SEMINAR ANNOUNCEMENT

國立中山大學物理系110學年度第一學期專題演講

Implications for the origin of fast radio bursts and testing general relativity

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Abstract:

Fast radio bursts (FRBs) are mysterious millisecond pulses in radio, most of which happen in distant galaxies. Revealing the origin of FRBs is becoming central in astronomy. Previous works suffer from the observational difficulty of the FRB localization and small sample sizes, which hamper a conclusion. To overcome this problem, we use a unique statistical approach to strongly constrain the origin of FRBs, being free from the localization problem. Here we show the energy functions of FRBs selected from the recently released CHIME catalogue. We use a homogeneous sample of 164 non-repeating FRB sources, which are about one order of magnitude larger than previously investigated samples. The energy functions and volumetric rates of non-repeating FRBs decrease towards higher redshifts similar to the cosmic stellar-mass density evolution.

Our results indicate that the event rate of non-repeating FRBs is likely controlled by old populations rather than young populations which are traced by the cosmic star-formation rate density. This suggests old populations such as old neutron stars and black holes as more likely progenitors of non-repeating FRBs. Furthermore, FRBs provide one of the ideal laboratories to test Einstein's weak equivalence principle (WEP): the hypothetical time lag between photons with different energies under a gravitational potential. If WEP is violated, such evidence should be exposed within the observational uncertainties of dispersion measures. Using our method and FRBs, our constraint on the WEP violation is about three orders of magnitude tighter than those of other astrophysical sources in previous works, validating general relativity with extreme accuracy.

TIME **Nov. 4, Thu.**
14:10

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