

Order-of-Magnitude Estimation

Black holes (Level 3)

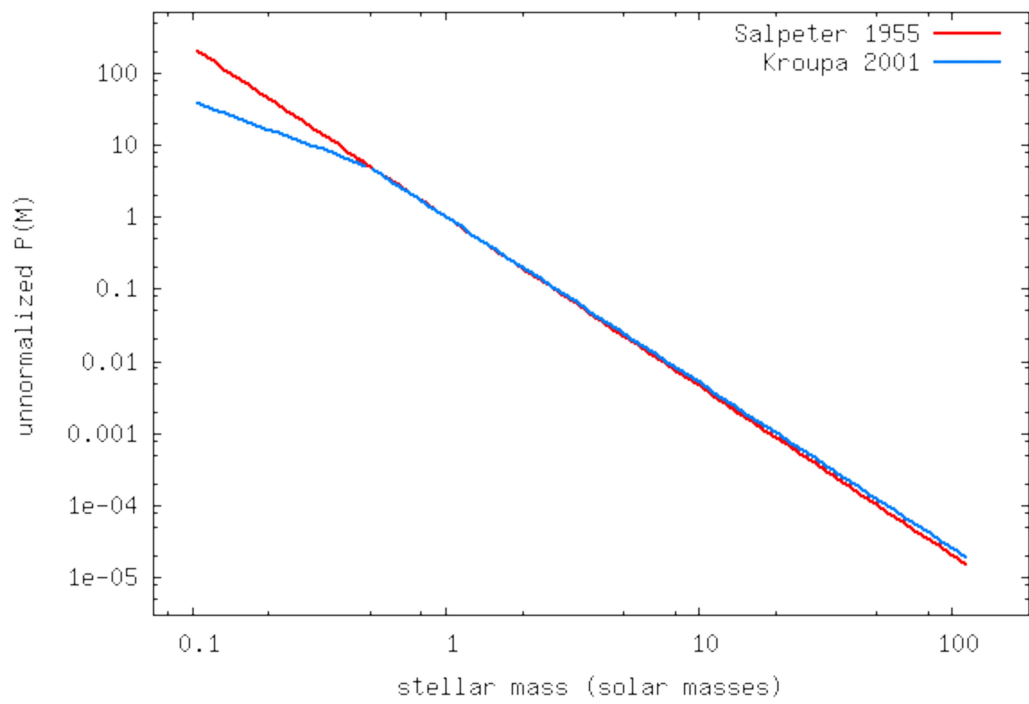
The Question

How many black holes are in the Milky Way Galaxy?

Background

Stars are constantly being born and dying in our Galaxy. The star formation rate of the Milky Way is about 3 solar masses per year (the Sun's worth of gas collapses into stars each year, on average). This is distributed amongst stars according to something called the initial mass function (see next page). When a massive star (about 10 times the mass of the Sun) runs out of fuel, it collapses on itself and explodes in a brilliant supernova. All that remains is its dense core, as either a neutron star or a black hole. These last effectively forever, and so they build up over the lifetime of the Galaxy.

The Solution



Education Standards

This OoM Estimation problems meets the following standards in **bold**:
Next Generation Science Standards (NGSS):

- Physical Sciences
 - Matter & Its Interactions
 - Motion and Stability: Forces and Interactions
 - Energy
 - Waves and Their Applications in Technologies for Information Transfer
- Life Sciences
 - From Molecules to Organisms: Structures and Processes
 - Ecosystems: Interactions, Energy, and Dynamics
 - Heredity: Inheritance and Variation of Traits
 - Biological Evolution: Unity and Diversity
- Earth and Space Sciences
 - Earth’s Place in the Universe
 - Earth’s Systems
 - Earth and Human Activity
- Engineering, Technology, and Applications of Science
 - Engineering Design

Common Core Standards (CSS):

- **Counting & Cardinality**
- **Operations & Algebraic Thinking**
- **Numbers & Operations in Base Ten**
- **Number & Operations — Fractions**
- **Measurement & Data**
- Geometry
- Ratios & Proportional Relationships
- The Number System
- Expressions & Equations
- Functions
- **Statistics & Probability**