Possible experimental proof of Lorentz interpretation (LI) of GRT – M87

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1 Breakthrough discovery in astronomy: Press conference (April 10, 3:00 PM)

The EHT observations become released: https://www.eso.org/public/announcements/ann19018/ Therefore, here are some predictions of LI of GRT [5] concerning the galaxy M87.

2 Possible experimental proof of Lorentz interpretation (LI) of GRT by EHT observations of M87

Related to the considerations concerning SGR A* in [3], this article appertains to M87.
The mass of the supermassive object (SMO) of M87:

$$m_{M87} = 6.6 * 10 \wedge 9 * m_{\odot}$$
$$= 1.31\ 10 \wedge 40 / kg$$

Using the formulas (3) – (5) of [2]

$$(1)\quad m(r) = (3/14)\left(\frac{G}{c^2}\right)^{-1} r$$

$$(2)\quad \boldsymbol{\rho(r) = (3/14)\left(\frac{G}{c^2}\right)^{-1}(4\pi r^2)^{-1}}$$

$$(3)\quad \boldsymbol{p(r) = (1/14)\left(\frac{G}{c^2}\right)^{-1}(4\pi r^2)^{-1}c^2}$$

one gets the radius of the SMO of M87

$$r_{M87} = 4.5410 \wedge 13 / m$$

and its Schwarzschild radius

$$rsm_{M87} = 1.95\ 10 \wedge 13 / m$$

Since this analytical solution of the TOV belongs to a SMO with infinite mass and infinite radius it is rational to construct a SMO consisting of a kernel and a shell with different equations of state This was done in [3] for SGR A* and is here repeated for the 'BH' of M87. The kernel obeys the analytical solution of TOV with the equation of state

$$p = 1/3\,\rho c^2.$$

and the shell a numerical solution with the equation of state of neutron stars (NS)

$$p = factor_{rel}\,\rho^{4/3}\,c^2.$$

The numerical simulations - shown below - have the result:

$$m_{M87} = 1.31\ 10 \wedge 40 / kg$$
$$r_{M87+NS} = 3.03\ 10 \wedge 13 / m$$
$$rsm_{M87+NS} = 1.95\ 10 \wedge 13 / m$$
$$r_{M87+NS} = 1.56\, rsm_{M87+NS}$$

(Perhaps accidentally, the factor 1.56 is the same as for SGR A*)

These results allow a prediction for the oncoming results of the EHT observations concerning M87. LI of GRT predicts for the SMO of M87 a sphere with radius r_{M87+NS}. The diameter of the sphere d_{SGRA*}

$$d_{M87} = 2 * 1.56 * rsm_{M87}$$

rsm_{SGRA*} is seen from earth under 10 μas. What is the angle of rsm_{M87+NS}? From [4], table 1, one gets

$$\theta_{photo\,ring}(SGRA*) = 53\,\mu as$$
$$\theta_{photo\,ring}(M87) = 22\,\mu as$$

So, r_{M87+NS} is seen under $10 * 22 / 53\,\mu as$. Assuming gravitational lensing having the same enlargement of 2.5 as for SGR A* one gets

$$d_{M87} = 2 * 1.56 * 10 * 22 / 53 * 2{,}50\,\mu as$$

$$d_{M87} = 32\,\mu as$$

This should be comparable with the oncoming results of EHT on 10.4.2019.
Considering the effects of accretion disk and jets, this should improve the prediction - as well as better equations of state and regarding the line of sight.

3 Simulation of the SMO of M87 using TOV equation

The simulation of the SMO of M87 has two steps. In the first step the kernel is calculated using the analytical solution of the TOV differential equation with an equation of state $p = 1/3\,\rho c^2$. One gets e.g. the mass 0.875 10^40 kg of the kernel and with formulas (1) – (3) the values of *r, p* and ρ. These are the starting conditions for the second step, the numerical solution of TOV for the closure with the equation of state of $p = factor_{rel}\,\rho^{4/3}\,c^2$
The details are seen in the fig. 1 – 4 and follow [1],[2]. The total mass of the SMO is equal to the mass of the SMO of M87 as is required.

