



THE CHINESE UNIVERSITY OF HONG KONG  
*Department of Physics*  
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# New Developments in the Galactic Center Gamma-ray Excess

*by*



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*Place: LA, Science Centre, CUHK*

ALL INTERESTED ARE WELCOME

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## Abstract

The Galactic center gamma-ray excess (GCE) remains one of the most intriguing discoveries from the Fermi Large Area Telescope (Fermi-LAT) observations. Explanations of the GCE include a new population of millisecond pulsars, or annihilating dark matter. The latter explanation could provide us with the first evidence for dark matter interacts with the Standard Model particles. Debates over the GCE origin have lasted over a decade. I will report new developments toward solving the puzzle. In the first part of my talk, I will describe how we test the sensitivity of the GCE with an updated point source catalog, 4FGL, from the Fermi-LAT collaboration. We found that a population of millisecond pulsars with luminosity function that follows a single-power law, once considered the leading interpretation of the GCE, is not a viable candidate to explain the excess. In the second part, I will describe how we revisit the characteristics of the GCE with a set of newly developed galactic diffuse gamma-ray emission templates, which are calibrated with data from multi-messenger observations. We found the broad properties of the GCE are qualitatively unchanged although its quantitative features appear mildly different than those obtained in previous analyses. In particular, we find the morphology of the GCE is approximately spherical and the spectrum has a high-energy tail at higher significance than previously reported. Both features disfavor the millisecond pulsar interpretation of the GCE. We further investigated the template-dependence on the GCE morphology in a follow-up study. See arXiv:1911.12369, 2112.09706, and 2209.00006 for more details.