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Orbital precession of the S2 star in Scalar-Tensor-Vector-Gravity

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The GRAVITY Collaboration achieved the remarkable detection of the orbital precession of the S2 star around the Galactic Centre supermassive black hole, providing yet another proof of the validity of the General Relativity. The departure from the Schwarzschild precession is encoded in the parameter $f_{\rm SP}$ which multiplies the predicted general relativistic precession. Such a parameter results to be $f_{\rm SP} = 1.10 \pm 0.19$, which is consistent with General Relativity ($f_{\rm SP} = 1$) at 1σ level. Nevertheless, this parameter may also hide an effect of modified theories of gravity. We used the Schwarzschild-like metric of Scalar-Tensor-Vector-Gravity to predict the orbital motion of S2-star, and to compare it with the publicly available astrometric data, which include 145 measurements of the positions, 44 measurements of the radial velocities of the S2 star along its orbit, and the recent measurement of the orbital precession. We employed a Monte Carlo Markov Chain algorithm to explore the parameter space, and constrained the only one additional parameter of Scalar-Tensor-Vector-Gravity to $\alpha \leq 0.410$ at $99,7\%$ confidence level, where $\alpha = 0$ reduces this modified theory of gravity to General Relativity.

Authors: DELLA MONICA, Riccardo (Universidad de Salamanca); DE MARTINO, IVAN (Universidad de Salamanca); Prof. DE LAURENTIS, Mariafelicia (Università degli Studi di Napoli Federico II)

Presenter: DELLA MONICA, Riccardo (Universidad de Salamanca)

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