

X31a Millisecond Pulsars Modify the Radio-SFR Correlation in Quiescent Galaxies

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The observed correlation between the far-infrared (FIR) and radio luminosities of star-forming galaxies shows the close connection between star formation and cosmic-ray production. LOFAR recently extended radio observations of the related correlation with star formation rate to lower frequencies (150 MHz), finding a peculiar radio excess in galaxies with high stellar masses and low star-formation rates. We show that recycled/millisecond pulsars (MSPs) can dominate the non-thermal emission in these massive quiescent galaxies and explain the excess. This is supported by recent data suggesting that MSPs can efficiently convert a large fraction of their spin-down power to electron/positron pairs. We find that MSP-based models provide a significantly improved fit to LOFAR data. We discuss implications for the radio-FIR correlation and the observation of radio excesses in nearby galaxies.