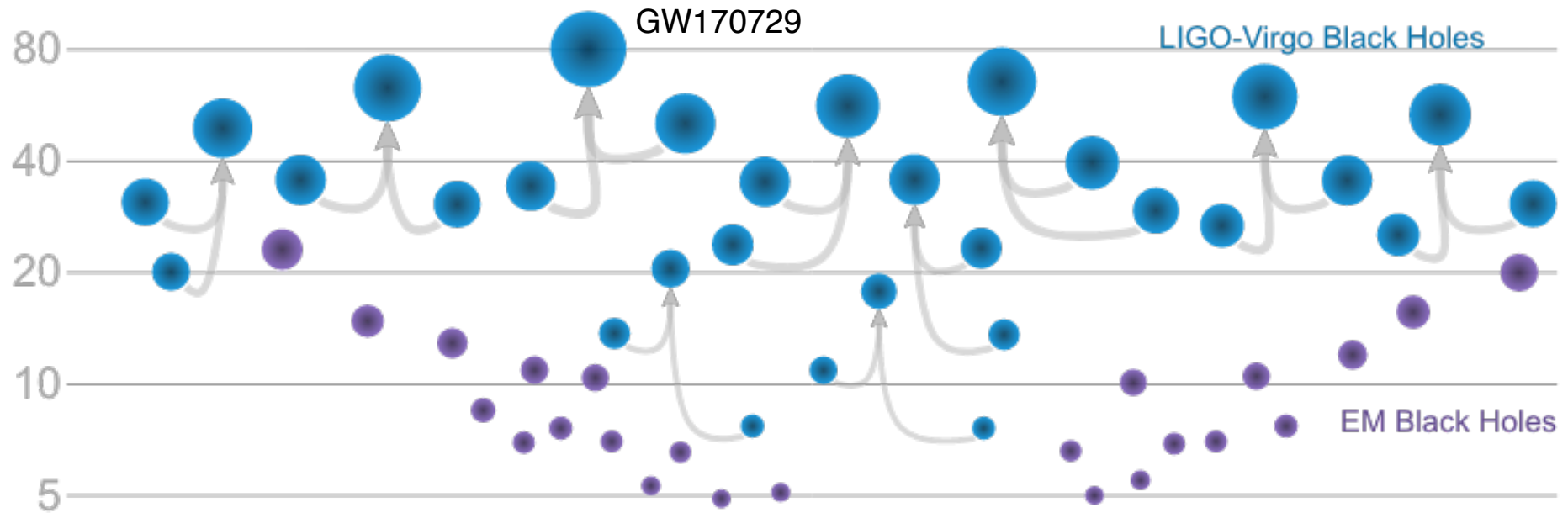


Intermediate mass black holes: to be or not to be

A theoretical perspective

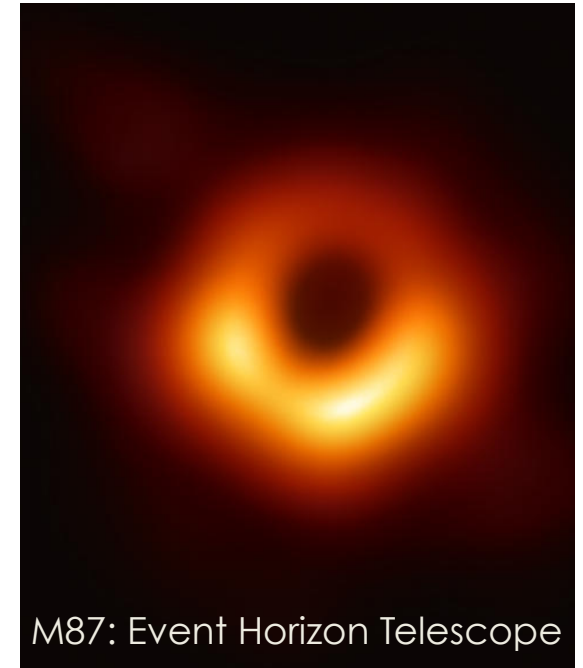
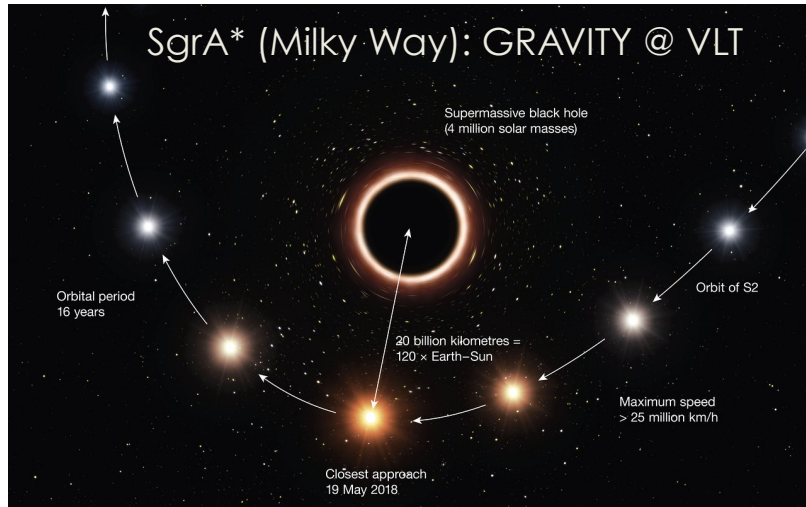
Marta Volonteri
Institut d'Astrophysique de Paris

