

Martin

Title: Characterization of the Inner Knot of the Crab: The Site of the Gamma-ray Flares?

Abstract: One of the most intriguing recent discoveries has been the detection of powerful γ -ray flares from the Crab Nebula. Such events, with a recurrence time of about once per year, can be so dramatic to make the system the brightest source in the gamma-ray sky as occurred, e.g. in April 2011. These flares challenge our understanding of how pulsar wind nebulae work and defy current astrophysical models for particle acceleration. We present here our study of the inner knot located within a fraction of an arcsecond from the pulsar with the aim of characterizing the feature and asking if this might be the site of the origin of the γ -ray flares. We took data using Keck, HST, and Chandra obtained as part of our multi-wavelength campaign to identify the source of the enigmatic flares. We set an upper limit as to the x-ray flux from the knot. We also find that the dimensions, surface brightness, flux, etc. of the optical and infrared knot are all correlated with distance of from the pulsar. This distance, in turn, varies with time. In addition to this most thorough characterization of the inner knot's properties, we examine the hypothesis that the knot may be the site of the flares by examining the knot separation versus the Fermi/LAT γ -ray flux. Finally, as part of this research, we make use of a new approach employing singular value decomposition (SVD) for analyzing time series of images and compare the approach to more traditional methods. Our conclusions are only refined but not impacted by using the new approach.