"Dissemination of Education for Knowledge, Science and Culture"

Shikshan Maharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Dattajirao Kadam Arts, Science & Commerce College, Ichalkaranji

Department of Physics (Academic Year 2025-2026)

B. Sc. III Seminar (Semester-VI)

Notice

Date: 01/12/2025

This is to notify that the Seminar (PPT) for Semester-VI of B. Sc. III (Physics) students will be held on 21st January 2026 at: 11:50 AM in Smart room of Mathematics department (Room No. 102). All students must prepare a PowerPoint presentation (10-15 minutes) and be present on time.

Note: Attendance and presentation are mandatory. A seminar report is a formal document summarizing the content presented during a seminar. The topic of seminars is as per given table.

Sr. No.	Roll No.	Name of students	Topic of Seminar
1	5501	Mr. Chavan Digambar Sagar	Black Hole
2	5502	Miss. Khot Pragati R	Construction and Principle of Betatron
3	5503	Miss. Khot Priya Arun	GM Counter
4	5504	Miss. Malage Gayatri Vijay	Miller Indices
5	5505	Mr. Nimbalkar Atharv Sunil	Classification of Elementary Particles
6	5506	Miss. Pawar Ragini Sanjay	Raman Effect
7	5508	Mr. Salunkhe Ojas Ganesh	Superconductivity
8	5509	Miss. Singh Ashwini Manoj	Hubble's Law
9			

Date: 21st January 2026

Venue: Digital Classroom (Room no. 102)

(Dr. V. V. Ganbavle)

HEAD,
Department of Physics
Dattajirao Kadam A.S.C College,
Ichalkaranji.

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Department of Physics

B. Sc. III Seminar, 2025-2026 (Semester VI)
Attendance Sheet

Sr. No.	Roll No.	Name of students	Signature
1	5501	Mr. Chavan Digambar Sagar	
2	5502	Miss. Khot Pragati Ramchandra	
3	5503	Miss. Khot Priya Arun	
4	5504	Miss. Malage Gayatri Vijay	
5	5505	Mr. Nimbalkar Atharv Sunil	
6	5506	Miss. Pawar Ragini Sanjay	
7	5508	Mr. Salunkhe Ojas Ganesh	
8	5509	Miss. Singh Ashwini Manoj	
9			
10			

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Dattajirao Kadam Arts, Science & Commerce, Ichalkaranji

Department of Physics

B. Sc. III Seminar Evaluation Report 2025-2026 (Semester VI)

Sr. No.	Roll No.	Name of students	Content of Knowledge (02Marks)	Presentation Skills (02Marks)	Engagement (02Marks)	Critical Thinking (02Marks)	Time Management (02Marks)	Total Marks (10Marks)
1	5501	Chavan Digambar Sagar	02	01	02	02	02	09
2	5502	Khot Pragati Ramchandra	02	01	01	02	02	08
3	5503	Khot Priya Arun	02	02	02	02	02	10
4	5504	Malage Gayatri Vijay	02	02	02	01	02	09
5	5505	Nimbalkar Atharv Sunil	02	01	01	02	02	08
6	5506	Pawar Ragini Sanjay	02	02	02	02	02	10
7	5507	Pedanekar Prasad Dhananjay	02	01	02	02	01	08
8	5508	Salunkhe Ojas Ganesh	02	01	02	01	02	08
9	5509	Singh Ashwini Manoj	02	02	02	02	02	10
10								

(Mr. S. D. Pathan) (Dr. V. S. Pawar)

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DATTAJIRAO KADAM ARTS, SCIENCE AND COMMERCE COLLEGE, ICHALKARANJI

DEPARTMENT OF PHYSICS

SEMINAR REPORT

Name: Chavan Digambar Sagar

Class: BSC III

Roll No: 5501

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Tour Incharge
(Signature)

