Abstract: Gravitational collapse in bimetric gravity

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Bimetric theory is a consistent theory of massive gravity, containing two interacting spin-2 fields (metrics): g and f. The spectrum of exact solutions of the equations of motion has been analysed in the homogeneous and isotropic case, yielding accelerated cosmological solutions even in the absence of a cosmological constant. In vacuum, assuming staticity and spherical symmetry, one can reproduce the corresponding GR solutions, i.e. Schwarzschild-(A)dS, but there are also black hole solutions without correspondence in GR. These solutions exhibit asymptotic behaviour different from Minkowski or (A)dS. On the other hand, in the presence of matter sources, there are non-GR solutions with the same asymptotic structure as in GR. Given the different asymptotic structures of the black hole solutions and the solutions in presence of matter, it has been speculated that the gravitational collapse of a star does not produce any of the known black hole solutions as its end state. The outstanding question at this point is what the end state of spherically symmetric gravitational collapse is in bimetric gravity. We answer this question for one class of solutions.

We derive a closed-form solution of gravitational collapse where the g metric is of generalized Vaidya type and the f metric is Schwarzschild-(A)dS. In this set up, the bimetric interaction contributes with an effective cosmological constant to the equations of motion. The g metric can represent gravitational collapse of massless, charged, particles in a cosmological background. During the collapse, an event horizon forms with respect to the g metric that, generically, covers the curvature singularity of the g-sector. However, the curvature singularity of the f-sector is naked with respect to the g-event horizon.

The end states of gravitational collapse are the known static and spherically symmetric GR solutions.