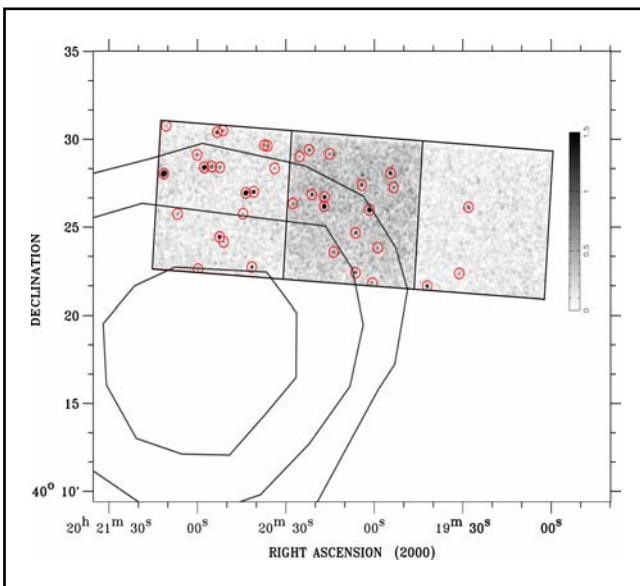


Deep X-ray and radio observations with Chandra and the Green Bank Radio Telescope leave Gamma-Cygni still unidentified

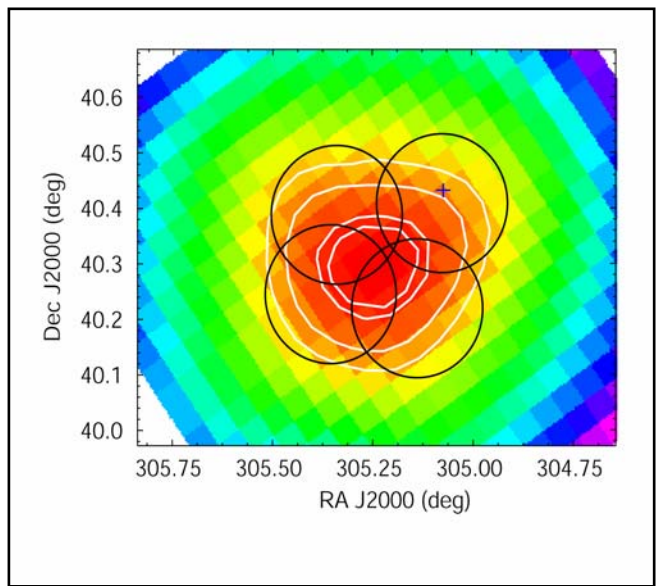
The final EGRET catalog of gamma-ray sources lists 271 objects (Hartman et al. 1999) of which about 170 are unidentified. 3EG J2020+4017 is among the brightest persistent sources in the EGRET sky. Originally listed as a COS-B source (2CG078+01) it is still unidentified. Its gamma-ray flux is consistent with constant flux and the spectrum is hard and best described by a power-law with photon-index of 1.9

In search of the counterpart we observed the Gamma-Cygni field with the *Chandra* X-ray Observatory and with the Green Bank Telescope (GBT). To complete the analysis we reanalyzed archival ROSAT data. With *Chandra* it became possible for the first time to measure the position of the putative gamma-ray counterpart RX J2020.2+4026 with sub-arcsecond accuracy and to deduce its X-ray spectral characteristics. These observations demonstrate that RX J2020.2+4026 is associated with a K- field star and therefore is unlikely to be the counterpart of the bright gamma-ray source in the SNR G78.2+2.1 as had been previously suggested by Brazier et al. (1996). In addition to RX J2020.2+4026, the *Chandra* observation detected 37 X-ray sources which were correlated with catalogs of optical and infrared data. Subsequent GBT radio observations covered the complete 99% EGRET likelihood contour of 3EG J2020+4017 with a sensitivity limit of $L_{820} \sim 0.1$ mJy kpc² which is lower than most of the recent deep radio search limits (Becker et al. 2004, ApJ, in press).

If there is a pulsar operating in 3EG J2020+4017, this sensitivity limit suggests that the pulsar either does not produce significant amounts of radio emission or that its geometry is such that the radio beam does not intersect with the line of sight. Finally, reanalysis of archival ROSAT data leads to a flux upper limit of f_x (0.1-2.4 keV) $< 1.8 \times 10^{-13}$ erg s⁻¹cm⁻² for a putative point-like X-ray source located within the 68% confidence contour of 3EG J2020+4017. Adopting the SNR age of 5400 yrs and assuming a spin-down to X-ray energy conversion factor of 10^{-4} this upper limit constrains the parameters of a putative neutron star as a counterpart for 3EG J2020+401 to be $P \leq 160$ (d/1.5 kpc)⁻¹ ms, $\dot{P} \leq 5 \times 10^{-13}$ s s⁻¹, $B_{\pm} \leq 9 \times 10^{12}$ (d/1.5 kpc)⁻¹ G.



Chandra ACIS field of 3EG J2020+4017. The 68%, 95% and 99% contour lines from the 3EG EGRET likelihood map are shown.



The fields covered by the GBT radio observations are indicated by black circles. The cross indicates the position of the putative ROSAT counterpart RX J2020+4026.