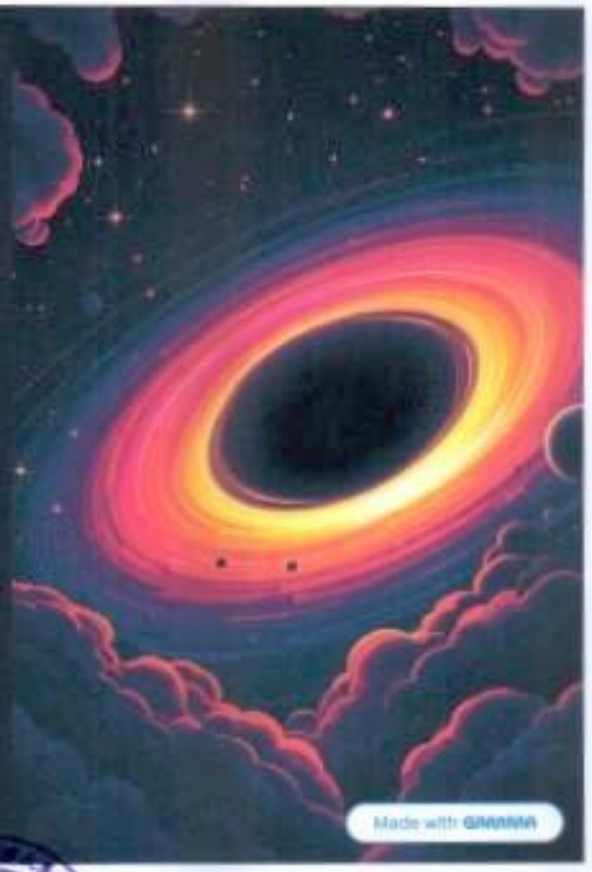
Examiner
(Signature)
14/01/26

Head of Department
(Signature)

Dept. of Physics
Dattajirao Kadam A.S.C College
Ichalkaranji

Unveiling the Universe's Ultimate Mystery

A Journey into Black Holes



What is a Black Hole?

A black hole is an **extremely dense region of spacetime** where gravity is so intense that nothing—**not even light**—can escape once it crosses the point of no return.

The concept emerged from **Einstein's general relativity** in 1915, though the term "black hole" wasn't coined until 1967 by physicist John Wheeler. Karl Schwarzschild's 1916 solution to Einstein's equations revealed the possibility of such objects.

