



**Aryabhata Research Institute
of
Observational Sciences
(ARIES)**

Academic Activities

Preamble

Aryabhata Research Institute of Observational Sciences (ARIES) is an autonomous institute devoted to research and development in Astronomy & Astrophysics and Atmospheric Sciences. It first came into existence at Varanasi in 1954 with the name U. P. State Observatory. The Institute is funded by the Department of Science and Technology (DST), Government of India. Nearly 60 scientists and engineers are actively engaged in the scientific activities of the institute.

Research activities at ARIES

Astronomy & Astrophysics

Research activities at ARIES cover topics related to sun, stars and galaxies. ARIES has significant contributions particularly in the field of variable stars, Radio Galaxies, Star clusters and Gamma-Ray Bursts (GRBs) etc. The longitude of ARIES (79° East) locates it in the middle of about 180-degree wide longitude band having modern astronomical facilities between Canary Islands (20° West) and Eastern Australia (157° East). The observations, which are not possible in Canary Islands or Australia due to daylight, can be covered by ARIES. Because of its geographical location and existence of good astronomical sites, ARIES has made unique contributions to many areas of astronomical research, particularly those involving time critical phenomena (e.g., the first successful attempt to observe optical afterglow of GRBs was carried out from ARIES in the country). A large number of eclipsing binaries, variable stars, star clusters, nearby galaxies, GRBs, and supernova have been observed from ARIES. The other research areas include stellar variability and pulsation, photometric studies of nearby galaxies, Quasars, and transient events like supernovae and highly energetic Gamma-Ray Bursts (GRBs). Several solar eclipses were also successfully observed from India as well as from abroad. In the past, new ring systems around Saturn, Uranus, and Neptune were observed from the observatory.

Atmospheric Sciences

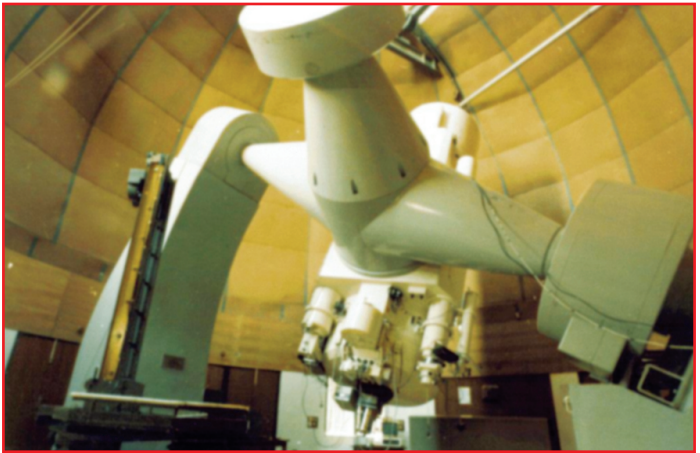
Nainital (29.4°N; 79.5°E, 1958 m above sea level) is located at higher altitude in the Central Himalayas and away from urban cities or any major polluting source. This factor makes it best suited for carrying out observations in background condition and to study the regional environment, particularly

interactions between natural and anthropogenic trace species and climate change. Additionally, this site can also provide information on long range transport of pollutants. Studies on lower atmospheric dynamics are also very important in this region, which is severely lacking over northern India.

Facilities

Astronomy & Astrophysics

The 104-cm telescope, known as the Sampurnanand telescope, has been the mainstay of the photometric, spectrophotometric and polarimetric observations. It is equipped with modern instruments like cooled CCD camera, spectrophotometer, and narrow and wide band filters etc. Other instruments available are Cassegrain plate holder, near infrared and photoelectric photometer. For the study of solar flares, prominences, etc. we have 15-cm Solar Tower Telescope equipped with Bernhard Halle H α filter and fast CCD Camera.



104-cm Sampurnanand Optical Telescope located at Manora Peak, Nainital.



