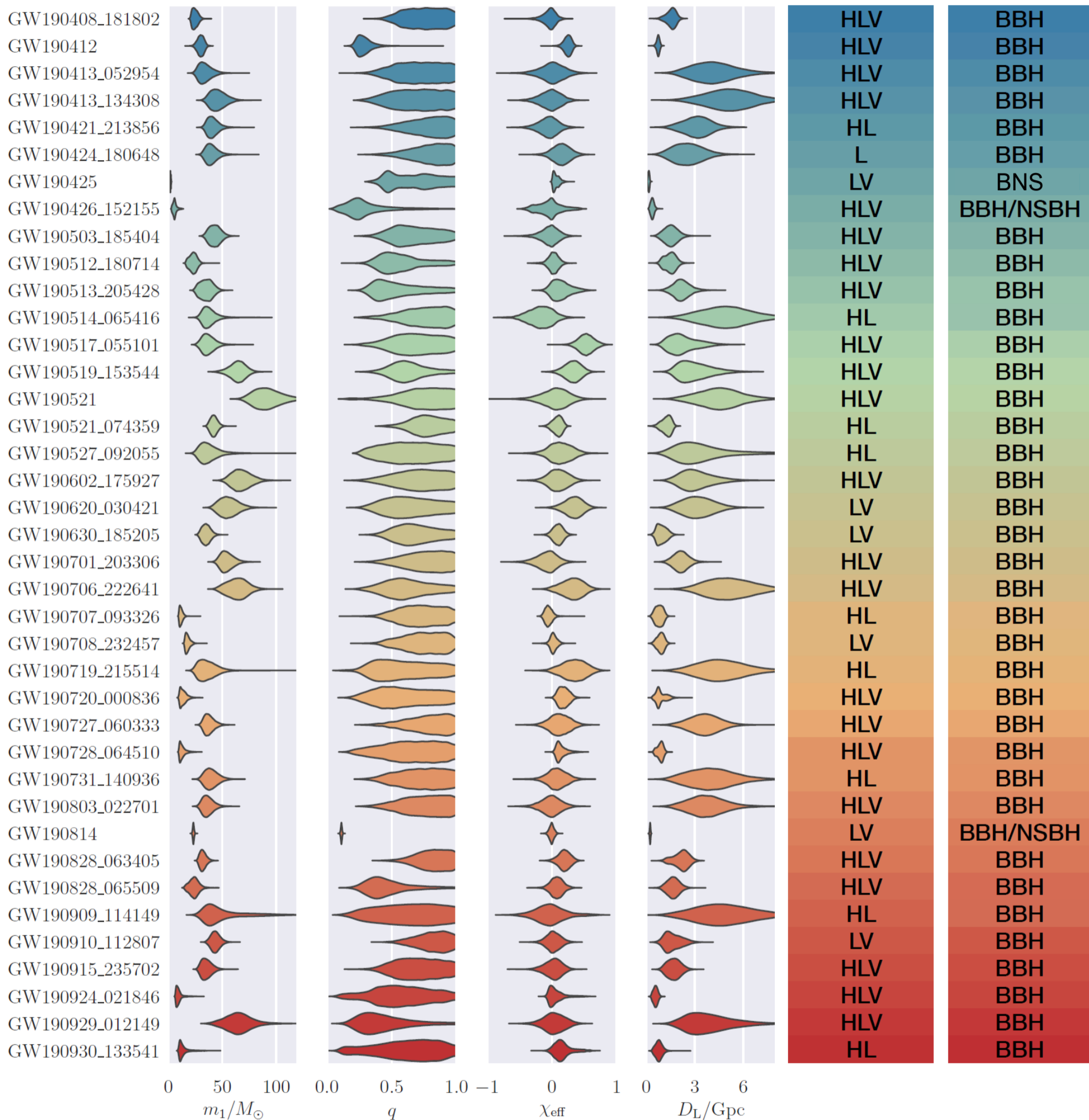


Gravitational-Wave Transient Catalog 2

Compact Binary Coalescences from the first part of the third Observing Run (O3a)



The 39 new events reported in the catalog are listed above with their primary mass in solar masses, m_1/M_\odot , mass ratio, $q = m_2/m_1$, effective spin perpendicular to the orbital plane, χ_{eff} , and distance, D_L .

Also listed are the detectors that observed each event (*H: Hanford, L: Livingston, V: Virgo*) and the most likely source classification (*BBH: Binary Black Hole, BNS: Binary Neutron Star, NSBH: Neutron Star Black Hole*).

Gravitational-Wave Transient Catalog 2

Compact Binary Coalescences from the first part of the third Observing Run (O3a)



Observing period: **1st April 2019 15:00 UTC**
to **1st October 2019 15:00 UTC**

False Alarm Rate (FAR) threshold: **2 per year**

Mean event rate: **~3 events every 2 weeks**

More than **3 times** as many detections as in
Gravitational-Wave Transient Catalog 1

5 real-time **GW search pipelines** operating

4 'exceptional' events previously published

33 low latency GCN alerts – 7 alert retractions + 13 new offline events
reported for the first time = **39 catalog events from O3a**

Events of Note

GW190521

Most massive binary system with total mass = $157.9 M_{\odot}$

GW190425

Least massive system & Closest event

Total Mass = $3.4 M_{\odot}$; Distance = 0.16 Gpc

GW190426_152155

Second lowest total mass ($M = 7.2 M_{\odot}$), **NSBH or BBH**

GW190814

Most extreme mass ratio **$q = 0.11$** , **NSBH or BBH**

GW190924_021846

Least massive definite **BBH** system with total Mass = $13.9 M_{\odot}$

GW190514_065416

Lowest effective spin perpendicular to orbital plane: $\chi_{\text{eff}} = -0.16$

GW190517_055101

Highest effective spin perpendicular to the orbital plane: $\chi_{\text{eff}} = 0.53$

GW190909_114149

Most distant event

Luminosity distance = 4.77 Gpc; Redshift = 0.75

GW190412

First event with evidence of **higher multipole mode** contribution

Aside from GW190814, most unequal mass ratio: **$q = 0.28$**

GWTC-2 Fun Facts

- **Four events** (GW190519_153544, GW190521, GW190602_175927 and GW190706_222641) have **total black hole masses** that likely exceed **100 solar masses**.
- **GW190521** is the most **powerful gravitational-wave event** ever observed.
- Closest event, **GW190425**, is still more than **800 billion times** more distant than **Pluto**.
- Most unequal mass event, **GW190814**, is like comparing the weight of a **soccer ball** and a **golf ball**.