01

1784

John Michell proposes "dark stars" with escape velocity exceeding light speed

02

1915

Einstein publishes general theory of relativity

03

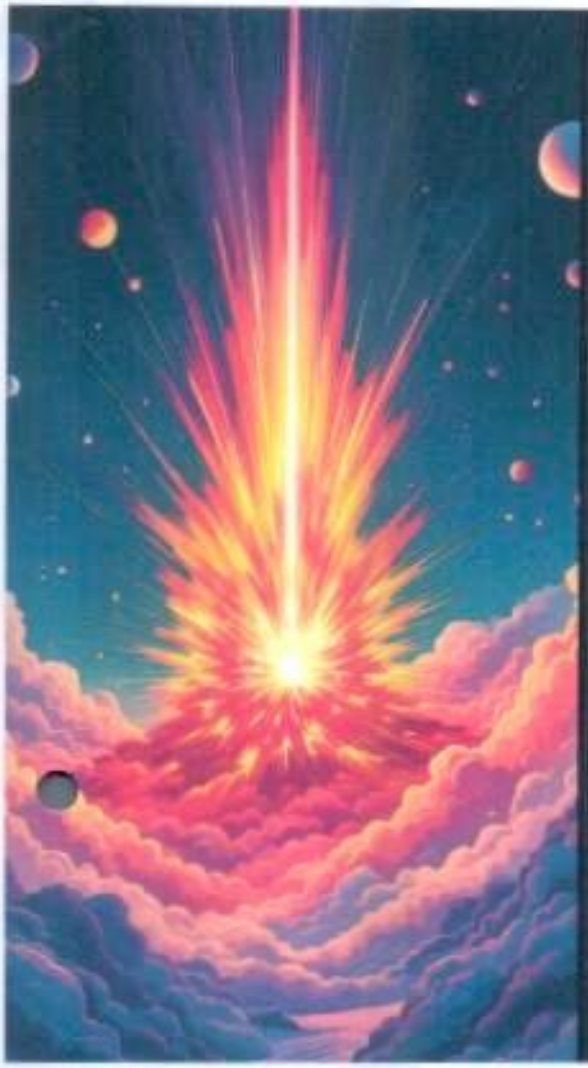
1916

Schwarzschild finds first black hole solution

04

1967

Term "black hole" popularized by John Wheeler



The Birth of Giants

Stellar Collapse and Supermassive Black Hole Formation

Stellar-Mass Black Holes

Form when massive stars (≥20 solar masses) exhaust their nuclear fuel. The core collapses under gravity, triggering a supernova explosion. If the remaining core exceeds ~3 solar masses, it collapses into a black hole.

Supermassive Black Holes

Found at galaxy centres, containing millions to billions of solar masses. Formation mechanisms remain uncertain—possibly from direct collapse of massive gas clouds, rapid accretion, or mergers of smaller black holes.

Intermediate-Mass Black Holes

Rare objects between stellar and supermassive categories (100–100,000 solar masses). May form in dense star clusters through runaway stellar collisions or represent seeds of supermassive black holes.

Anatomy of a Black Hole

Event Horizons, Singularities & Spacetime Curvature

Event Horizon

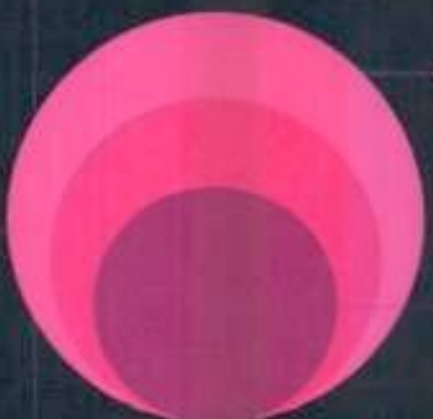
The point of no return where escape velocity equals light speed. Once crossed, no information can reach external observers.

Spacetime Curvature

Mass warps spacetime itself, creating what we perceive as gravity. Near black holes, curvature becomes **infinite** at the singularity.

Singularity

The infinitely dense core where all mass concentrates. General relativity breaks down here—quantum gravity theory needed.



How Do We "See" the Unseen?

Detection Methods & Observational Evidence

Stellar Motion Tracking

Observing stars orbiting invisible massive objects reveals black hole presence through gravitational influence on nearby matter.

X-ray Binaries

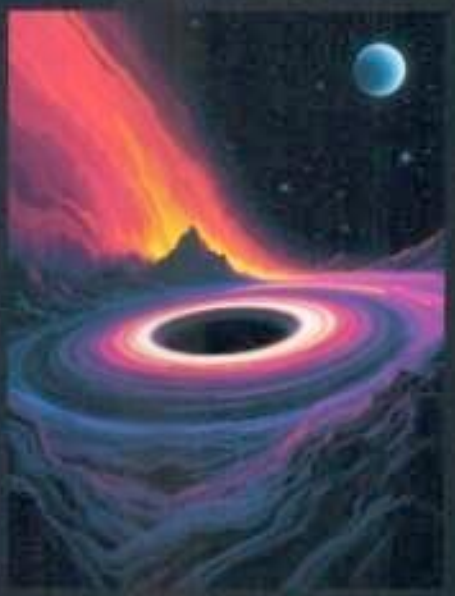
Gas from companion stars heats to millions of degrees as it spirals into black holes, emitting detectable X-rays before crossing the event horizon.

Active Galactic Nuclei

Supermassive black holes consuming matter create intensely bright quasars and active galactic nuclei visible across cosmic distances.

Direct Imaging

Event Horizon Telescope captured first direct image of M87*'s shadow in 2019, confirming theoretical predictions with remarkable precision.