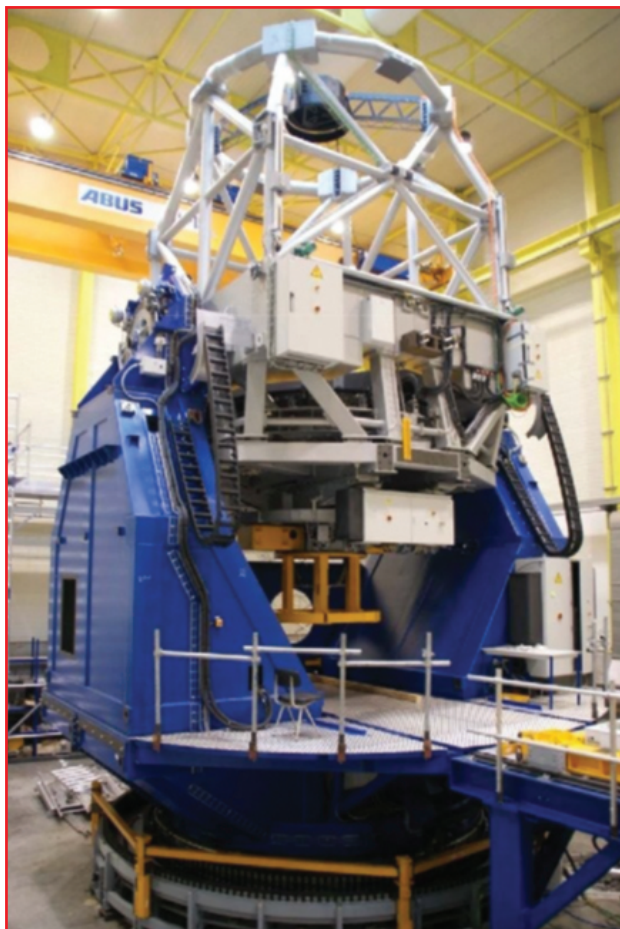
15-cm Coude Solar Tower Telescope equipped with Bernhard Halle H α filter & fast CCD Camera for solar activity observations.

Devasthal Observing Station : Devasthal (latitude 29°22'22" North; longitude 79°40'57" East, Altitude: 2500 meter) is being developed as an astronomical site. The site is far from any urban development and is the most suitable for astronomical observations. A 1.3-m optical telescope has already been installed and 3.6-m DOT is expected to be ready by December 2012 for observations of celestial sources at optical and near infrared wave lengths.



1.3-m optical telescope at Devasthal.

ARIES promotes research programmes using observations taken at other wavelengths like X-ray, ultra-violet, and radio also. It is proposed that ARIES will help in building up of a user community for the upcoming observing facilities like ASTROSAT, the first multi-wavelength Indian astronomical Satellite to be launched in coming years, and the existing facilities such as Giant Meter-wave Radio Telescope (GMRT) of the Tata Institute of Fundamental Research (TIFR) and 2-m IUCAA Telescope near Pune and the new 2-meter Optical Himalayan Chandra Telescope (HCT) of the Indian Institute of Astrophysics (IIA) at Hanle in Leh.



Fully assembled 3.6-m telescope at AMOS, Belgium workshop to be installed at Devasthal.

Atmospheric Sciences

Aerosols optical depth observations are being carried out using a Multi-wavelength Solar Radiometer. An optical particle counter and an Aethalometer are being used for observations of number concentration of composite aerosols in 15 (micron sizes) ranges and black carbon, respectively. Observations of trace gases (O_3 , CO , CH_4 , NMHCs, CO_2 , N_2O , and SF_6) have also been initiated using in-situ instruments and air-samplings. A portable lidar system is operational for aerosols and clouds studies. A Rayleigh and Mie Lidar is also being setup to study up to ~ 80 km altitude. Installation of a Stratosphere-Troposphere (ST) Radar is also in final stage. This radar would be operated up to about 20 km altitude. Phased Array Yagi Antenna will be used and physical area of the array is about

800 m². This system will be very useful for meteorological study, turbulence and up to some extent stratosphere-troposphere exchange (STE) studies.



Work is in progress for the mini profiler (49 subarray) at ECIL, Hyderabad.

Infrastructure

The Institute has in-house workshops to meet the requirements of electronic, mechanical, and optical maintenance of the instruments. ARIES has a modern computer centre with internet facility and a well maintained Knowledge Resource Centre (KRC)/library with more than 10,000 volumes of research journals and an excellent collection of books on Astronomy & Astrophysics and Atmospheric Sciences.

