Introductory Astronomy

Week 6: Relativity and Black Holes

Clip 15: Black Holes in Theory

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Black Hole Facts

- No Hair: Collapse loses all properties of star. Black hole characterized completely by mass, angular momentum, and electric charge
- Singularity is real (Hawking, Penrose). General Relativity is incomplete
- Cosmic censorship conjecture: singularities hidden inside horizons. Physics outside well-defined

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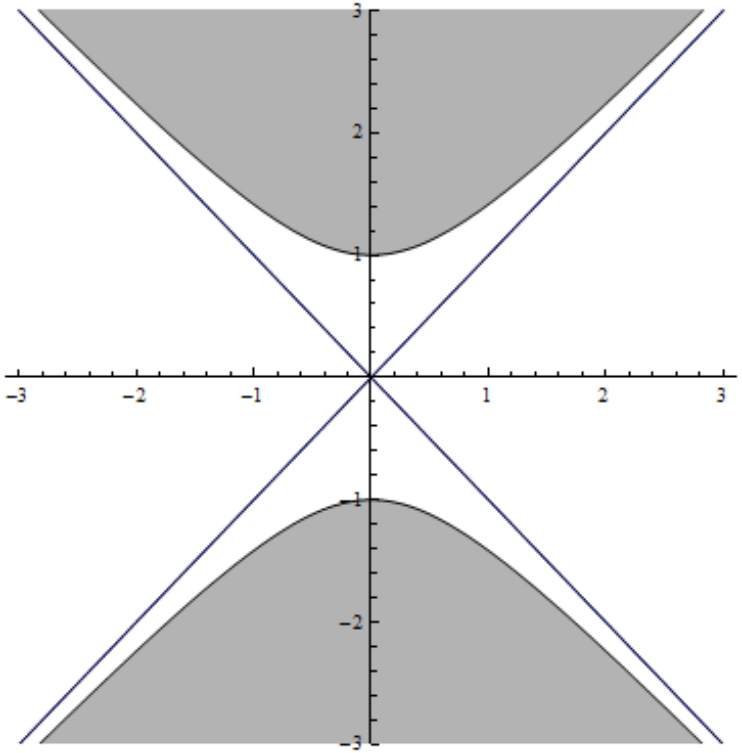
Wormholes

- Look again at description of region near horizon.
- Describes two separate spacetimes touching for an instant
- Nothing can get through
- Try to modify solution to get big wormholes – not yet
- What's on the other side?



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Quantum Black Holes

- Hawking: Quantum effects near horizon leads to radiation with energy loss
- Hawking radiation is blackbody at $T \sim M^{-1}$
- Negative specific heat: hotter as loses energy
- Evaporate in $10^{62}\,\mathrm{yr}$ for $M = 5M_\odot$
- Microscopic black holes go faster if created?

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Credits

- Kruskal Coordinates: Wikimedia Commons/AllenMcC http://en.wikipedia.org/wiki/File:KruskalKoords.gif

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