https://www.researchgate.net/post/Do_you_think_that_general_relativity_needs_modifications_or_it_is_a_perfect_theory

"*…In other words only if one thinks that the 4D space-time is an ontology, c is constant, virtually by definition …..*"

- both facts, i.e. that Matter's spacetime is 4D, and that *c*is constant, are postulated in the SR/GR interpretations of experimental data, and nothing else. As any other physical laws/links/constants in any physical theory are; if a theory isn't a fairy tale, of course.

That is another thing, that some SR/GR postulates are fundamentally illusory interpretations, first of all the postulates

– that real Matter's spacetime is imaginary [mathematically] Minkowski and pseudo Riemannian spaces,

- that there is no absolute Matter's spacetime, and so all inertial reference frames are absolutely completely equivalent and legitimate;

- that letters "*x*" and "*t*" in Lorentz transformations relate to all points in the spacetime, and so Lorentz transformations describe real the spacetime transformations, i.e. "space contraction", "time dilation", etc.,

- that the "relativistic effects", i.e. that the "contracted space" and "dilated time" in moving frame really contracts lengths of real material objects, and slows internal processes in real objects, including slows real tick rates of real objects "clocks",

- that some "masses" really "bend spacetime", and that this "bended" spacetime really forces, say, Earth to rotate around Sun, etc.

Really, as that is rigorously shown in the Shevchenko-Tokarevsky's "The Information as Absolute" conception https://www.researchgate.net/publication/260930711_the_Information_as_Absolute DOI 10.5281/zenodo.268904, where the fundamentally transcendent in mainstream philosophy and science, including in physics, and including for the authors of the SR/GR, absolutely fundamental phenomena/notions "Space" and "Time" [and practically all other fundamental phenomena/notions, including "Matter", though] are rigorously scientifically defined,

- and in the Shevchenko-Tokarevsky's informational physical model, for first reading see https://www.researchgate.net/publication/342600304_The_informational_physical_model_some_fundamental_problems_in_physics DOI: 10.13140/RG.2.2.12325.73445/2, which is based on the conception:

- Matter's spacetime is the fundamentally absolute, fundamentally flat, and fundamentally Euclidian, [5]4D spacetime with metrics (*cτ,X,Y,Z,ct*), which fundamentally cannot be "contracted", "dilated", "bended", etc.,

- the Lorentz transformations are equations of motions of points of rigid bodies/systems in one reference frame by using data about coordinates of these points in moving in this frame other frame – a that evidently Galileo transformations are;

- **and so the letters "*x*" and "*t*' in Lorentz transformations relate only to points of rigid bodies/rigid systems of the bodies, which the bodies/systems occupy in concrete time moments; and by no means these letters relate to other points in the spacetime, as that is in Galileo transformations**,

- and the **letters "*x*" and "*t*" in the GR equations [really of motion], till the equations are adequate to the reality, also relate only to points of the bodies/systems**, as that these letters in Newton Gravity mechanics are;

- the Lorentz transformations, which are actualization in Matter of the indeed extremely mighty Galileo-Poincaré relativity principle, are valid completely **only** for the rigid bodies/systems.

For systems of free bodies the transformations aren't applicable completely, and so the absolute motion can be observed, and, say, absolute motion of pair of two free clocks can be measured, see https://www.researchgate.net/publication/259463954_Measurement_of_the_absolute_speed_is_possible DOI 10.5281/zenodo.48709.

The post is rather long already, whereas the list of the SR/GR problems is too long for one post. So only one point else – Gravity is by no means nothing else than "fourth" fundamental Nature force, which in number of traits is similar to the other fundamental Nature force – EM Force.

Cheers

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"*…general relativity is certainly not the final wisdom when there appear infinite density solutions…..*"

- that isn't, in certain sense, so. In certain sense "infinite density" exists in official physics in many cases. Say, in QM particles are principally point-like objects with so infinite density, and just so the QM a particle's property "spin" is some "purely QM" property – since for something to have an own angular momentum $\boldsymbol{M=p\times r}$, where $\boldsymbol{p}$ is a non-zero momentum of some having an inertial mass point, $\boldsymbol{r}$ is radius vector, "x" is the cross-product, "bold" means a vector, it is necessary to have non-zero $\boldsymbol{r}$.

