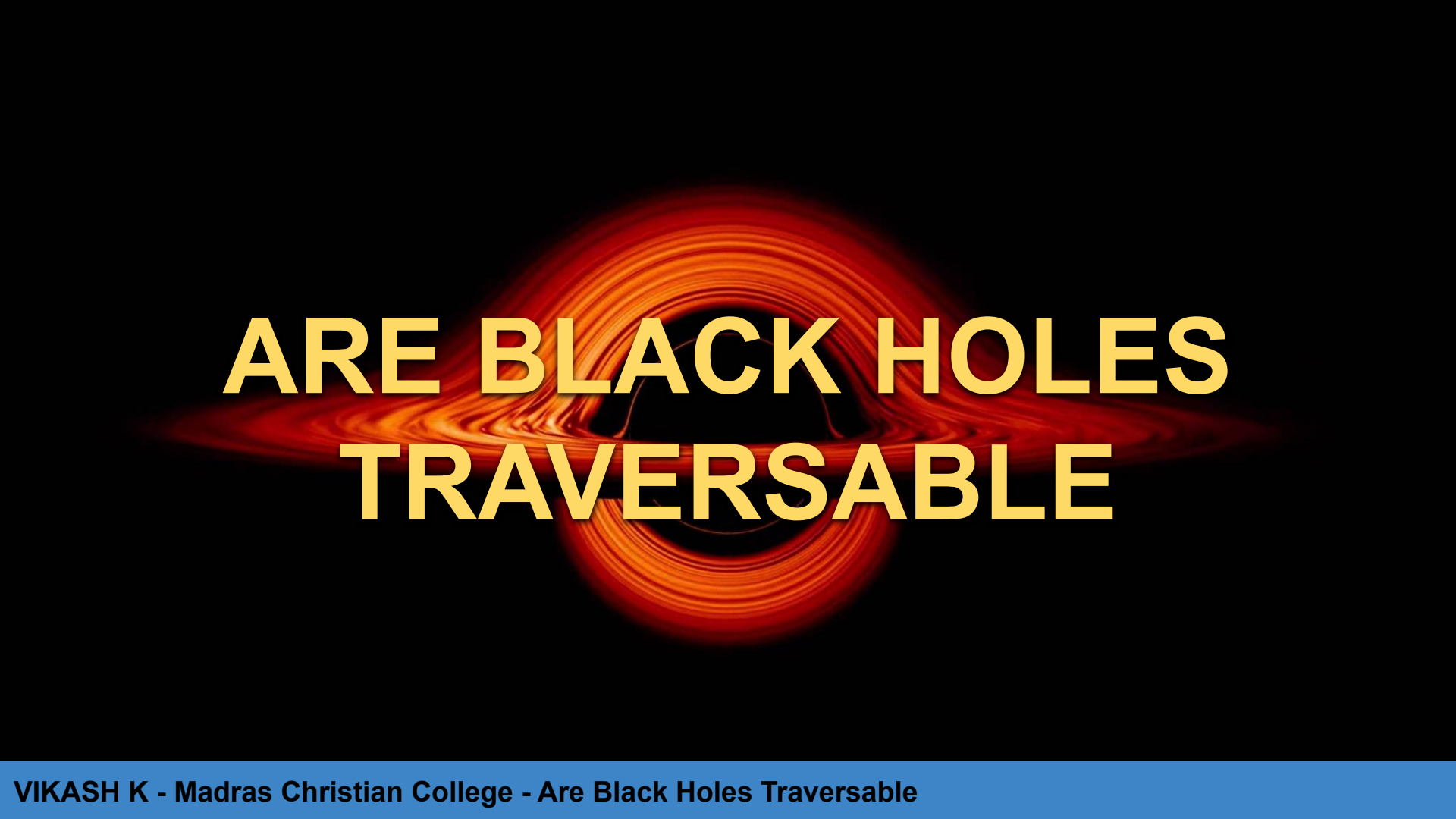
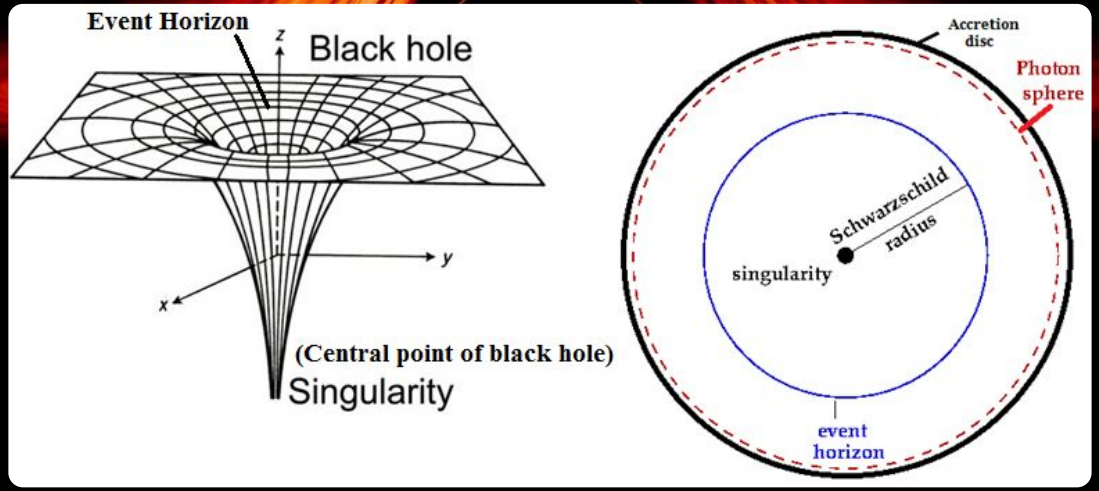