Intermediate mass black holes: what's in a name



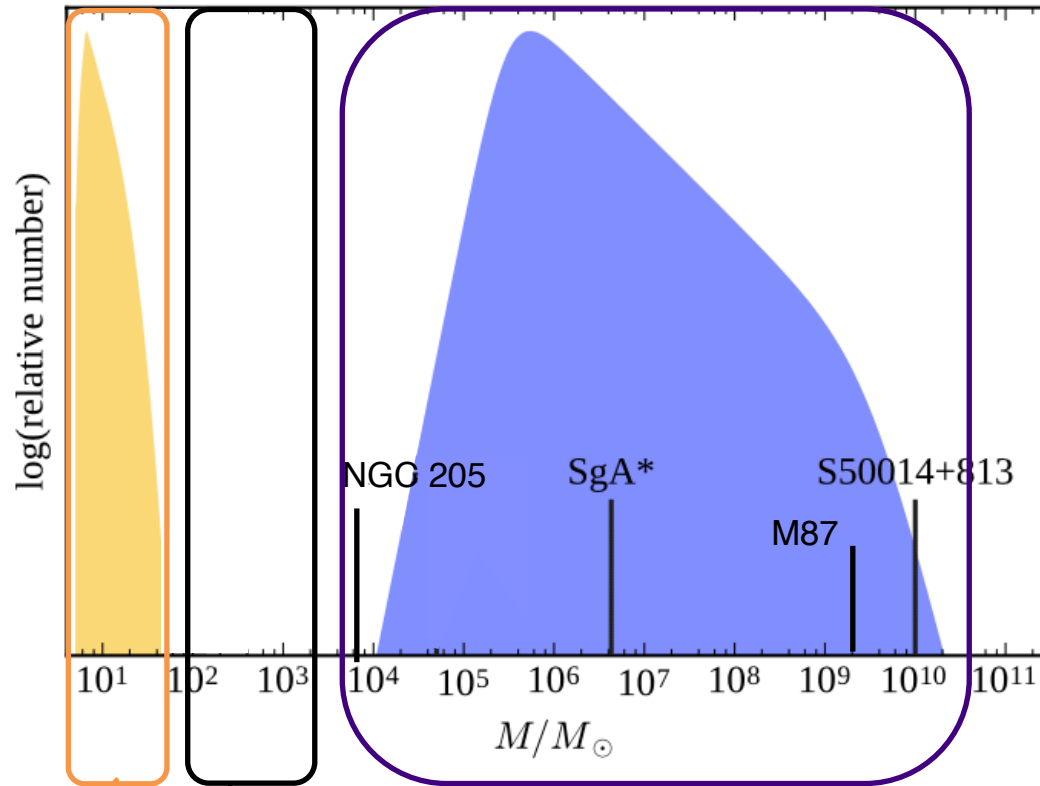
Stellar mass black holes

Intermediate mass black holes: what's in a name



Massive black holes

Intermediate mass black holes: what's in a name

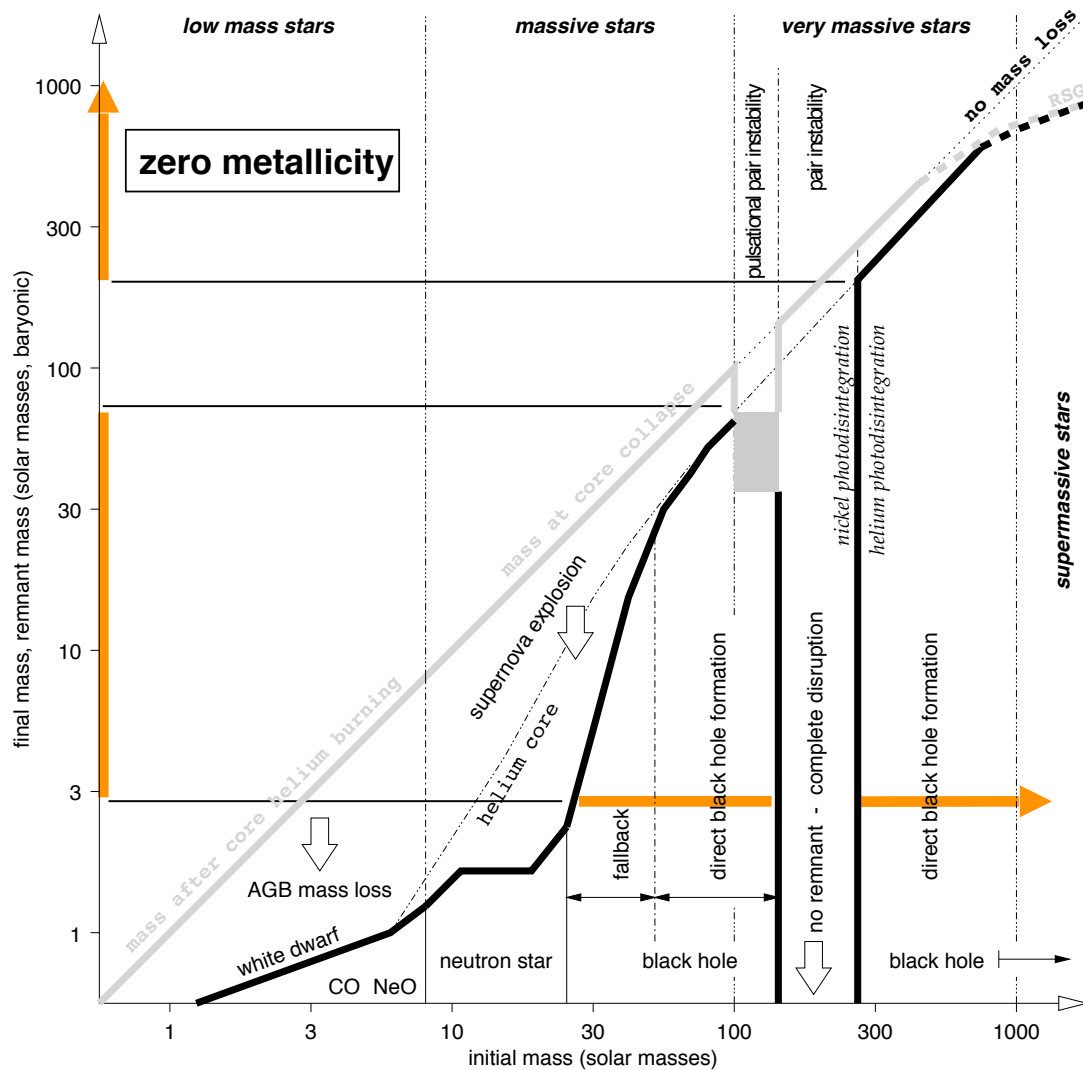


Stellar mass black holes

Massive black holes

Something in between?