Doctoral Programme

ARIES offers fellowships to pursue Ph. D. in Astronomy & Astrophysics and Atmospheric Sciences. ARIES selects students as research scholars via the JEST and NET exams. The minimum qualification is M.Sc. degree in Physics. The details of these exams are usually announced via., advertisements in national newspapers and posters at most of the educational institutes/universities in the country. The final selection is based on an interview, which is usually held in June.

Course work, Tenure, Scholarship & other allowances

All selected research scholars are required to undergo a course work, which lasts for about nine months. The course work comprises of class teaching, assignments, seminars, and project works. At the end of course work, research scholars are required to opt either Astronomy & Astrophysics or

Atmospheric Sciences as the field of their interest for Ph. D. degree. Research scholars are expected to submit their thesis within five years from the start of their programme. Research scholars admitted for the Ph. D. programme are initially offered a Junior Research Fellowship (JRF) and on completion of two years as JRF, as a Senior Research Fellow (SRF), with Fellowships as per DST Govt. of India norms. Research scholars are also eligible for a book grant on yearly basis, accommodation in the campus and catering facilities at nominal cost. ARIES promotes research scholars to participate in national and international meetings and conferences.



ARIES KRC/library with more than 10,000 volumes of research journals and an excellent collection of books on Astronomy & Astrophysics and Atmospheric Sciences.

Postdoctoral Programme

ARIES offers postdoctoral fellowships in any branch of Astronomy & Astrophysics and Atmospheric Sciences and visiting positions to work Engineering and Instrumentation, or Software development. Exceptionally bright and highly motivated candidates can be considered for regular staff positions.

Visiting Students Programme

Apart from regular Ph. D. programme, ARIES also has two more training programmes mainly for students (graduates & postgraduates from other institutes/universities) involved in various projects supervised by ARIES faculty members.

(a) The summer project students programme

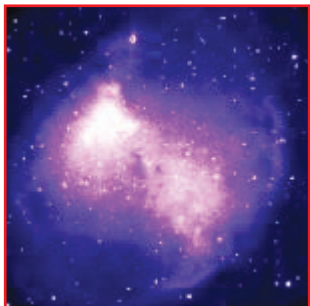
This programme aims at spotting young talented students and attract and encourage them to do research in Astronomy & Astrophysics and Atmospheric Sciences. Under this programme, students entering in their final year of M.Sc./B.E. can work on short term projects with any of the faculty at ARIES during the summer for a period of about two months. The programme is widely publicized in January every year by sending posters to a large number of educational institutions. Selected students are fully supported. The number of students to participate are normally around 10. The programme starts by the last week of April every year. The projects can be on instrumentation, observations or theory and are carried out at the Nainital campus or at Devasthal campus.

(b) Visiting Research Scholars Programme

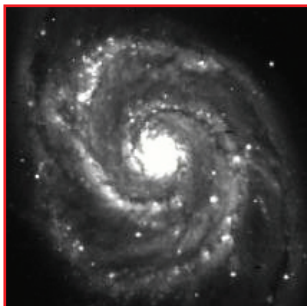
Research scholars working for their Ph. D. in other institutes or universities can visit ARIES to work in collaboration with any of the institute faculty. Such visits are generally expected to be financially supported by their home institutes.

Important dates

Summer projects	: last week of April
Interview for Ph.D. Programme	: Last week of June
Notification of results	: first week of July
Commence of Ph.D. course work	: 1 st of August



A planetary nebulae imaged with the 104-cm telescope at ARIES. The nebulae of gas is created by explosion of a runaway Sunlike star



The Whirlpool (M 51) galaxy imaged with the 104-cm telescope. The spiral arms are the sites, where new stars are being born.

Areas of Research

Sun and Solar System	Observations and modeling of solar activity waves, transient events in the solar atmosphere Comets asteroids and planets.
Stellar Astronomy	Young stars, evolved stars, novae, supernovae, stellar variability and asteroseismology, chemically peculiar stars, binary stars, circumstellar matter and chromospherically active stars.
Star Clusters and Star Formation	Initial mass function and star formation, stellar evolution and stellar dynamics.
Intrastellar Medium	Study of galactic HII regions, extinction and reddening properties, galactic structure and molecular clouds.
X-ray Astronomy	X-ray emitting binary stars.
Extragalactic Astronomy	Kinematics of star clusters in external galaxies multi-wavelength variability of active galactic nuclei, quasars absorption line systems microlensing, study of gamma ray burst afterglows, massive star formation in external galaxies, large size radio galaxies, dark matter and galaxy formation.
Atmospheric Sciences	Trace gases, aerosols-physical and chemical properties, studies on lower dynamics and lower atmospheric studies using satellite data.

