ENERGY of GRAVITY WAVES Unit 10 & 11,

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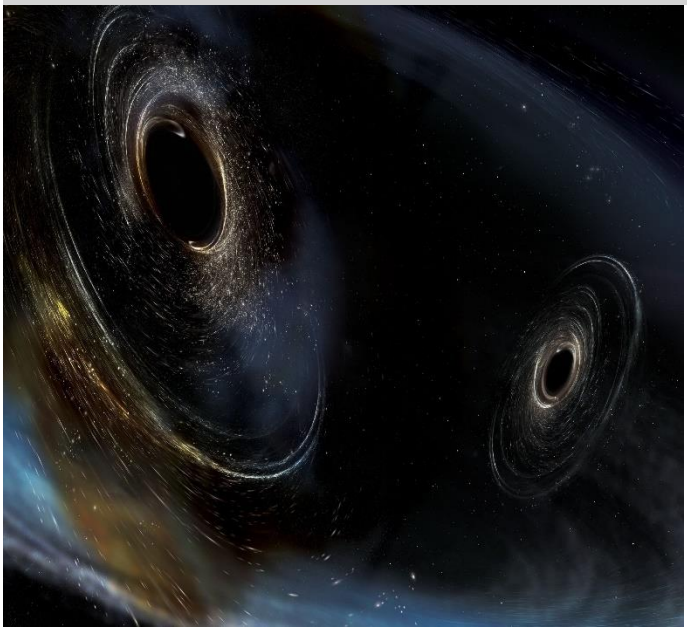
Third Gravitational Wave Detection, From Black-Hole Merger 3 Billion Light Years Away



INTRODUCTION: **These two joining black holes (31 + 19 = 50 sun masses) smashup and join to form a single black hole of (of 49 sun masses, where $2X10^{30}$ kg. = 1 sun mass). In the process, a gravitational wave energy of 1 sun mass is released. It is stated in article this *gravitational wave has more energy than all the stars in the observable universe.***

QUESTIONS: **(a) Find relativistic energy $E = m c^2$ of one sun mass ?, (b) Hubble(NASA) states 6000 stars are in our observable universe & stars(like our sun) on average emit 400 Trillion Trillion = $4 X 10^{26}$ Watts(J/s.) of energy each. Find energy from stars in our observable universe? (c) So, is last statement in introduction true?**

HINTS: **$c = 3 X 10^8$ m./s. ,**

ANSWERS: **(a) $1.8 X 10^{46}$ J , (b) $2.4 X 10^{30}$ J, (c) Yes!**

An artist's conception shows two merging black holes similar to those detected by LIGO. Astronomers said Thursday that they had felt space-time vibrations known as gravitational waves from the merger of a pair of mammoth black holes resulting in a pit of infinitely deep darkness.The void is rocking and rolling with invisible cataclysms. Astronomers said Thursday that **they had felt space-time vibrations known as gravitational waves from the merger of a pair of mammoth black holes resulting in a pit of infinitely deep darkness weighing as much as 49 suns, some 3 billion light-years from here.** ***This is the third black-hole smashup*** that astronomers have detected since they started keeping watch on the cosmos back in September 2015, with LIGO, the Laser Interferometer Gravitational-Wave Observatory. All of them are more massive than the black holes that astronomers had previously identified as the remnants of dead stars. In less than two short years, the observatory has wrought twin revolutions. It validated Einstein's longstanding prediction that space-time can shake like a bowlful of jelly when massive objects swing their weight around, and it has put astronomers on intimate terms with the most extreme objects in his cosmic zoo and the ones so far doing the shaking: massive black holes. The National Science Foundation, which poured $1 billion into LIGO over 40 years, responded with pride. "This is exactly what we hoped for from N.S.F.'s investment in LIGO: taking us deeper into time and space in ways we couldn't do before the detection of gravitational waves," France Cordova, the foundation's director, said in a statement. "In this case, we're exploring approximately 3 billion light-years away!"

In the latest LIGO event,(((a black hole *19 times the mass of the sun* and another *black hole 31 times the sun's mass,* married to *make a single hole of 49 solar masses.*))) During the last frantic moments of the merger, they were shedding more energy in the form of gravitational waves than all the stars in the observable universe.