INFN

CONCORSO PER TITOLI ED ESAME COLLOQUIO DI CUI ALL'AVVISO N. PG/R3/22126 PER UN POSTO PER IL PROFILO PROFESSIONALE DI RICERCATORE DI III LIVELLO PROFESSIONALE, PER ASSUNZIONE A TEMPO DETERMINATO PRESSO LA SEZIONE DI PERUGIA DELL'INFN.

DOMANDE PER ESAME COLLOQUIO

A – B – C – D - E

1. Descrivere in cosa consiste la detection multi-messenger in GW170817 e quali sono state le sue implicazioni fisiche
2. Descrivere come il network di rivelatori di onde gravitazionali effettua la localizzazione di una sorgente e come questa viene comunicata alla comunità astrofisica
3. Descrivere i meccanismi di emissione di onde gravitazionali da parte di sorgenti astrofisiche
4. Descrivere le metodiche e l'organizzazione dell'analisi dati negli esperimenti di onde gravitazionali
5. Descrivere gli elementi principali del raccolto in termini di scienza dei primi 3 run scientifici di LIGO e Virgo
6. Descrivere le possibili sorgenti di onde gravitazionali con conseguente followup elettromagnetico non ancora rivelate dagli strumenti attuali

F - LINGUA INGLESE

1) We report the observation of a compact binary coalescence involving a 22.2–24.3 Me black hole and a compact object with a mass of 2.50–2.67 Me (all measurements quoted at the 90% credible level). The gravitational-wave signal, GW190814, was observed during LIGO's and Virgo's third observing run on 2019 August 14 at 21:10:39 UTC and has a signal-to-noise ratio of 25 in the three-detector network. The source was localized to
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18.5 deg^2 at a distance of $241\,_{4}^{41}{}_{5}$ Mpc; no electromagnetic counterpart has been confirmed to date. The source has
-+
the most unequal mass ratio yet measured with gravitational waves, $0.112^{0\,008}$, and its secondary component is
-0.009
either the lightest black hole or the heaviest neutron star ever discovered in a double compact-object system. The dimensionless spin of the primary black hole is tightly constrained to .0.07. Tests of general relativity reveal no measurable deviations from the theory, and its prediction of higher-multipole emission is confirmed at high confidence. We estimate a merger rate density of 1–23 $Gpc^{-3}\,yr^{-1}$ for the new class of binary coalescence sources that GW190814 represents. Astrophysical models predict that binaries with mass ratios similar to this event can form through several channels, but are unlikely to have formed in globular clusters. However, the combination of mass ratio, component masses, and the inferred merger rate for this event challenges all current models of the formation and mass distribution of compact-object binaries.
Unified Astronomy Thesaurus concepts: Gravitational wave astronomy (675); Gravitational wave sources (677); Astrophysical black holes (98); Compact binary stars (283); Gravitational waves (678); Gravitational wave detectors (676)

2) On August 17, 2017, the LIGO-Virgo detector network observed a gravitational-wave signal from the inspiral of two low-mass compact objects consistent with a binary neutron star (BNS) merger. This discovery comes four decades after Hulse and Taylor discovered the first neutron star binary, PSR B1913+16 [1]. Observations of PSR B1913+16 found that its orbit was losing energy due to the emission of gravitational waves, providing the first indirect evidence of their existence [2]. As the orbit of a BNS system shrinks,

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the gravitational-wave luminosity increases, accelerating the inspiral. This process has long been predicted to produce a gravitational-wave signal observable by ground-based detectors [3–6] in the final minutes before the stars collide [7].

Since the Hulse-Taylor discovery, radio pulsar surveys have found several more BNS systems in our galaxy [8]. Understanding the orbital dynamics of these systems inspired detailed theoretical predictions for gravitationalwave signals from compact binaries [9–13]. Models of the population of compact binaries, informed by the known binary pulsars, predicted that the network of advanced gravitational-wave detectors operating at design sensitivity

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G - INFORMATICA

1) Qual è il formato dei dati adottato dagli esperimenti di onde gravitazionali e verso quale standard si vorrebbe andare? Qual è il vantaggio di un formato dati standardizzato?

2) Che cos'è GitHub?