High Energy Pulsations from 
PSR J2022+3842

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PSR J2022+3842\textsuperscript{1} is a young, energetic pulsar with a characteristic age of 8.9 kyr and spin down power 3.0 \times 10^{37} \text{ erg s}^{-1}. Located in SNR G76.9+1.0, and spatially coincident with a Fermi LAT source\textsuperscript{3}, pulsations with a period of \textasciitilde 48.6 ms have been observed in radio by the GBT, as well in the X-ray band by Chandra, RXTE, and XMM-Newton\textsuperscript{3}. Large amounts of timing noise typical of young pulsars combined with the radio-faint nature of this pulsar makes deriving a global timing solution that smoothly connects all individual observations challenging. Analysis with the Fermi LAT, although complicated by high levels of background in the target region, can help bridge these gaps. In this work we present a preliminary analysis of data from NuSTAR showing strong pulsations from PSR J2022+3842 in the 3-79 keV energy range. Continuing a Fermi LAT analysis which confirmed MeV-GeV pulsations\textsuperscript{5}, we now analyze over 10 years of Pass 8 data at energies >60 MeV.

\begin{itemize}
  \item \textbf{Chandra (0.3-12 keV)}
  \begin{itemize}
    \item 54 ks
    \item PSR J2022+3842 discovery data.
  \end{itemize}

  \item \textbf{RXTE (2-60 keV)}
  \begin{itemize}
    \item 99 ks
  \end{itemize}

  \item \textbf{XMM-Newton (0.5-12 keV)}
  \begin{itemize}
    \item 110 ks
  \end{itemize}

  \item \textbf{NuSTAR (3-79 keV)}
  \begin{itemize}
    \item 54 ks
  \end{itemize}
\end{itemize}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{nustar.png}
\caption{New NuSTAR observations show a pulsed profile (black) consistent with that of previous x-ray telescopes. The background-subtracted zero point is shown in red, and the average count in off-pulse bins is shown in blue.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fermi_lat.png}
\caption{The Fermi LAT provides long term, high energy analysis of PSR J2022+3842.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fermi_lat_preliminary.png}
\caption{Fermi LAT: Preliminary
\begin{itemize}
  \item 709 Days
  \item Analyzing a small fraction of Fermi LAT data confirms that PSR J2022+3842 pulses in the gamma-ray spectrum. This timing solution will be extended to connect observations from RXTE, XMM-Newton and NuSTAR. It was used to produce a phase-resolved SED, which will likewise be improved when the timing solution expands.}
\end{itemize}
\end{figure}