Gravitational Lensing & Hawking Radiation

Unravelling Their Impact

Gravitational Lensing

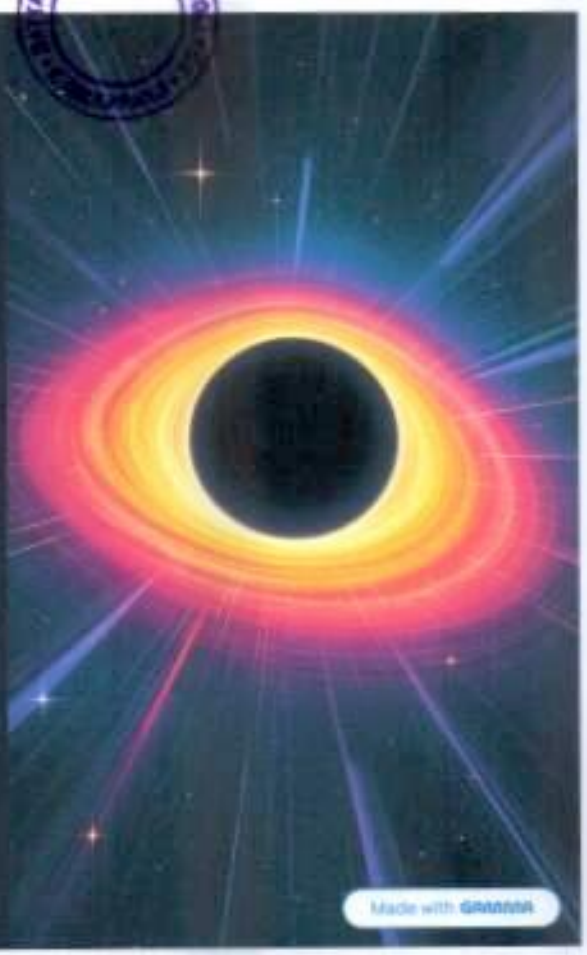
Black holes bend light paths dramatically, creating **Einstein rings and multiple images** of background objects. This warping acts as a cosmic magnifying glass, revealing otherwise invisible structures.

Lensing effects allow astronomers to map dark matter distributions and measure black hole masses independently of other methods.

Hawking Radiation

Stephen Hawking predicted in 1974 that black holes **emit quantum particles** at their boundaries, slowly losing mass over astronomical timescales.

This radiation implies black holes have **temperature and entropy**, resolving information paradox debates. However, detection remains impossible with current technology.



Black Holes in Popular Culture

Fact vs. Fiction

Film: Interstellar (2014)

Accurate: Scientific visualization of Gargantua by Kip Thorne showed realistic accretion disk and lensing effects.
Inaccurate: Human survival near event horizon and time travel through singularity.

Wormholes

Often depicted as black hole shortcuts through spacetime. While mathematically possible in general relativity, **no evidence supports their existence** or traversability.

Galactic Centers

Many films show black holes consuming entire galaxies rapidly. Reality: **Supermassive black holes influence but don't dominate** galactic dynamics—stars remain safe at vast distances.

> "Black holes are not cosmic vacuum cleaners. They're simply very massive objects with intense gravity—like any other massive body, they obey orbital mechanics."

The Role of Black Holes in Galactic Evolution

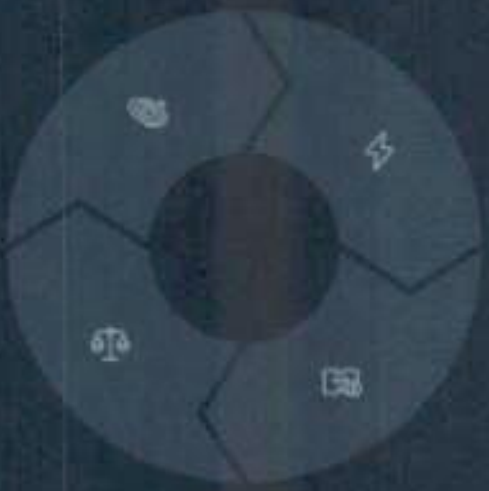
Shaping the Cosmos

Galaxy Formation

Supermassive black holes likely seeded early galaxy formation, providing gravitational anchors for gas clouds to collapse around.

