Exploring Hot Gases near a Black Hole

Distance	Black Hole 1		Black Hole 2	
(Kilometers)	Temperature (Kelvin)	Color (nm)	Temperature (Kelvin)	Color (nm)
2.0 million	9,000	400 (violet)	13,500	267 (UV-B)
3.0 million	6,000	600 (orange)	9,000	400 (UV-A)
4.0 million	4,500	800 (crimson)	6,800	530 (yellow)
4.5 million	4,000	900 (infrared)	6,000	600 (orange)
D	???		???	

The table above compares the color and temperature of a gas at various distances from two black holes. The first black hole has a mass of 10 times our sun. The second black hole has a mass of 50 times our sun's mass.

Problem 1 – If you were in a spaceship located 4 million kilometers from a black hole, how could you tell if it had a mass of 10 times or 50 times our suns mass?

Problem 2 – What is the formula that give the temperature T of the gas near a black hole given your distance from the black hole for A) the 10 solar mass black hole? and B) the 50 solar mass black hole?

Problem 1 – If you were in a spaceship located 4 million kilometers from a black hole, how could you tell if it had a mass of 10 times or 50 times our suns mass?

Answer: The gas around you would be glowing yellow if you were near a black hole with 50 times the suns mass, but would shine in 'blood red' crimson light if you were near a 10 solar mass black hole.

Problem 2 – What is the formula that gives the temperature T of the gas near a black hole given your distance from the black hole for A) the 10 solar mass black hole? and B) the 50 solar mass black hole?

Answer: In each case, as the distance, D, increases, the temperature decreases so the relationship between D and T is an inverse relationship.

A) For 3 million km we have T = 6000 K, so T = 18,000 million / D

B) For 3 million km we have T = 9000 K so T = 27000 million / D