The mass “gap” and above

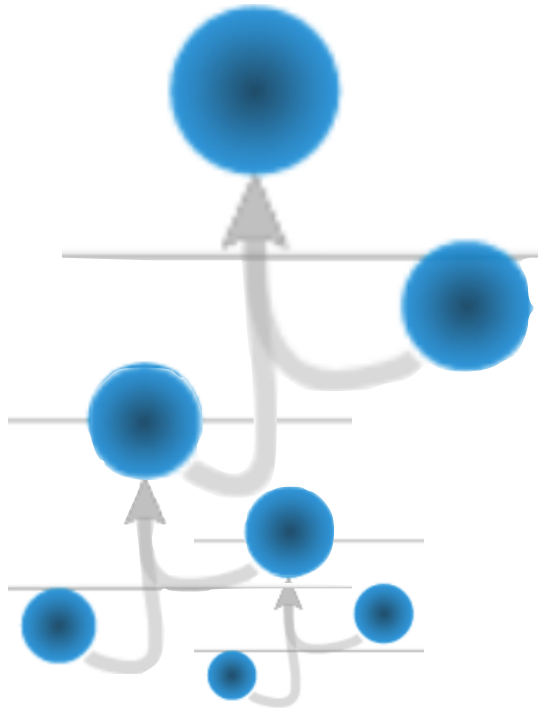


Heger & Woosley 2002

The mass of stellar remnants is higher at lower metallicity: weaker winds and nuclear energy release

Most massive single black hole at zero/very low metallicity depends on what's the most massive star one can make

