

# Sub-arcsecond radio and optical observations of the likely counterpart to the gamma-ray source 2FGL J2056.7+4939

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Received: 15 December 2011 / Accepted: 4 February 2012 / Published online: 29 February 2012  
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**Abstract** We have searched and reviewed all multi-wavelength data available for the region towards the gamma-ray source 2FGL J2056.7+4939 in order to constrain its possible counterpart at lower energies. As a result, only a point-like optical/infrared source with flat-spectrum radio emission is found to be consistent with all X-ray and gamma-ray error circles. Its structure is marginally resolved at radio wavelengths at the sub-arcsecond level. An extragalactic scenario appears to be the most likely interpretation for this object.

**Keywords** Gamma rays: general · X-rays: general · Radio continuum: galaxies

## 1 Introduction

The low galactic latitude gamma-ray source known as 2FGL J2056.7+4939 is one of the entries in the recent Large Area Telescope (LAT) 2-year Point Source Catalog provided by the Fermi Gamma-ray Space Telescope in the 100 MeV

to 100 GeV energy range (Abdo et al. 2011). The Fermi team points out a preliminary classification as an active galactic nucleus (AGN) of unknown type. This high-energy source is likely to have been detected as well by other observatory missions in the past in both X-rays and soft gamma-rays. The reader is referred to Table 1 for an historical account. Attempts to find out the nature of this object based on these lower energy detections have provided no conclusive result yet. In particular, inside the 2FGL J2056.7+4939 95% confidence ellipse there is only one conspicuous X-ray source, namely 1RXS J205644.3+494011. Up to very recently, the identification of this ROSAT source with the luminous star BD+493420 was still considered plausible instead of an extragalactic origin (Haakonsen and Rutledge 2009). In addition, Paredes et al. (2001) proposed this X-ray emitter as a possible microquasar candidate pointing out its coincidence with an intense radio source.

In this work, we address the new Fermi detection together with all the multi-wavelength observational data available to try to shed light about the true origin of 2FGL J2056.7+4939.

## 2 Radio observations

Radio imaging of high energy sources has proved to be an important tool to their understanding. In Fig. 1, we show a contour map of radio emission in the field of 2FGL J2056.7+4939 according to the NRAO VLA Sky Survey (NVSS, Condon et al. 1998). Only the extended radio source NVSS J205642+494005 is consistent even with the less accurate positions in Table 1 reported by Fermi, INTEGRAL and Beppo-Sax. As the NVSS has a poor angular resolution, we inspected the NRAO data archives in search for interferometric observations with long baselines.

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