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The Leavitt law of Milky May Cepheids from Gaia DR2 static companion parallaxes

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Cepheids represent a fundamental tool for measuring the distances in the Universe thanks to the Leavitt law (period-luminosity) relation. In order to calibrate this relation accurately, precise distance measurements are required. The Gaia satellite monitors a large number of Galactic Cepheids, and will eventually provide extremely accurate parallaxes to hundreds of them. This will considerably improve the calibration of the Leavitt law, setting it on a solid basis of trigonometric distance measurements.

However, the second Gaia data release (DR2) shows that variable star parallaxes are subject to biases due to saturation (for the nearest stars) and to the large amplitude of their color variation. As a result, the calibration of the Leavitt law using the present DR2 Cepheid parallaxes is unreliable. In order to overcome this difficulty, we used the parallaxes of the detached companions of a sample of 23 Galactic Cepheids as a proxy for the parallaxes of the Cepheids themselves. Their Gaia parallaxes are unaffected by saturation and color related biases, since they are relatively faint and stable stars. Based on these parallaxes, we obtained a new calibration of the Galactic Leavitt law. Scaling the existing Hubble constant value determined by Riess et al. (2019), our new calibration implies a value of 68.4 +/- 2.1 km/s/Mpc for a Gaia parallax zero point of 0.029 mas. This value is close to the determination from the Planck satellite.

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