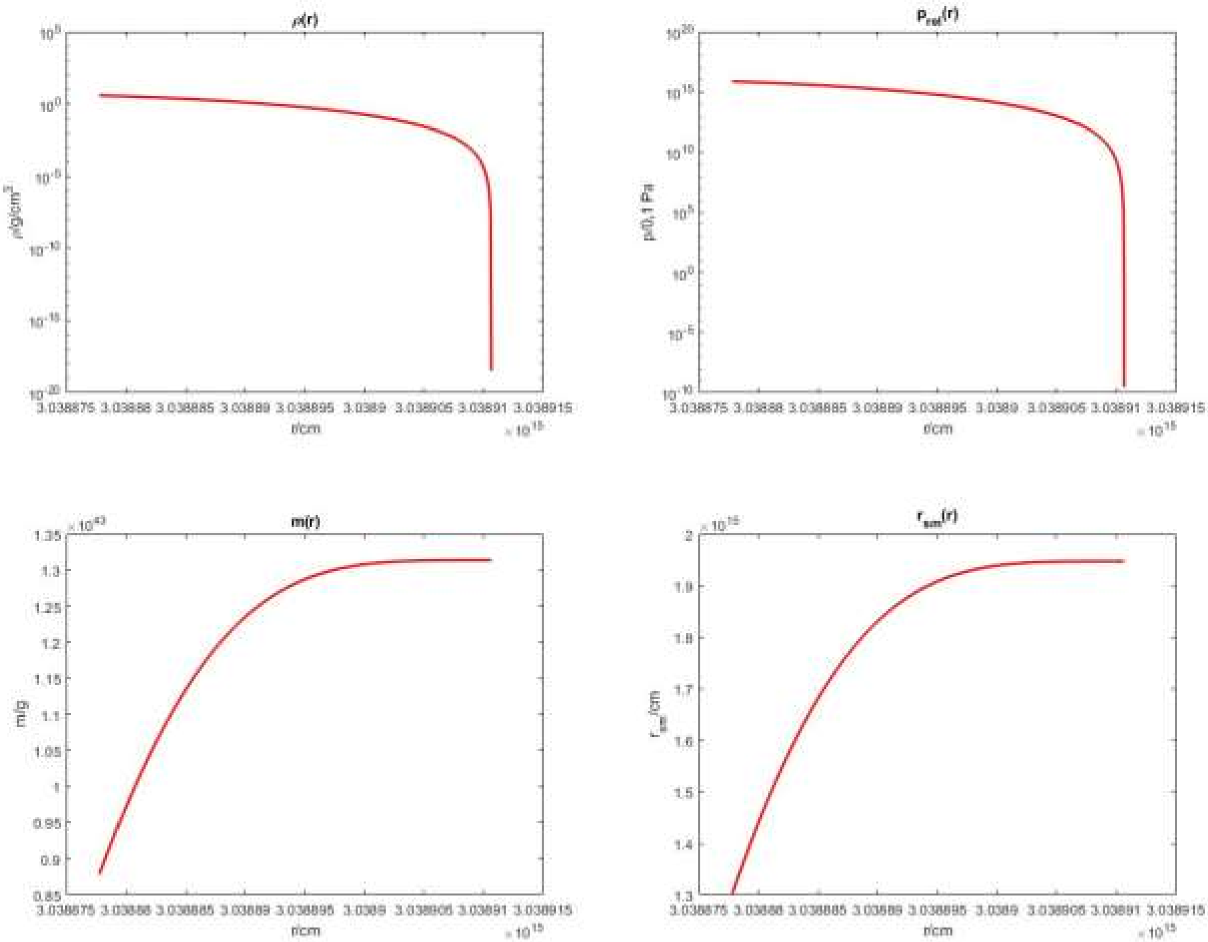

Figure 1 -4. The closure of the SMO of M87.
The numerical calculations start with the analytical results of the kernel. The details are related to [2], fig. 5 - 6.

4 The EHT observations of M87

Before going into details and before more reflections, here some preliminary, short comments on the M87 image presenting a black hole shadow, [6]-[10].
1.) This very important observation of the EHT collaboration opens the door for many other helpful experiments. It's deeply impressing to see the photon ring for the first time.
2.) LI of GRT becomes less convincing but it is not rejected. If there are SMO's without event horizon then their radius Rsmo is restricted, Rsm < Rsmo ~< Rphotonring.
3.) One should not forget, Rsmo is calculated using standard physics. It needs TOV and some degenerated equations of state of QM, only. So, if LI of GRT is rejected then there remains some contradiction within GRT or QM.
4.) The next important event of EHT is the shadow of SGR A*. Please present it yesterday.

5 Literature

[1] *First steps in calculating supermassive objects (black holes) using TOV equation*, on the homepage of the author: http://www.grt-li.de

[2] *Supermassive objects (SMO's) calculated using the Tolman Oppenheimer Volkoff (TOV) equation and possible observation by gravitational waves (GW's) and by the event horizon telescope (EHT)*, see homepage of the author: http://www.grt-li.de

[3] *Possible experimental proof of Lorentz interpretation (LI) of GRT - further arguments - Poster DPG 2019* see homepage of the author: http://www.grt-li.de

[4] ***Masses of Nearby Supermassive Black Holes with Very-Long Baseline Interferometry*** Tim Johannsen, Dimitrios Psaltis (Arizona), Stefan Gillessen (MPE), Daniel P. Marrone, Feryal Ozel (Arizona), Sheperd S. Doeleman, Vincent L. Fish (MIT Haystack) arXiv:1201.0758v2 [astro-ph.GA] 20 Aug 2012

[5] Brandes, J.; Czerniawski, J. (2010): *Spezielle und Allgemeine Relativitätstheorie für Physiker und Philosophen - Einstein- und Lorentz-Interpretation, Paradoxien, Raum und Zeit, Experimente*, Karlsbad: VRI, 4. erweiterte Auflage

[6] First M87 Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole The Event Horizon Telescope Collaboration *et al.* 2019 *ApJL* **875** L1

[7] First M87 Event Horizon Telescope Results. V. Physical Origin of the Asymmetric Ring The Event Horizon Telescope Collaboration *et al.* 2019 *ApJL* **875** L5

[8] First M87 Event Horizon Telescope Results. IV. Imaging the Central Supermassive Black Hole The Event Horizon Telescope Collaboration *et al.* 2019 *ApJL* **875** L4

[9] First M87 Event Horizon Telescope Results. III. Data Processing and Calibration The Event Horizon Telescope Collaboration *et al.* 2019 *ApJL* **875** L3

[10] First M87 Event Horizon Telescope Results. II. Array and Instrumentation The Event Horizon Telescope Collaboration *et al.* 2019 *ApJL* **875** L2