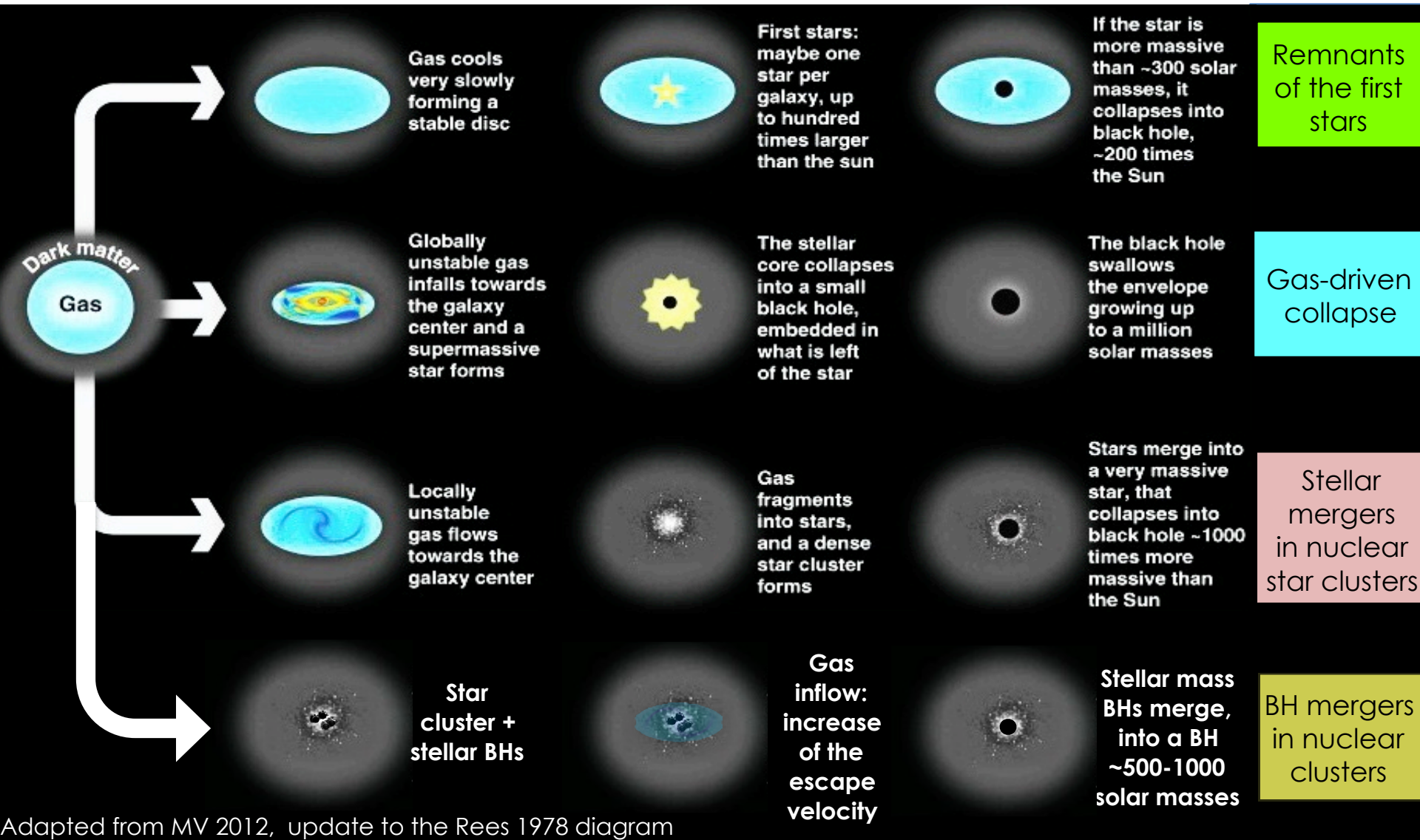
The mass “gap” and above



Black hole mergers are facilitated in dense stellar systems, e.g., globular clusters

