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Do high-energy astrophysical neutrinos trace star formation?

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The IceCube Neutrino Observatory has provided the first map of the high energy ($\sim 0.01 - 1$ PeV) sky in neutrinos. Since neutrinos propagate undeflected, their arrival direction is an important identifier for sources of high energy particle acceleration. We present a statistical analysis of positional coincidences of the IceCube neutrinos with known astrophysical objects from several catalogs. When considering starburst galaxies with the highest flux in gamma-rays and infrared radiation, up to $n = 8$ coincidences are found, representing an excess over the ~ 4 predicted for the randomized, or “null” distribution. The probability that this excess is realized in the null case, the p-value, is $p = 0.042$. This value falls to $p = 0.003$ for a partial subset of gamma-ray-detected starburst galaxies and superbubble regions in the galactic neighborhood. Therefore, it is possible that starburst galaxies, and the typically hundreds of superbubble regions within them, might account for a portion of IceCube neutrinos.

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