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## The Fast Folding Algorithm for large-scale pulsar surveys

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The Fast Folding Algorithm (FFA) is a fully phase-coherent search technique for periodic pulsar signals dating back to 1969, which consists of folding the input data at all distinguishable signal periods. It has historically seen limited use, having been dismissed in favour of the less computationally expensive Fast Fourier Transform (FFT) on which the standard search method is based. Interest in the FFA has been growing in the past few years and has been presented as a method more apt to find pulsars with periods of a few seconds or longer. However, we have demonstrated a much stronger result from first principles: a properly implemented FFA search is *the* most sensitive search method for all periodic signals. The sensitivity improvement offered by the FFA over the standard method grows larger for narrower pulses, with the FFA being 5 times more sensitive to pulsars with short (0.1%) duty cycles. Part of the pulsar parameter space has therefore been systematically under-explored until now, which has significant consequences for pulsar population synthesis studies. We have developed and published an end-to-end FFA search pipeline fast enough to be run on modern all-sky pulsar surveys. The pipeline is currently running on survey data from Parkes and LOFAR, and will soon be running on GMRT and MeerKAT data. More than a dozen new pulsars that were missed by standard FFT search codes have already been discovered.

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