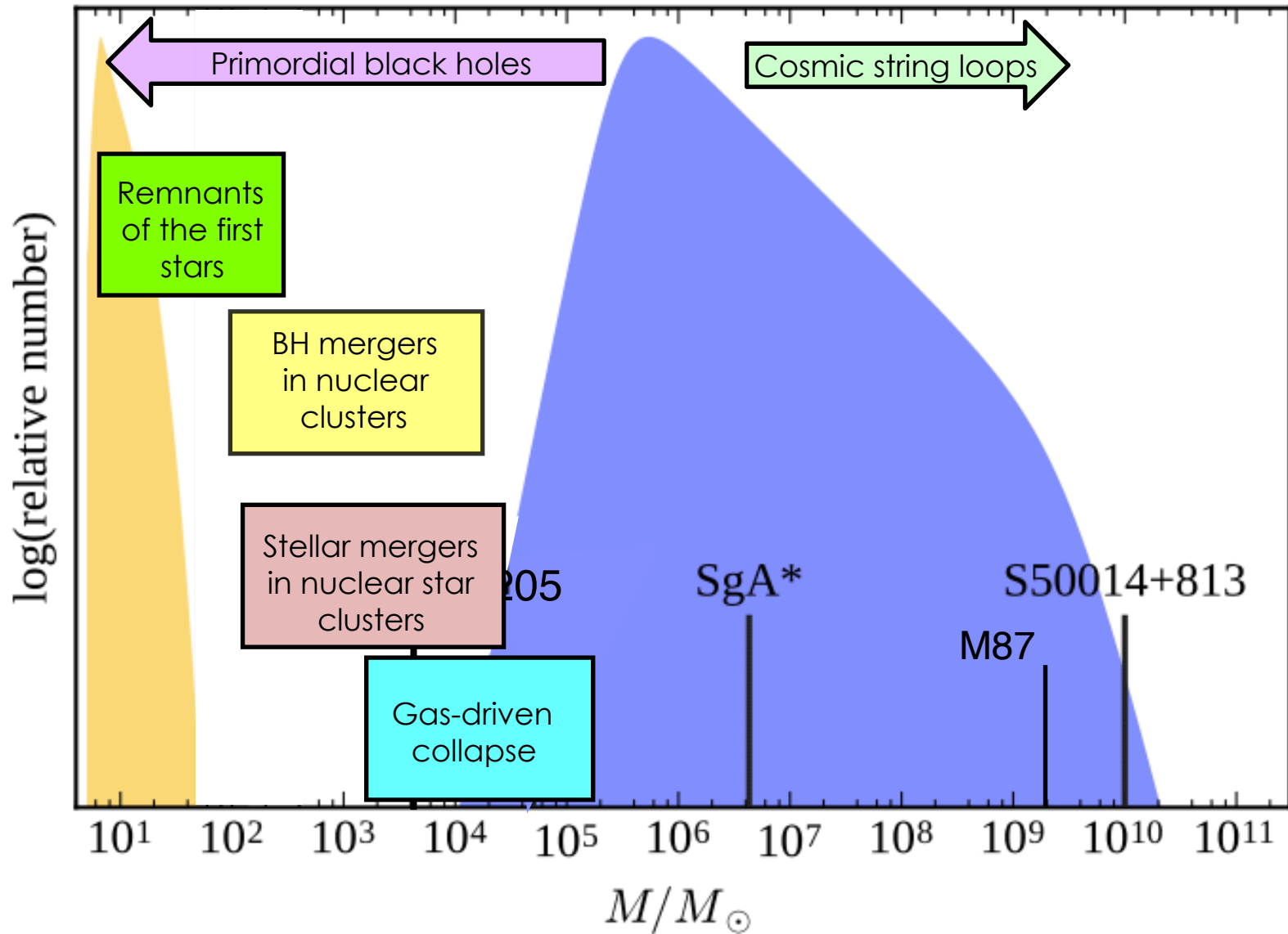
IMF + mass segregation + dynamical interactions + kick vs escape speed from cluster determine the max black hole mass that can form

