TACTIC

Astrophysical Sciences Division
Bhabha Atomic Research Centre

Picture Gallery

TACTIC (**T**eV **A**tmospheric **C**herenkov **T**elescope with **I**maging **C**amera)

Location - Mt. Abu, Rajasthan, India (24.6^0 N, 72.7^0 E, 1300m asl)
Light collector area $\sim$ 9.5 m^2
Number of pixels = 349
Pixel size = 0.318^0
Camera FOV $\sim$ 5.90^0 X 5.90^0
Trigger FOV $\sim$ 3.40^0 X 3.40^0
Trigger Criteria - NNT/NNP
Mount - Alt-Azm
Threshold Energy $\sim$ 850 GeV
Back end electronics-NIM/CAMAC
DACS - QNX RTOS

TACTIC (**T**eV **A**tmospheric **C**herenkov **T**elescope with **I**maging **C**amera)

The TACTIC (TeV Atmospheric Cherenkov Telescope with Imaging Camera) gamma-ray telescope has been in operation at Mt. Abu (24.6 degree N, 72.7 degree E, 1300m asl), India, for the last several years to study TeV gamma-ray emission from celestial sources. The telescope uses a tessellated light collector of area $\sim$ 9.5 meter square which is capable of tracking a celestial source across the sky. The telescope deploys a 349-pixel imaging camera, with a uniform pixel resolution of $\sim$0.3 degree and an $\sim$ 6 degree X 6 degree field-of-view, to take a fast snapshot of the atmospheric Cherenkov events produced by an incoming cosmic ray particle or a gamma-ray photon with an energy above $\sim$850GeV. Using a trigger field-of-view of 11 X 11 pixels ($\sim$3.4 degree X 3.4 degree), the telescope records a cosmic ray event rate of $\sim$4Hz at a typical zenith angle of 15 degree. The consistent detection of a steady signal from the Crab Nebula above $\sim$850GeV energy, at a sensitivity level of $\sim$5.0 sigma in $\sim$15 h, alongwith excellent matching of its energy spectrum with that obtained by other groups, reassures that the performance of the TACTIC telescope is quite stable and reliable. Furthermore, encouraged by the detection of strong gamma-ray signals from Mrk 501 (during 1997, 2006 and 2012 observations) and Mrk 421 (during 2001, 2005-2006, 2009-2010, 2015 and 2017-18 observations), we believe that there is considerable scope for the TACTIC telescope to monitor similar TeV gamma-ray emission activity from other active galactic nuclei on a long-term basis.

Physics

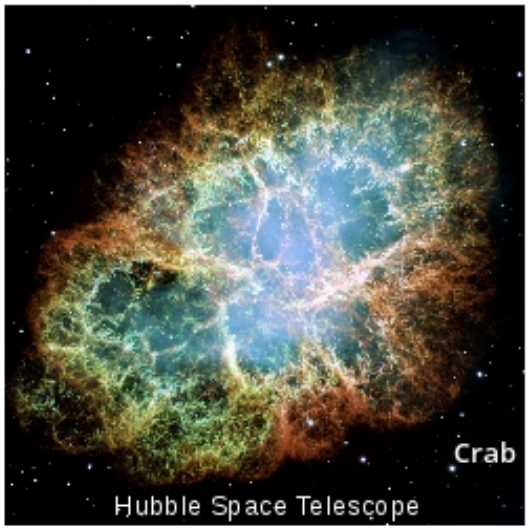
Cosmic-rays were discovered by Victor Hess in 1912. Even after one hundred years of their discovery it is not known how and where cosmic-rays are originated. There are some hints which indicate that Supernova Remnants (SNR), Pulsar Wind Nebulae (PWN), Active Galactic Nuclei (AGNs) etc., are the possible sites where cosmic-rays can be produced. As cosmic-rays are charged particles and they get deflected in interstellar and intergalactic magnetic field therefore from the direct detection of cosmic-ray particles on the Earth one can't trace back to their site of origin. But an alternative path was suggested by astrophysicists. Cosmic-rays can interact with the ambient medium at the site of their origin and can produce gamma-rays. This gamma-ray can reach the Earth without any deviation in their path. Therefore if one can detect such gamma-ray from the astrophysical sources then one can trace back their origin. Infect in early 80's the first gamma-ray satellite Cos-B send by NASA detected 25 sources in million electronvolt (MeV, 1 MeV $= 10^6$ eV) energy range. This detection gave birth to gamma-ray astronomy and it became the most favorable path to study cosmic-ray origin. With time the field of gamma-ray astronomy evolved, more sensitive technique called Imaging Atmospheric Cherenkov Technique (IACT) came up which work in the giga electronvolt (GeV, 1 GeV $= 10^9$ eV) to tera electronvolt (TeV, 1 TeV $= 10^{12}$ eV) energy range.

In India, the first IACT telescope TACTIC (TeV Atmospheric Cherenkov Telescope with Imaging Camera) started operating in the year 1997 at Mount Abu, Rajasthan.