Cosmic Balance

Black hole mass correlates tightly with host galaxy properties, suggesting **co-evolution** through feedback processes over billions of years.



Feedback Mechanisms

Jets and radiation from active black holes heat surrounding gas, regulating star formation rates throughout galaxies.

Galactic Mergers

Colliding galaxies bring black holes together, triggering violent accretion episodes and powerful gravitational wave emissions.

Without black holes, galaxies would form stars uncontrollably, potentially preventing stable planetary systems from developing.

The Future of Black Hole Research

Gravitational Waves and Beyond

Gravitational Wave Astronomy

LIGO and Virgo detectors now routinely observe **black hole mergers** through spacetime ripples, opening new window into the invisible universe.

Next-Gen Telescopes

Extremely Large Telescope and space-based observatories will achieve **unprecedented resolution**, imaging more black hole shadows and tracking stellar orbits with milliarcsecond precision.

Quantum Gravity Probes

Understanding black hole information paradox may require **theory of quantum gravity**, potentially revealed through Hawking radiation observations or holographic principle insights.

Multi-Messenger Astronomy

Combining gravitational waves, electromagnetic signals, and neutrino detections creates **complete picture** of black hole environments and merger events.

Made with GAMMA

Key Takeaways

Embracing the Cosmic Unknown

Gravity's Ultimate Triumph

Black holes represent where gravity overcomes all other forces, compressing matter into infinitely dense singularities governed by unknown physics.

Invisible Yet Detectable

Though light cannot escape, we observe black holes through their gravitational influence, accretion radiation, and spacetime-warping effects.

Galactic Architects

Supermassive black holes shape entire galaxies through feedback mechanisms, proving essential to cosmic structure formation.

Unsolved Mysteries Remain

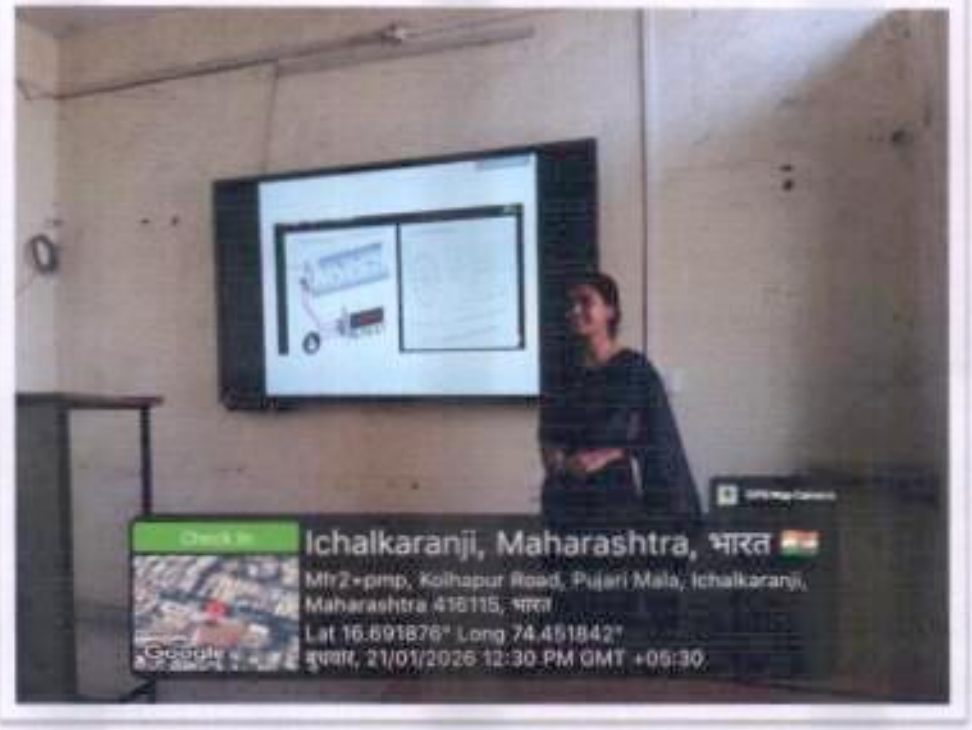
Quantum gravity, information paradox, and singularity physics await breakthroughs from gravitational wave astronomy and theoretical advances.