Massive black hole “seeds”

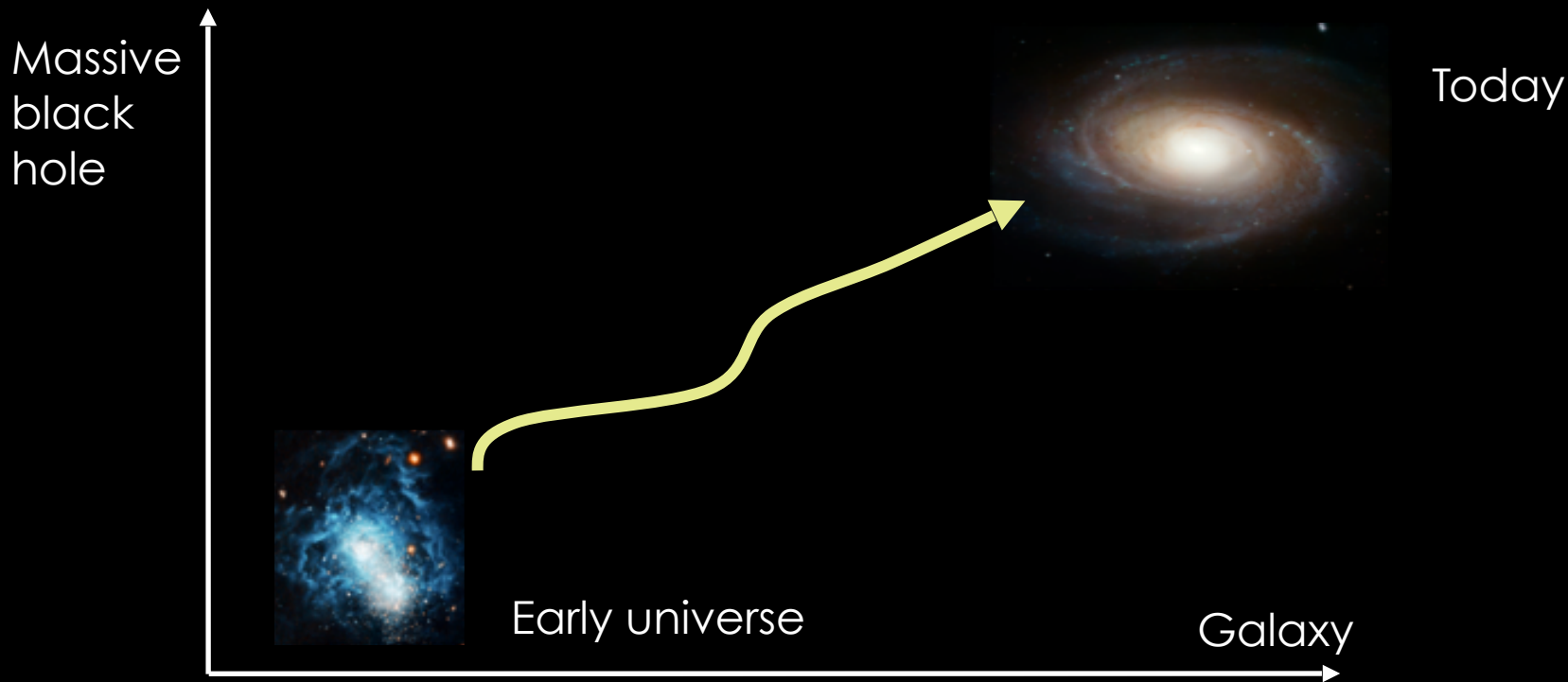


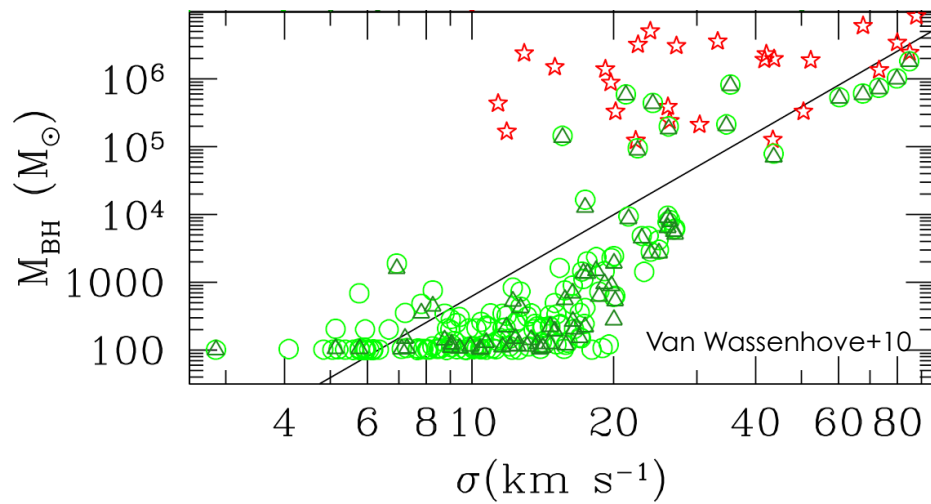
Adapted from MV 2012, update to the Rees 1978 diagram

