Contribution ID: **88** Type: **oral**

Updated constraints on dark matter (WIMP) annihilation by radio observations of M31

Monday, 25 July 2022 14:30 (15 minutes)

The present work is dedicated to dark matter indiret searches and derived the robust constraints on annihilating WIMP parameters utilizing new radio observations of M31, as well as new studies of its dark matter distribution and other properties. The characteristics of emission due to DM annihilation were computed in the frame of 2D galactic model employing GALPROP code adapted specifically for M31. This enabled to refine various inaccuracies of previous studies on the subject. DM constraints were obtained for two representative annihilation channels: $\chi\chi \to b\bar{b}$ and $\chi\chi \to \tau^+\tau^-$. A wide variety of radio data was utilized in the frequency range ≈(0.1–10) GHz. As the result the thermal WIMP lighter than ≈ 72 GeV for $b\bar{b}$ channel and ≈ 39 GeV for $\tau^+\tau^-$ was excluded. The corresponding mass threshold uncertainty ranges were estimated to be (20–210) GeV and (18–89) GeV. The obtained exclusions are competitive to those from Fermi observations of dwarfs and AMS-02 measurements of antiprotons. Our constraints does not exclude the explanation of gamma-ray emission from outer halo of M31 and Galactic center excess by annihilating DM. The thermal WIMP, which explains the outer halo, would contribute about a half to the non-thermal radio flux in M31 nucleus fitting well both the spectrum and morphology. And finally we questioned the opportunity to robustly constrain heavy thermal WIMP with $m_x > 100$ GeV by radio data on M31 claimed in other studies. The talk is based on my paper ArXiv:2205.01033.

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Session Classification: Parallel 1

Track Classification: DM