Black holes continue to challenge our understanding of physics, serving as cosmic laboratories for testing general relativity and quantum mechanics. As observational capabilities advance, **each discovery reveals deeper questions** about the fundamental nature of spacetime, matter, and the universe itself.

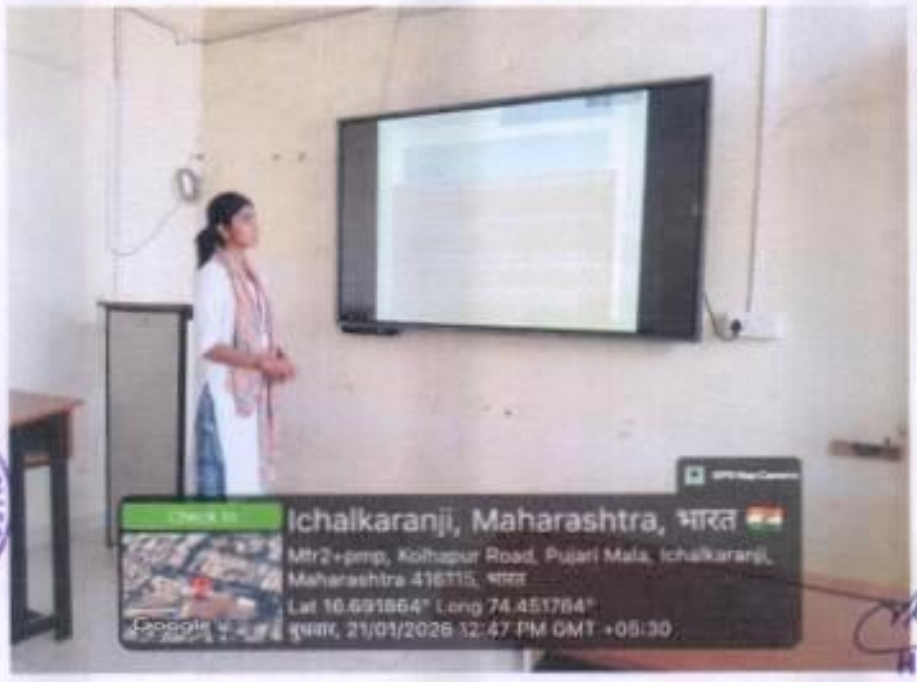
Made with GAMMA

"B. Sc. III Seminars, Semester-VI (2025-26)"

"Miss. Priya conducting an insightful lecture on the *Geiger–Müller Counter*, explaining its working principle, applications and significance"



"Miss. Ashwini delivering an engaging seminar on the *Evolution of the Solar System*"



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इचलकरंजी

Department of Physics

B. Sc. III Seminar Report - Semester VI (2025-2026)

Date: 22/01/2026

As a part of the academic curriculum of **B. Sc. III Physics (Semester VI)**, student seminars were conducted with the objective of enhancing conceptual understanding, scientific communication skills and confidence in presenting physics topics using PowerPoint presentations. A total of **9 students** actively participated in the seminar activity. The seminar topics covered important areas of physics, including **Black Holes, Betatron (construction and principle), Geiger–Müller Counter, Miller Indices, Classification of Elementary Particles, Raman Effect, Superconductivity** and **Hubble's Law**. These topics span diverse branches such as Astrophysics, Nuclear physics, Solid-state physics, Crystallography, Particle physics, Optics and Cosmology.

Students demonstrated a good understanding of the fundamental principles involved in their respective topics and used visual aids effectively. The presentations encouraged active interaction, improved confidence, and helped students develop analytical thinking and presentation skills.

All students used PPT effectively and demonstrated satisfactory subject knowledge. The seminars encouraged interactive discussion and helped students strengthen their presentation and analytical skills. Overall, the seminar session was academically enriching and successful.

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