Massive black hole “seeds”



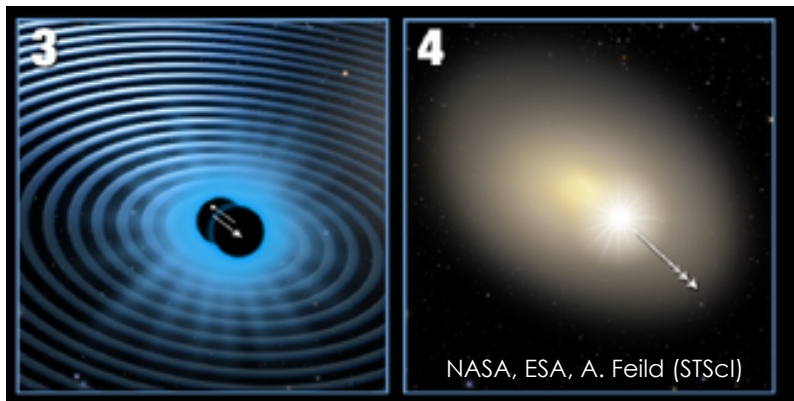
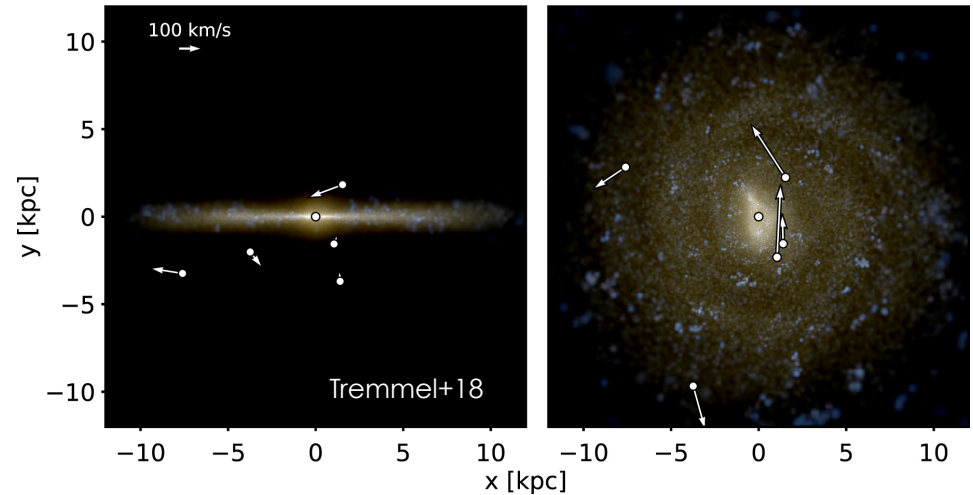
The evolution of massive black holes in galaxies