Mailing Address:

The Director

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Manora Peak, Nainital - 263 129, INDIA.

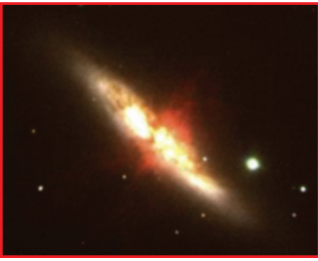
Tel: +91 - 5942 - 235136; Fax: +91 - 5942 - 233439

EPABX: +91 - 5942 - 233727, 233734, 233735, 232655

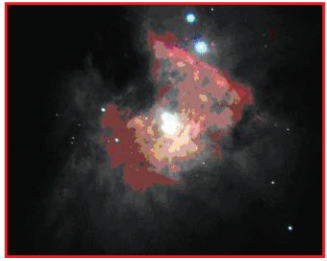
Gram : ASTRONOMY

E-mail : directoraries@aries.res.in; URL : <http://www.aries.res.in>

How to reach : Connected from Kathgodam (broad-gauge) and Lal Kuan (meter-gauge) railway stations. ARIES is about 9-km from Nainital bus stand.



H-alpha image of star burst galaxy M82 overlaid upon broadband VR image of the galaxy imaged with the 130-cm telescope at Devasthal.



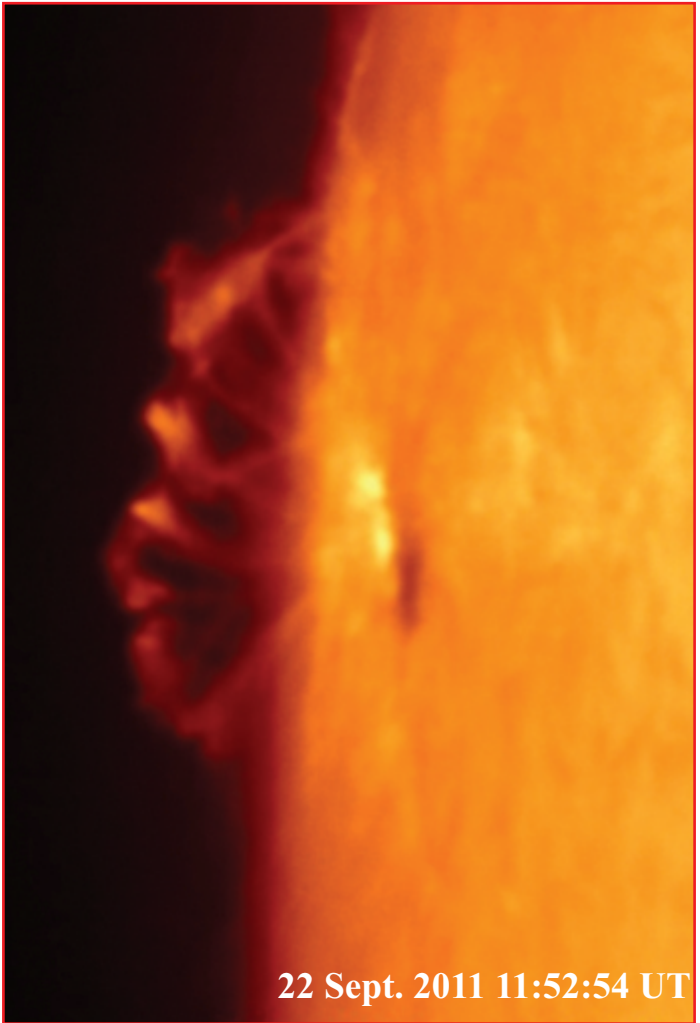
The BVR composite image of Orion star forming region imaged with the 130-cm telescope at Devasthal.



Comet Hale-Bopp



Red sprite with bluetendrils seen above thunderclouds.



22 Sept. 2011 11:52:54 UT

H α post flare loops of 2N/X1.4 class major flare observed on 22 September 2011 from active region NOAA 11302 with 15-cm Coude Solar Tower Telescope at ARIES, Nainital.

ARIES, Nainital



2012