ARE BLACK HOLES
TRAVERSABLE

What is a Black Hole?

- From Newtonian perspective, Black Hole is an “object” that theoretically has infinite density and surrounded by an Event Horizon from no object can escape.
- But Geometrically speaking, Black Hole is the personification of a point that is not in space(time) at all (i.e) It is the place where the “flow” of all objects end.
- The Event Horizon is an aftermath of a black hole but not an entity of a black hole itself when spoken in terms of geometry.
- But when digged in deeper, an outer observer will see an Event Horizon and a Black Hole as a single entity

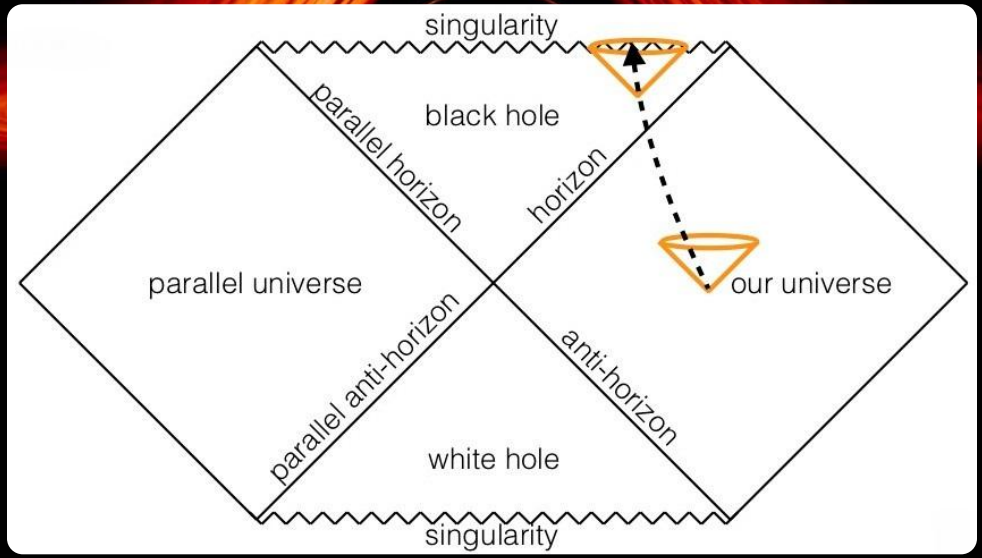
- Because a observer never sees an object crossing the event horizon unless he himself is in the black hole but he observes the strength of the gravitational field (the metric) changing.
- Basically putting everything together, a “Black Hole” is the space where a set of events that cannot be observed by an outside observer occur.



Is a Black Hole Traversable

- The answer to this lies in the fact of the type of Black Hole. Black Holes could be with net charge or with angular momentum or with both or without both.
- Traversability can be very apparent when these black holes are studied in suitable coordinate systems.
- These coordinate systems have null geodesics (flow path of photons) with 45 degree angles and should be compact. The compact null coordinate system that we are going to use is the well known Penrose Carter Coordinate commonly also known as the Penrose Carter diagram.

- **Let’s see a Schwarzschild Black Hole, The penrose carter diagram of this black hole clearly shows two different spacetimes, they could be the spacetimes of parallel universes. But seeing different geodesics clearly tells that it is impossible to traverse through since they all the null geodesic end at the singularity always.**



- The penrose carter diagram for a “rotating” black hole is similar to a “charged” black hole. This has infinite number of spacetimes.
- Here, it is possible to travel across different spacetimes and it can be seen very clearly from the diagram itself.
- In the case of a Schwarzschild black hole, it was not possible at all but in this case, it is just at its extreme that one could mathematically travel across different universes infinitely.