

Gamma Ray Pulsar Luminosities

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Gamma rays represent the dominant form of energy loss for several isolated pulsars and are most likely important in the energy budget of many others. However, the small number of detected gamma ray pulsars makes modeling the gamma ray pulsar population and understanding gamma ray emission mechanisms difficult. We therefore apply a likelihood analysis which makes use of all available information about gamma ray pulsars (including detections, upper limits, and diffuse background measurements) to constrain the luminosity law for gamma ray pulsars, estimate several pulsar population parameters, and quantify the pulsar contribution to the diffuse gamma ray background.

We have applied this analysis to detections, upper limits, and diffuse background measurements from both the OSSE and EGRET instruments. We find that the dependence of luminosity on period and magnetic field is very different in these two energy ranges, suggesting that different mechanisms are responsible for pulsar hard x-ray and high energy gamma ray emission. We use our luminosity law to predict which radio pulsars are likely to be strong emitters in the OSSE and EGRET energy ranges. We use diffuse background measurements to place constraints on several important pulsar population parameters, such as braking index, magnetic field, and initial spin period. Finally, we estimate the pulsar contribution to the diffuse background and predict the number of pulsars likely to be detected by future gamma ray missions.