Moreover, that for fundamental particles is well tested, at least the "electron's size" experimentally is "zero" up to at least 10^{-19} - 10^{-22} m.

That is another thing, that in the GR the very specific "densities" are possible – first of all some "spacetime curvature densities", i.e. the singular solutions of the GR equations; utmost known that are "event horizons" of "black holes in the spacetime";

- though not only – in the equations many of similarly strange solutions are possible, and so the GR publications with marvelous singularities as “white”, “worm” “holes”, “channels”, etc., in the spacetime are numerous.

However indeed, really in Matter there cannot be, and aren’t, any infinities, including in density of anything; though at extreme increasing of pressure, what is possible only in objects with extreme gravitational [and inertial, of course] masses, because of Gravity is, though extremely weak, however long range and fundamentally non-compensated by some ways fundamental Nature force – unlike any other Force,

- matter indeed passes through some exotic phase states – [non-exotic] “ordinary matter”, “white dwarf matter”, “neutron stars matter” and “something matter”.

All these phases are very interesting physical objects for study, and, whereas “ordinary matter” states are studied rather successfully, about the other phases till now rather vague knowledge exists. Including, say, the standard explanation of “white dwarf” phase stability as that it is caused by “electron degeneracy pressure” – i.e. eventually as some action of the Pauli exclusion principle; however this principle is introduced in QM again as some “purely QM” principle aimed at fitting QM with experiment, whereas an explanations of – how the principle acts, and so what is the principle strength? – in QM don’t exist, the principle is simply “omnipotent”, and so , say,

- the next phase “neutron star matter” appears because of “electrons are pressed into protons, that so are transformed into neutrons”, what is principally possible, though, and the phase transition can be – and seems is - rather fast, because of possible fast distraction of the “electron degeneracy”, and appearance of some “neutron degeneracy”; when the Pauli principle again acts well in rather wide the pressure/density interval.

However this interval is experimentally observable up to mass/pressure value, when the “escape velocity” becomes be equal to the speed of light, and the parameters of such object become to be drastically lesser experimentally observable.

In the GR this transition is fundamentally singular, and it is stated that the parameters are fundamentally non-observable at all; it is principally impossible to know what happens in some “hole in the spacetime”. However really that isn’t so; say, looks as rather probable that photons, which are radiated in such object orthogonally to its surface, leave the object, though being extremely redshifted in the objects Gravity field. This radiation is rather weak, nonetheless can be observable in some cases – first of all if the object hasn’t background noise in this case of its accretion disk radiation.

And in this case it seems there appears a possibility to study the possibly next - “post-neutron star” - matter phase of the object that is in center of its “black hole”. As that is, say, Sagittarius A* SMBH in Milky Way, which has the average density “below the event horizon” $ro=1.1\times10^{6}$ kg/m^3, i.e. is more than in ten orders by magnitude lesser than the neutron star density $8.4 \times 10^{16} – 1 \times 10^{18}$ kg m^3.

It seems thus evident, that really the average density Sagittarius A* above isn’t the density of something that is in the center of this “black hole”, which, if even that is a neutron star with mass $4x10^{6}$ Suns, has radius thousands times lesser than the “black hole radius”, and the problem – what is this object? – is indeed fundamental physical problem, which, however, principally can be studied really only outside the GR.

Though mass of $4x10^6$ Suns seems as tooo large for a neutron star, and so it seems as rather plausible to suggest, that, as that is assumed in the Shevchenko-Tokarevsky's informational physical model, in this case see https://www.researchgate.net/publication/342600304_The_informational_physical_model_some_fundamental_problems_in_physicsDOI: 10.13140/RG.2.2.12325.73445/2, section "Cosmology", where unique now rational model of Matter creation is developed, including the "matter-antimatter asymmetry" problem is practically for sure principally solved,

- in the center of this SMBH – and other SMBHs, though, mostly some "Planck mass particles matter" is placed; whereas these particles seems are again fermions…
A few SS posts in https://www.researchgate.net/post/If_black_holes_take_forever_to_form_why_do_astronomers_rarely_question_the_claim_that_black_holes_exist_in_the_present_universe#view=600ec803cdd6172a86003040 are relevant to this thread question also.

Cheers