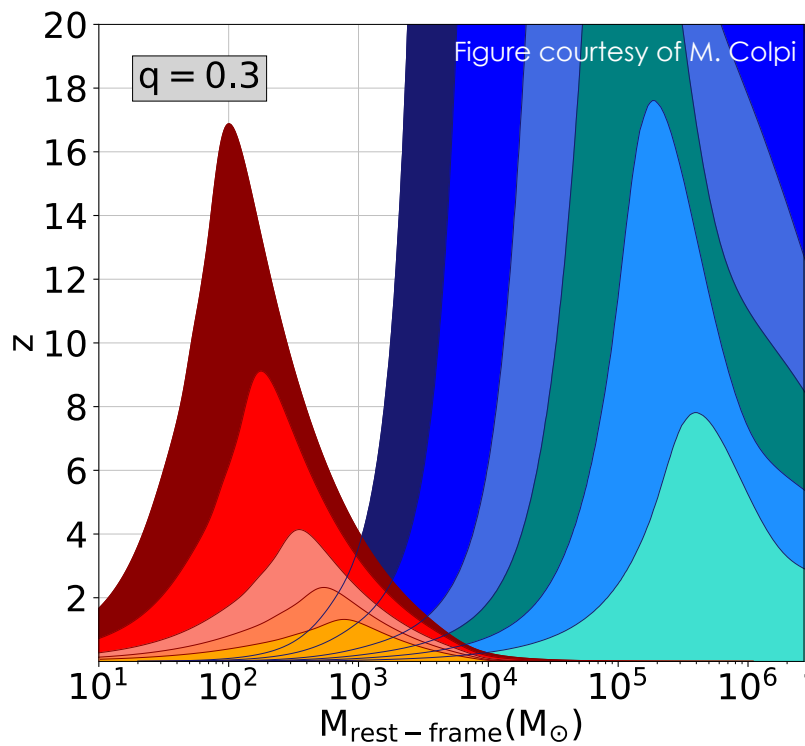


“I” MBHs in dwarf galaxies don’t grow much

Wandering “I” MBHs left over from failed mergers

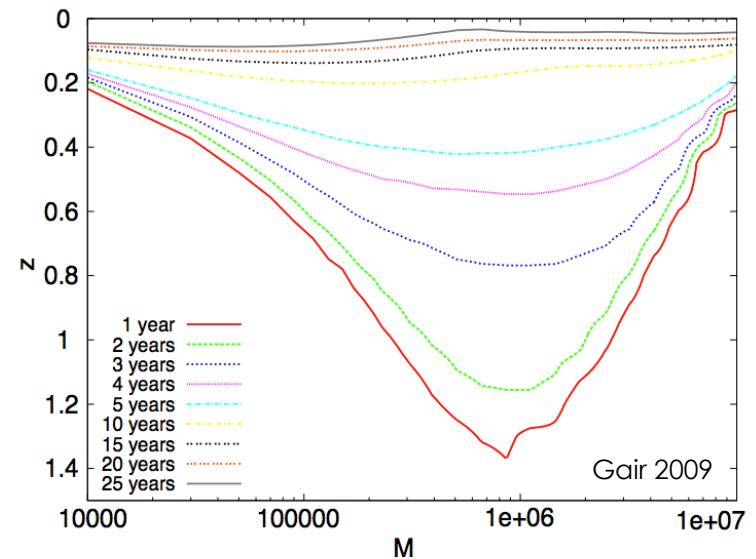


“I” MBHs ejected by 3-body scattering or gravitational wave recoil



“I”MBH mergers with LISA and 3G detectors (e.g., Einstein Telescope, Cosmic Explorer)

Extreme Mass Ratio
Inspirals (EMRIs: stellar
mass + “I”MBH) with LISA



Intermediate mass black holes: a theoretical perspective

What's an "intermediate" mass black hole?

Very massive, supermassive stars: the mass of the most massive "stellar origin" black hole is determined by how massive is the most massive zero metallicity star

Merging black holes makes more massive black holes (duh) but beware of kicks and recoils

Where should we look? Globular clusters, dwarf galaxies, outskirts of massive galaxies, the intergalactic medium...

How should we look? With photons or gravitational waves