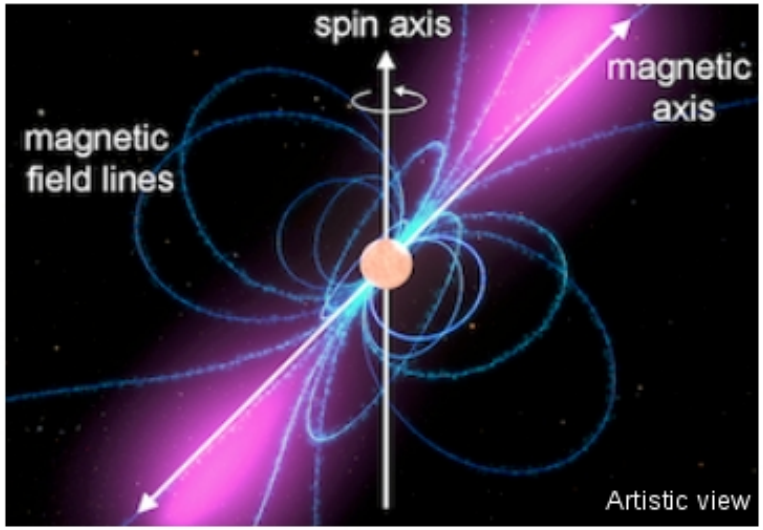
One can study different types of astrophysical sources with the TACTIC telescope specially Active Galactic Nuclei (AGNs).

Potential sources to be observed with TACTIC telescope

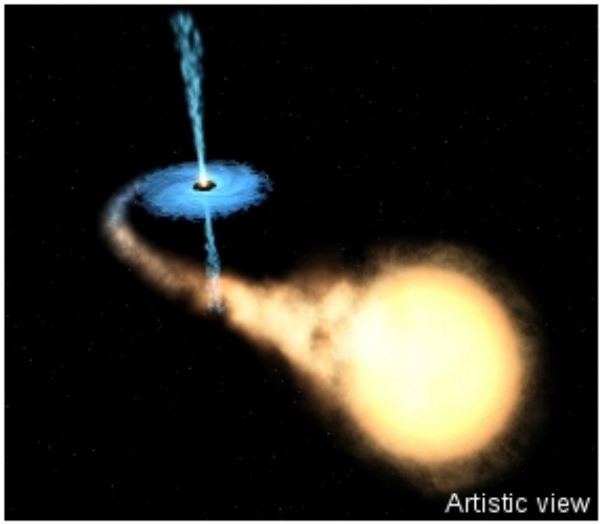
SNR



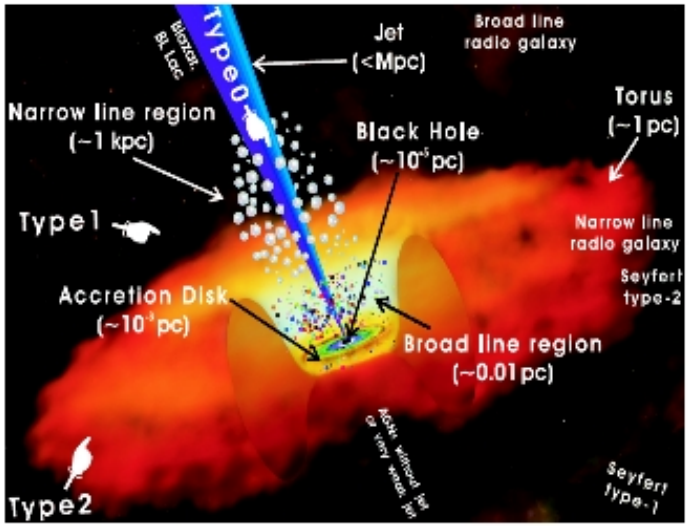
Pulsar



Binary system



AGN



Location

Figure: The TACTIC gamma-ray telescope @ Mount Abu, Rajasthan.

Location

How to reach observatory (TACTIC, Mt. Abu, India):

- Air: The nearest airports to Mount Abu are :
  - Ahmedabad Airport [Prefer Ahmedabad route as train and frequent bus services are avaliable from here].
  - Maharana Pratap Udaipur Airport, Dabok (Udaipur)

  One can hire a taxi to get to Mount Abu from both airports. From Ahmedabad and Udiapur airport bus service to Mount Abu is also avaliable.
- Rail: The nearest railway station is Abu Road (29-km) situated on Mumbai-Ahmedabad-Ajmer-Jaipur-Delhi route. From Abu Road one can take a taxi, jeep or bus to Mount Abu (tell taxi person the place name as BARC,Oriya Village near peace park.
- Road: Ahmedabad is 222-km via Palanpur. Jodhpur is 235-km via Sirohi and Pali. Udaipur is 156-km via Pidwara. (Journey on this route is advisable only during the day). Jaipur is 509-km via Pali-Ajmer. It is connected to all the major towns in northern and western India.

Local Transport: Unmetered taxis are available for local transportation within the city.
Temperature (Winter): Minimum: 0-5 Degree C, Maximum: 20-25 Degree C
Temperature (Summer): Minimum: 10-15 Degree C, Maximum: 30-36 Degree C
Nights are much cooler in winter as compared to day time. One can bring some woollen cloths in winters.