THE PROBLEM OF THE MISSING HOLES

Black holes have a bad reputation. In many ways, it is deserved. They are the most efficient engines of destruction known to humanity.

Kimberley Weaver (2003)

Black holes came first and somehow—we don't know how—grew the galaxy around them.

Christopher Carilli (2009)

The study … does not explain how a black hole can nurture a galaxy; if anything, it should tear it apart.

George Musser (2009)

Understanding the link between galaxies and their black holes has become one of the most important problems in astrophysics.

Timothy Heckman (2011)

In the morning it's not easy to get back to work. Two nights in a row I didn't sleep a wink. Which I think is Willie Nelson, though the thought flits through my head without me really fixing on it. My mind is on the voice. In the office I sit staring out the window seeing nothing much.

It's after ten before I get much done. Oddly LAPD hasn't showed his face so far. It's odd because I told him that today is black hole day. He's usually attuned to stuff she thinks is hot. But then she hasn't said the words 'black hole' to me for many days and this also is odd. Well, they can read it. So I write. I start with Penrose saying that a black hole 'roughly speaking is a region of spacetime that has resulted from the inward gravitational collapse of material, where the gravitational attraction has become so strong that even light cannot escape.'

That seems simple but black holes enjoy a history of problems. It's not much of a stretch to say the whole idea is a problem. But for GR it's an opportunity. In the '30s its practitioners, all few of them, have difficulty finding work. Black holes provide a park for physicists to exercise their GR dog.

A black hole's said to be a mass that has no size, a Singularity in popular disguise. Indeed black holes are mostly *said* to be. *If* they exist, GR (which says they *must* exist) says Singularities are what they are. But, as I've stressed for Frank, GR knows nothing of such abstract points. It just *supposes* points

and so it says that black holes must exist. Maybe they don't exist or maybe they're not singular. No one's seen one; maybe no one ever will.

Whether it is possible to make a black hole with a big machine is controversial. Nobody claims yet to have done it but it worries some who see a black hole as a gate to doom. The controversy seems to be more fear than physics but then fear drives much more politics than physics does.

Making a black hole with no machine requires a base amount of mass—a mass so big the matter at its center can't support the weight of all the rest. It collapses. There is no risk the Sun will do this; it's too small. This is lucky as the birthing of a big black hole destroys a star. It's the most spectacular event there is. It's called a supernova. With big telescopes astronomers can see a new one almost every day maybe ten billion trillion miles away. Of course that means astronomers are seeing things that happened long ago. If one happened in our galaxy it would be good to not be in the 'hood. It would sterilize our Solar System even from ten trillion miles. I'd be a dead man walking for a year or two before the news arrived; Thomas Hardy.

So astronomers have seen the birthing, they believe, but they have never seen the baby. So why *do* they believe? Well, in 1915 that becomes a fashionable question. Schwarzschild uses GR to show black holes *might* exist. Then in 1970 Hawking and Penrose use GR to show black holes *must* exist. Soon astronomers find hot gas zipping too fast in tight circles around nothing they can see. They explain this odd behavior by the presence of a big black hole.

So why should *she* care? I don't know why, but it seems she does. And why do I feel that my Frank would care? I'm zapping muddy coffee when I stumble on an answer. Think a village with a crocodile. The croc eats everyone it can. It's always hungry. It gets bigger and its appetite grows with it so the village becomes smaller. But a crocodile grows only to a certain size. It sleeps instead of eating villagers. A croc-size survey would find hordes of hatchlings, fewer mid-size, and the odd colossal one-ton, but not two-ton, crocodile.

Big black holes don't sleep. Yet they too seem to have a largest size. It's one five-hundredth of the masses of the galaxies they occupy. It's as though the government kept taxes to a max of 0.2%. It's out of character. It makes me wonder: Why? A black hole at the center of a giant galaxy may have the mass of several billion suns. It eats gas, dust, stars and even other big black holes. It hangs out in a cosmic smorgasbord for some five billion years. What keeps it from obesity? It seems that no one has an answer. But then I can't find anyone who asks.

Before Hawking, physics says that black holes suck stuff in and they let

nothing out. Not a single photon. Never. Hawking shows this isn't true: They give off radiation; the jargon is that they evaporate. But losing weight this way takes far too long. A big black hole eats more mass in a nanosecond than the Hawking radiation loses in a trillion years. And, says Hawking, it's the only weight-watch program black holes have.

Big black holes are the most massive objects in the universe. So where did all the biggest of the black holes go? Losing them would be the kind of thing that Oscar Wilde calls carelessness. It seems to me to be a problem. Will he think that it's a clue? And right on cue . . .

"What if Hawking's wrong?"

I don't suppose he means to sound so snide.

"What if they just waste away?"

This time I take in what he is saying. According to Hoyle—the British barrister, not Fred—this is impossible. It's something that the rules do not allow. Not just Hawking's rules. It's GR's rules that would be bent. It seems to me a big black hole would be the place to bend them. Of course, if he is my detective, he's a mix of fact and fiction. He is open to all kinds of possibilities. Even those that are impossible. It is his forte, you might say—the possible impossibility.

What if he's right? What if big black holes do waste away, the bigger faster? Then the Problem would be: How?